



ITALIAN TRADE AGENCY

ICE - Agenzia per la promozione all'estero e
l'internazionalizzazione delle imprese italiane

Biotechnology in Korea

Overview, Perspectives
&
Opportunities for collaboration
between Italian and Korean players

December 18, 2014

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Imprese Italiane

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1. Korea Overview

1.1 The '20-50 Club' and Biotech

On June 23rd of 2012, South Korea officially joined the '20-50 club'; the indicators being population of over 50 million, and surpassed the mark of USD 20,000 GDP per capita income. The only other country in Asia in this elite club is Japan, which was the first member of the group since 1987. The US followed the trail in 1988, after that Italy and France joined in 1990. Germany did in 1991, and Britain in 1996. This is quite remarkable considering that the country is the only one that did not have a history of industrial base before the Second World War.

From an impoverished economy 60 years ago at the of the Korean war to being the world's largest producer in the world of LCD displays, flat-screen TVs and flash memories, Korea has come a long way. It also ranks at the first place in the world in shipbuilding and the production of steel plates. Not to mention it is the 3rd largest producer of petrochemical products, the 4th in consumer electronics, the 5th in automobiles and machinery, the 8th in textile and the 12th in cosmetics.

Korea has been strategically promoting the biotechnology sector since biotechnology has emerged as a solution to the problems of aging, environment and energy. Korea has done so by committing large investments to build suitable technologies and industrial infrastructure. In biotechnology R&D, the Korean government's investment began to increase conspicuously from the 1990s and consequently Korea today has a very strong biopharmaceuticals sector.

1.2 Macroeconomic Indicators in 2013

1.2.1 General overview

Table 1 General overview

General overview		
General	Country name	Republic of Korea (South Korea)
	Language	Korean (Writing system: Hangeul)
	Capital city	Seoul
	Territory	99,720 sq km
	Currency	won (US\$ 1 = KRW 1,130.13) (as of December 1, 2014)
	Illiteracy rate	0% (people aged between 20 and 40)
People	Population	50,423,955 persons (2014) * Foreign residents (including short-term sojourners) : 1.2 million

	Life expectancy	Male: 78 years & Female: 84.6 years (2012)
	Religion	Buddhism (24%), Protestantism (23%), Catholic (8%), Others (0.8%), Religionless (44.2%)
Government	Political system	Republic with a president elected to a single 5-year term by direct popular vote. Division of power among the executive, legislature (unicameral National Assembly), and judiciary branches
	President	Park Geun-hye (Since 2013)
Economy	Gross domestic product	USD 1,196 billion (2013)
	Per capita GNI	USD 26,205 (2013) GDP growth rate: 3.6% (2013)
	Major industrial products	Semiconductors, automobiles, ships, consumer electronics, mobile telecommunications, equipment, steel, and chemicals

<Biotechnology in Korea 2013>, Ministry of Science, ICT and Future Planning (MSIP), Biotech Policy Research Center (BPRC), 2013

Table 2 Trade

Trade	
Trade	Index
Total trade (USD million)	1,075,233
Total imports (USD million)	515,585
Total exports (USD million)	559,648
Official foreign reserves (USD million)	346,459

InvestKorea Facts & Statistics (<http://www.investkorea.org/ikwork/iko/eng/cont/contents.jsp?code=1020103>)

Table 3 Trade by country

Trade by country					
Exports of goods			Imports of goods		
	Country	USD million		Country	USD million
1	China	145,869	1	China	83,052
2	USA	62,052	2	Japan	60,029

3	Japan	34,662	3	USA	41,511
4	Singapore	22,289	4	Saudi Arabia	37,665
5	Hong Kong	27,756	5	Qatar	25,873
6	Vietnam	21,087	6	Australia	20,784
7	Taiwan	15,699	7	Germany	19,335
8	Indonesia	11,568	8	Kuwait	18,725
9	India	11,375	9	UAE	18,122
10	Russian Federation	11,149	10	Taiwan	14,632

InvestKorea Facts & Statistics (<http://www.investkorea.org/ikwork/iko/eng/cont/contents.jsp?code=1020103>)

Table 4 Foreign exchange rate

Foreign exchange rate		
Year	Won-Dollar	Won-100 Yen
2013	1,095.04	1,123.41
2012	1,126.88	1,413.14
2011	1,108.11	1,391.31
2010	1,156.26	1,320.56

InvestKorea Facts & Statistics (<http://www.investkorea.org/ikwork/iko/eng/cont/contents.jsp?code=1020103>)

Table 5 Foreign direct investment

Foreign direct investment	
FDI	Index
Total FDI (USD million)	14,548
By industry	Service (67.7%), Manufacturing (31.9%), Others (0.4%)
By type	Greenfield (65.8%), M&A (34.2%)
By country (%)	U.S.A (24.2%), Japan (18.4%), EU (33%)

InvestKorea Facts & Statistics (<http://www.investkorea.org/ikwork/iko/eng/cont/contents.jsp?code=1020103>)

Table 6 Korea's global FTA network

Korea's global FTA network	
Agreed	China
	Australia
	New Zealand
	Colombia
In effect	Turkey
	India
	Singapore

	United States
	Peru
	Chile
	ASEAN
	EFTA
	EU
Under negotiations	Indonesia
	Vietnam
	RCEP
Creating conditions to resume negotiations	Korea-China-Japan
	GCC
	Japan
Joint research for negotiations	Mexico
	Israel
	Malaysia
	Central America
	MERCOSUR

FTA Korea (<http://www.ftahub.go.kr/main/situation/kfta/ov/>)

1.3 Key Market Characteristics

1.3.1 Market of opportunities

- **The Korean market:** With a population of about 50 million and GDP in the range of US\$1.2 trillion as of 2013, Korea has a huge market. Its GDP per capita is about \$23,837 and the population has very strong purchasing power. In fact, the high-end Korean market is recognized as a global trend-setter. Its response to new products affects many companies' marketing strategies for not only China, Japan and ASEAN member nations, but also for Europe and other parts of the world.
- **Korea's neighboring markets:** Northeast Asia has now become one of the three global economic pillars, along with the United States and Europe. Geographically, Korea is situated at the center of air and maritime transportation networks in Northeast Asia. There are 51 cities with a 1 million-plus population within a 3-hour flight from Seoul. Also, Korea, Japan and China boast a combined GDP of about \$15 trillion. Their total population exceeds 1.53 billion, or 22% of the global population, and their trade volume is \$6.6187 trillion, or about 18% of the global trade volume as of 2012.
- **Korea's FTA markets:** Korea has signed free trade agreements with the EU and the United States, and they went into effect in 2011 and 2012, respectively. As of 2013, Korea has 47 FTAs in effect, including those with ASEAN, the European Free Trade Association (EFTA), India and Peru, while FTA negotiations are underway with China and Japan. The economies of the countries with which Korea has signed FTAs account for 61% of the total global economy and are home to 36.2% of the world population.

1.3.2 An ever-growing nation

- **A country of growth:** Just 60 years ago, Korea was a country devastated by war and poverty. But with aid from the international community, a devotion to hard work, steady government efforts to open up the economy and corporate efforts to innovate and enhance the country's global competitiveness, Korea has become one of the world's strongest economies. Between 1970 and 2012, Korea's GDP grew by more than 147 times, from \$8.1 billion to \$1.1975 trillion. Korea's GDP per capita also increased by more than 290 times—from \$82 in 1961 to \$23,837 in 2012. So far this millennium, from 2000 to 2012, Korea has achieved an average annual economic growth rate of approximately 2.5% and maintained strong economic vibrancy.

1.3.3 Driven people

- **Global talents:** Korea is a country famous for its passion for education, boasting an illiteracy rate of only 2.1% as of 2013. Every year, approximately 470,000 college graduates join the labor market. In 2013, Korea's college entrance rate was 72.5%, the highest among OECD member countries, and about 65% of the population between ages 25 and 34 were college graduates. Such a strong passion for education in a stable educational system explains Korea's continuous supply of high-quality human resources, which, in turn, enhances the competitiveness of companies and helps them constantly innovate.

1.3.4 Recent reputation for innovation

- **Enterprises and society pursuing innovation:** Korea is the most innovative country in the world, according to Bloomberg (2014). Such an innovation-oriented social and corporate atmosphere leads to great achievements for the multinational corporations from Korea.
- **6.1% of the world's patent applications filed by Korea:** According to a report by the World Intellectual Property Organization (WIPO), the number of Korea's Patent Cooperation Treaty (PCT) applications in 2012 is 11,848, or 6.1% of the worldwide cases (194,400). Korea stood at fifth place in terms of PCT applications after the USA, Japan, Germany and China.
- **High rate of R&D investment:** Of the top seven countries that invest heavily in R&D, Korea is number two in terms of the ratio of R&D investment to GDP ratio. Because of Korea's favorable conditions for R&D, a number of global companies have set up their R&D centers here. Such centers include the Microsoft Mobile Innovation Lab, IBM Ubiquitous Computing Laboratory, Google Engineering R&D Center, Kimberly-Clark Global Innovation Center Korea, Siemens Medical Research & Development Center, Dupont Nano R&D Center and Institut Pasteur Korea, a world-famous biotech research institute that opened in Korea in 2004 and has been very active in R&D.

1.3.5 Powerhouse industries

- **Competitive industries:** Korea has a number of global companies in various industries, including electronics, automobiles, chemicals, steelmaking, shipbuilding and ICT industries. Samsung Electronics, LG Electronics, Hyundai Motor Company, Kia Motors, POSCO and SK Telecom are a few of Korea's world-famous companies.

1.3.6 Strengths and weaknesses

Table 7 Strengths and weaknesses of Korean market

Strengths	Weaknesses
Advanced economy with high per capita income	Low birth rate, ageing society, declining growth potential
Ample foreign exchange reserves	High market entry barriers
Low external debt	Low labor market flexibility
Stable government and political climate	Geopolitical risks stemming from North Korea
Strong healthcare sector	Shortage of technical manpower

1.4 Foreign Direct Investment (FDI) of Korea

1.4.1 Definition of FDI

- Foreign Direct Investment (FDI) refers to the acquisition of stocks or shares of a Korean corporation by a foreigner with a view to establishing continuous economic relations with and participating in the management of the corporation. FDI differs from ordinary investment (portfolio investment), in that it is designed to exercise substantial influence over management of a company. FDI also means an investment made to create wealth via the transfer of tangible or intangible assets, such as intellectual property rights and real estate. It can be recognized as FDI when a foreigner makes a long-term loan of more than five years to a domestic company.
- **Concept of FDI:** Foreign Direct Investment (FDI) refers to an investment made by a foreigner for the purpose of establishing a continuous economic relationship with a corporation of the Republic of Korea or a company run by a national of the Republic of Korea, and is regulated by the Foreign Investment Promotion Act and other related laws. FDI differs from a portfolio investment, which means the purchase of stocks or bonds by foreigners with a view to realizing a short-term financial return.
- **Types of FDI:** FDI, as prescribed in the Foreign Investment Promotion Act, includes acquisition of shares or stocks of a Korean corporation or a company run by a national of the Republic of Korea, supply of a long-term loan to a foreign-invested corporation, a contribution to a non-profit corporation, etc.

1.4.2 Foreign Investment Promotion Act

- The Foreign Investment Promotion Act was enacted in Korea in 1998 for the purpose of courting foreign direct investment, after the 1997 Asian financial crisis swept the country. The Korean government also opened its market and liberalized foreign direct investment as part of the effort. Recently, the Foreign Investment Promotion Act was amended in order to improve the existing foreign investment system and promote foreign investment in the service sector (Act No. 10232, promulgated on April 5, 2010, taken into force on Oct. 6). Foreign investment zone, which refers to the zone designated exclusively for the purpose of leasing or transferring lands to foreign-invested companies, has been expanded to allow foreign-invested companies in the high value-added service industries to move into the zone. The amended Act also stipulates high value-added industries which are allowed to move into a foreign investment zone.
- **Understanding Foreign Investment Promotion Act:** The Foreign Investment Promotion Act is designed to facilitate foreign investment by supporting foreign investment and increasing investor convenience. The Foreign Investment Promotion Act serves as the basic law for foreign investment, and

its subordinate statutes include Enforcement Decree of the Foreign Investment Promotion Act and Enforcement Rule of the Foreign Investment Promotion Act, which prescribe matters delegated by the Foreign Investment Promotion Act and matters necessary for the enforcement thereof, and Regulations on Foreign Investment and Technology Introduction.

- **Legislation concerning Foreign Investment Promotion Act:** Except provided for by the Foreign Investment Promotion Act, matters concerning foreign exchange and foreign trade shall be governed by the Foreign Exchange Transaction Act. For foreign investment, taxes may be abated or exempted under conditions as prescribed by the Restriction of Special Taxation Act, Enforcement Decree of the Restriction of Special Taxation Act, Enforcement Rule of the Restriction of Special Taxation Act, and Regulations on Tax Abatement or Exemption on Foreign Investment.
- **Legislation concerning foreign investment:** Since a foreign-invested company is a domestic corporation established under the domestic law, the company is governed by the same laws applied to purely domestic corporations even if the foreign-invested company has taken the procedures as prescribed by the Foreign Investment Promotion Act. Therefore, a foreign-invested company should obtain permission or authorization under the domestic law when it is required.

1.4.3 Foreign investment promotion and regulation

- Foreign investors may face various difficulties, caused by political and economic situations of a country in which they operate, besides normal business risks. Given the risk factors, Korea has implemented regimes to protect foreign investors. Meanwhile, Regulations on Foreign Investment and Technology Introduction prescribes the restraints and restricted businesses.
- **Liberalization of foreign investment:** Except as otherwise prescribed by the Acts of the Republic of Korea, a foreigner may conduct, without restraint, various activities of foreign investment in the Republic of Korea. Foreigners are restricted from foreign investment in the following cases: where it threatens the maintenance of national safety and public order; where it has harmful effects on public hygiene or the environmental preservation or is against Korean morals and customs; and where it violates the Acts and subordinate statutes of the Republic of Korea.
- **Protection of foreign investment:** Protection of foreign direct investment has become stronger than that of indirect investment such as investment in securities and bonds, as prescribed by the Foreign Investment Promotion Act. Such legal acts are as follows; Guarantee of Remittance to Foreign Countries; Exceptions to the Safeguard Clause on Foreign Currency Transactions; National Treatment and Equal Application of Tax Abatement Regulations, etc.

- **Restrictions and prohibitions on foreign investment:** Out of a total of 1,145 categories of business under the Korean Standard Industrial Classification (KSIC), foreign investment is not permitted in 60 categories of business including public administration, diplomacy, and national defense (unpermitted category of business), while foreign investment is partially permitted in 29 categories of business (restricted category of business) out of the total 1,085 investment categories, as prescribed by the Foreign Investment Promotion Act.

1.4.4 Foreign investment procedures

- Foreign investment procedures consist of foreign investment report, remittance of investment fund, registration of incorporation & business, and registration of a foreign-invested company. The procedures applied to foreigners are basically the same as for Koreans except for the two additional steps: foreign investment report and registration of a foreign-invested company. Where a foreign investor registers a privately-owned business, 'registration of incorporation' is not required.

1.4.5 Follow-up management

- When a foreign investor or a foreign-invested company has completed payment of object of investment or acquired existing stocks, etc., he/she/it shall take procedures to register a foreign-invested company to the president of KOTRA or the head of a foreign exchange bank as prescribed by Acts and statutes of the Republic of Korea. The registration may be cancelled for certain reasons.

1.4.6 Major incentives

- Korea offers three key incentives to boost up foreign investment; first, tax support; second, cash grant; and third, site location support.
 - **Tax support:** For foreign investment which meets a set of qualifications, corporate, income tax and customs duties on capital goods are exempted or reduced in accordance with the Restriction of Special Taxation Act. Acquisition tax, registration tax, and property tax on properties acquired or held for the operation of the business are exempted or reduced under local government ordinances mandated by the Restriction of Special Taxation Act.

- **Cash grant:** In cases where foreign investment satisfies certain conditions, the central and local governments of Korea provide cash grant for the construction of a new factory, etc. In the process, the Korean government takes into account whether the relevant foreign investment accompanies high technology, the effect of technology transfer, the size of job creation, whether the foreign investment overlaps with domestic investment, the propriety of the location in which the foreign investment is made, etc.
- **Site location support:** The industrial location of Korea is divided into a planned location and an individual location where a company selects and develops the location for establishing its plant. A planned location refers to an industrial location where the nation or state-owned or private companies select a certain region to establish plants and develop the area. Planned industrial location includes national industrial complexes, general industrial complexes, urban high-tech industrial complexes and agricultural industrial complexes. Individual location refers to an area where an individual purchases a plant site other than the industrial complex area and obtains permission and approval for establishing a plant.
- Some of the representative planned locations to promote foreign investment are foreign investment zone under the Foreign Investment Promotion Act, free trade zone under the Act on Designation and Management of Free Trade Zones and free economic zone under the Act on Designation and Management of Free Economic Zones. The foreign investment zone is divided into complex-type, individual-type and service-type and the individual-type foreign investment zone is in the form of individual location.
- The foreign investment location can have different requirements, businesses and investment incentives (rent fee, tax, tariff and cash) depending on the purpose of the designation of the location. It is necessary to thoroughly review and analyze the investment location, even for planned location where the approval procedure for establishing a plant is relatively easier compared to others.

1.5 Relations with Italy

- Korea and Italy first opened gates for trade in the year 1884.**
 2014 marked the 130th Anniversary of establishing Italy and Korea establishing diplomatic relations. The Italy-Korea Business Forum for Creative Economy was held in Milan. The governments of both countries agreed to support corporate cooperation in the major creative economy industries such as textile, fashion, design and architecture, and step up exchanges in the energy sector including smart grid, wind power and photovoltaic power generation. The two nations also decided to hold the next forum in Korea on a mutual agreed date, and review setting up a business committee that promote corporate exchange.

Table 8 Korea-Italy trade growth over the years

Year	Export (fluctuation)	Import (fluctuation)	Trade revenue	Balance of payment
2008	3,545(-14.6%)	4,151(15.9%)	7,696	-606
2009	2,797(-21.1%)	3,513(-15.4%)	6,310	-716
2010	3,569(27.6%)	3,723(6.0%)	7,292	-154
2011	4,107(15.1%)	4,374(17.5%)	8,481	-266
2012	3,262(-20.6%)	4,828(10.4%)	8,088	-1,566
2013	3,126(-4.2%)	5,383(11.5%)	8,509	-2,257
As of July 2014	2,008(9.0%)	3,681(19.4%)	5,689	-1,673

[Unit: USD 1 million, %]

<The General Situation of Italy (Oct. 2014>), Ministry of Foreign Affairs (MOFA), 2014

- Italy's domestic market structure**
 - Most of Italy's companies in the biotech sector are small and medium sized enterprises, spread throughout the country.
 - To expand bilateral investment and export, business representatives from Korea attend various exhibitions on trade, while similar missions are sent over from Italy to Korea as well across industries of mutual interest.
- Though relatively small in value compared to Korea's top trading partners, total trade revenue has been steadily increasing:**
 - As of year 2013, Italy is Korea's 31st export country and 22nd import

country. Out of all EU countries, Italy ranks as the 5th largest trading partner for Korea.

- As of year 2013, Korea is Italy's 25th export country and 30th import country. Among top 10 trading partners, 8 of them are EU countries. European countries have the upper hand when it comes to trade.
- Building tight trade relations with Italy may offer multilateral trade chain, such as Korea-Italy-EU-Mediterranean.

- **Italy-Korea biotech partnerships**

- There are three Korean biotech companies that are currently collaborating with Italian companies.

Korean firm	Italian connection	Type of activity
Daewoong Pharmaceutical	Rotta	Biopharmaceutical products
	Bruschettini	
	Italfarmaco	
	Calao	
Hanall Biopharma	Rotta	Nonsteroidal anti-inflammatory drugs (NSAIDs)
	Alfa Wassermann	GI antibiotics
LG Life Scineces	Recordati	Biopharmaceutical product – launch of Zanidip (Iecandipine)

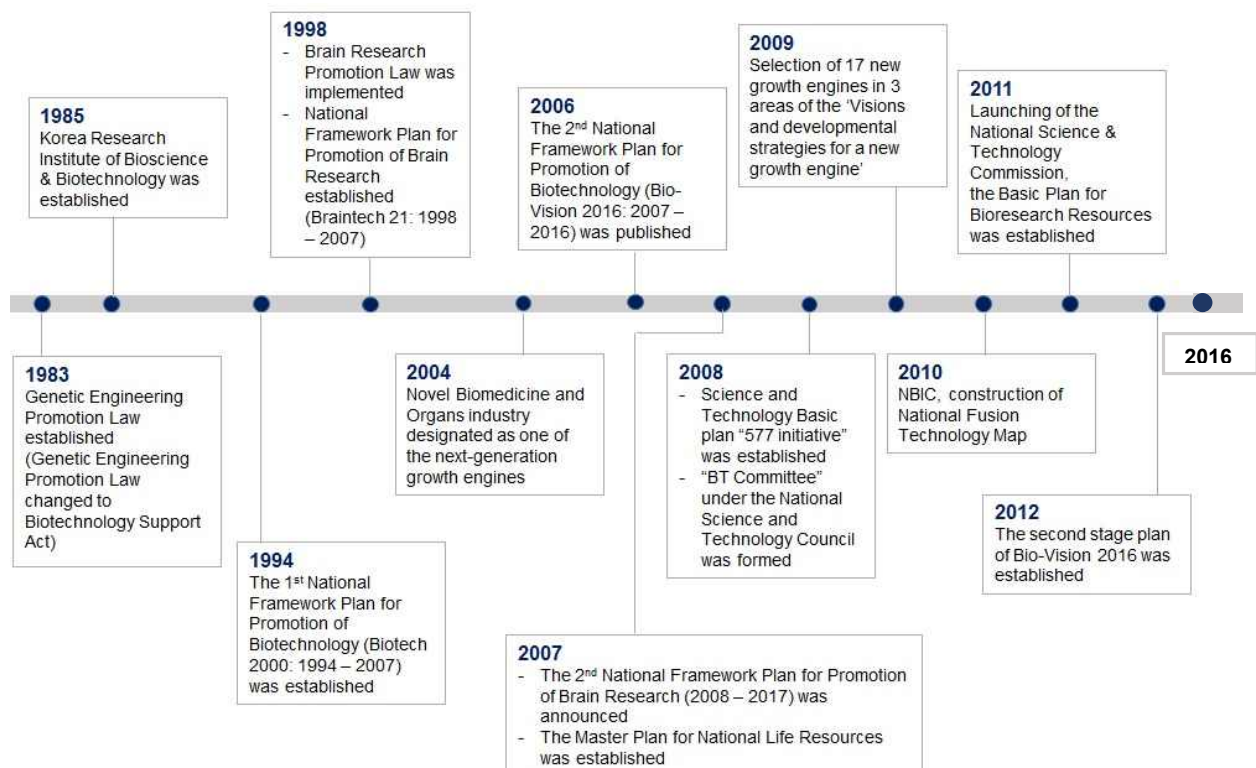
2. Biotechnology in Korea

2.1 Korean Biotechnology

2.1.1 Biotechnology policy of Korea

- It was only in 1983 that biotechnology was widely introduced to Korea. Full-scale government support started in that same year as the Ministry of Science and Technology chose biotechnology as one of its focus areas for the future. The first National Framework Plan for Biotechnology, Biotech 2000 (1994~2006), was established in 1994. Biotechnology was selected as the next-generation energy source in 2004.
- In 2006, the second framework for a pan-governmental biotechnology promotion, Bio-Vision 2016 (2007~2016) was established. It is a ten-year period development plan aiming for Korea to be a global biotechnology leader in the upcoming years. Relative government ministries have set up long term investment goals after the initial founding of the policies.
- The 3rd Basic Plan for Science and Technology established in 2013 was designed to support the realization of Korea's Creative Economy. The government's entire R&D budget for the period up to 2017 amounts to KRW 92.4 trillion, which will be concentrated on thirty designated key technologies. Bio-Vision 2016 is therefore the basis for the bio-tech industry in Korea.

Figure 1 Milestones of biotechnology initiatives and policy



<Biotechnology in Korea 2013>, MSIP, BPRC, 2013

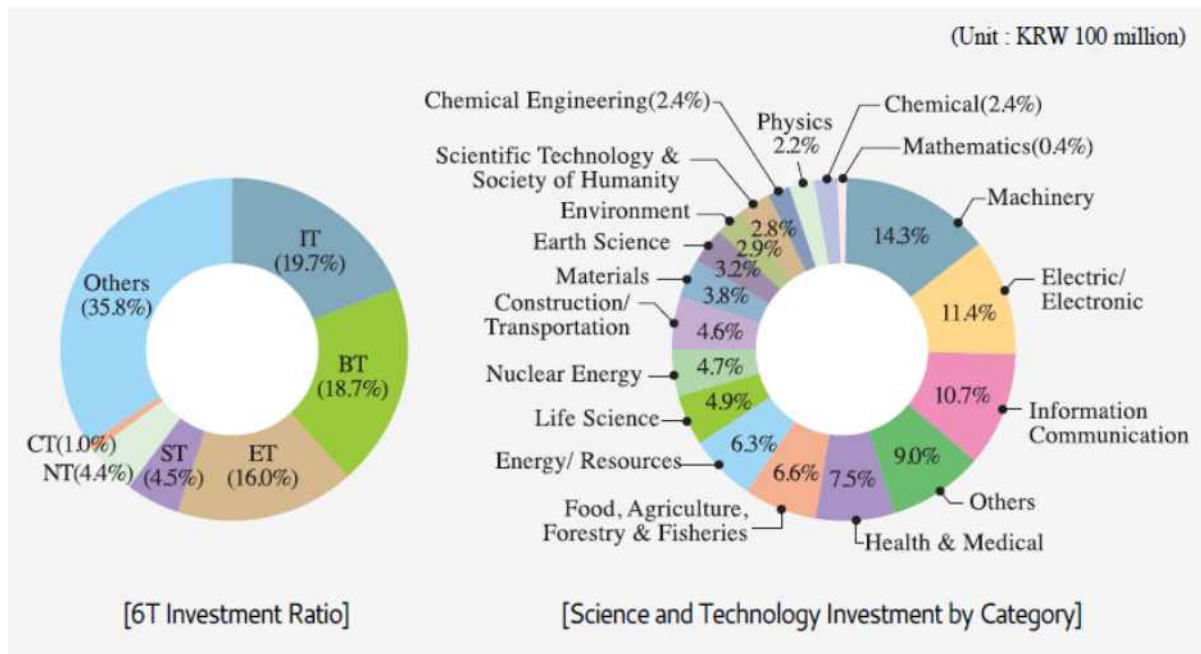
Table 9 The third pan-governmental biotechnology promotion framework began in year 2012 (Second stage of Bio-Vision 2016)

Vision			
1. A sound “Healthy Life” and “Prosperous Bioeconomy”			
2. Joining the Group of Global Top 7 Biotechnology Nations			
Goal			
Year	2005	2010	2016
Publication	13 th place	11 th place	7 th place
Patents	14 th place	15 th place	13 th place
Industrialization, creating a market	Bioindustries	\$2.5 billion	\$5.2 billion
	Pharmaceutical market	\$11.9 billion	\$17.6 billion
		\$22 billion	\$24 billion

<Biotechnology in Korea 2013>, MSIP, BPRC, 2013

2.1.2 Korea 6Ts (6 technologies) and biotechnology

Figure 2 6T investment ratio & Science and technology investment by category



<Biotechnology in Korea 2014>, MSIP, BPRC, 2014

※ IT: Information Technology, BT: Biotechnology, ET: Environmental Technology ST: Space Technology, NT: Nanotechnology, CT: Cultural Technology

- Ranked second following IT (\$2.6 billion) among Korea’s 6T investment sectors.
- The MSIP made the largest investment with 40.5% in Biotechnology R&D Report prepared for ITA by IBI Research and Consulting Group Ltd. www.groupibi.com

and 47.8% in basic science. The Ministry of Trade-Industry-Energy invested heavily in development whereas the Ministry of Health and Welfare focused on app.

- The Korean government has been investing heavily in promising new technologies (6T), especially in IT and BT that are expected to have great ripple effects and create new markets.
- In 2011 the IT sector comprised the highest percentage (19.4%) of the government's R&D budget, followed by BT (19.0%), ET (16.6%) and ST (5.2%).
- The percentage of the BT sector has been steadily rising, with an increase in investment in the biotech industry, new drug development and medical industry.
- IT: 18.3% (2009) → 18.9% (2010) → 19.4% (2011)
- BT: 17.7% (2009) → 18.6% (2010) → 19.0% (2011)

Table 10 From year 2008-2012, biotech industry total investment by sector

Section		2008	2009	2010	2011	2012	Yearly growth rate
Total investment	Amount	11,971	11,809	10,134	12,907	15,455	6.6
	Growth rate	8.1	-1.4	-14.2	27.4	19.7	
R&D	Amount	7,293	8,761	7,686	9,302	9,988	8.2
	Growth rate	9.4	20.1	-12.3	21.0	7.4	
Infrastructure	Amount	4,678	3,048	2,499	3,605	5,467	4.0
	Growth rate	6.2	-34.8	-19.7	47.2	51.6	

[Unit: KRW 100 million (\$92.3 million), %]

<2012 Korea Biotechnology Survey Report>, Ministry of Trade, Industry and Energy (MOTIE), Korea Bio, 2014

2.1.3 Net investment in biotechnology R&D

- Net investment in R&D for both the private and public sectors surpassed the \$46 billion threshold in 2012, representing an increase of 11.1% year-on-year. Net R&D investment in 2011 amounted to \$40 billion, showing an increase of \$5.2 billion. Net R&D investment amounted to USD 49.2 billion, putting Korea in sixth place after the USA, Japan, China, Germany, and France. R&D

investment as a proportion of GDP is 4.36%, coming a close second to Israel at 4.38%.

- The key themes of government biotechnology R&D are 'stronger safety management', 'creation of a high value-added new industry', 'responding to new diseases', and 'securing food safety and seed sovereignty'.
 - Net investment in government R&D amounted to \$14.7 billion in 2012.
 - There are 529 businesses in total with 49,948 on-going technology projects.
 - Biotechnology investment among all Promising New Technologies (6T) reached KRW \$1.8 billion in 2012, showing a 6.6% increase year-on-year and accounting for 18.7% of all government R&D investment.
 - Biotechnology: \$15.7 billion in 2008 > \$18.5 billion in 2009 > \$21 billion in 2010 > \$24 billion in 2011 > \$25.9 billion in 2012.

Table 11 R&D cost

Year	2007	2008	2009	2010	2011	2012
Total R&D cost (KRW 100 million - \$92.3 million)	313,014	344,981	379,285	438,538	498,904	554,501
The ratio of R&D cost (%)*	3.21	3.36	3.56	3.74	4.04	4.36

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

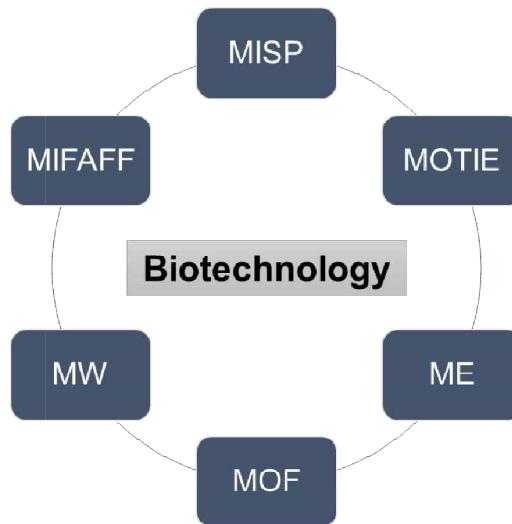
*The ratio of the biotech R&D cost to the total R&D cost

2.2 Biotechnology Infrastructure

2.2.1 Key bio related ministries

There are six relevant ministries and each of these has its own biotechnology support programs, designed to fit each ministries' general roles.

Figure 3 Key bio related ministries



2.2.1.1 MSIP - Ministry of Science, ICT and Future Planning

- Investment strategy for biotechnology R&D supports programs.
- Main fields: bio-medicals stem cell, brain science, genome study, next-generation medical devices

Table 12 MSIP's biotechnology investment strategy

Item	Main investment areas
Drug research	<ul style="list-style-type: none"> ▪ Establishment of an integrated R&D system from base research to clinical testing for the development of innovative new drugs ▪ Drug research capacity + (genome study / stem cell / brain research) => Pioneering New Fields (cures for cardiovascular disorders) ▪ Provision of support for the reproduction of generic drugs whose patents have expired and incrementally modified drugs
Stem cell	<ul style="list-style-type: none"> ▪ Provision of support for further development of adult stem cell medicine ▪ Support for the development of stem cell medicine/cell and gene therapy for incurable diseases

Item	Main investment areas
	<ul style="list-style-type: none"> ▪ Training of a leading research team as part of the mid- and long-term plans to acquire original technologies (i.e. induced pluripotent stem cell, direct conversion) for new technological fields
<p style="text-align: center;">Brain research</p>	<ul style="list-style-type: none"> ▪ Development of technologies to meet social issues such as 'brain mapping' and early diagnosis services for dementia patients ▪ Development of technologies (i.e. customized brain disease treatment, neurorehabilitating brain stimulation, optimized learning capability technology) for four major fields in brain research (brain disease, cranial nerve, brain and cognitive science, brain engineering)
<p style="text-align: center;">Genome study</p>	<ul style="list-style-type: none"> ▪ Development of 'individual genetic information analysis' for early diagnosis and customized treatments for individual patients <ul style="list-style-type: none"> ※ To be carried out in conjunction with the pan-governmental development of new industries in the post-genome market' project
<p style="text-align: center;">Next-generation medical infra</p>	<ul style="list-style-type: none"> ▪ Discovery/development of original technologies for healthcare systems using such equipment as mobile devices ▪ Development of original technologies such as the bio-diagnostic biochip, molecular imaging diagnosis instrument, and medical robots

<Biotechnology in Korea 2014>, MSIP, BPRC, 2014

- The Ministry of Science, ICT and Future Planning enacted the Biotechnology Support Act in 1983 to facilitate support for Biotechnology R&D. This was followed up by the Basic Plan for Biotechnology Support in 1994, along with additional efforts to carry out the law. The Ministry has recently released a new Biotechnology Support Strategy to realize Korea's Creative Economy so as to fulfill its purpose as a forward-looking future-oriented organization (November 2013).
 - The Ministry's most recent investment strategy is the guideline on its Biotechnology R&D support strategy which covers five years during President Park Guen-hye's tenure (2013-2018). The Ministry will use the strategy as the basis for continuous investment, resolving social issues, and encourage the budding of new industries, so that the fruits of the investment are distributed among the public. To that end, R&D investment will be focused on creating tangible results.
 - The Ministry has designated five main fields in Biotechnology (drug research, stem cell, brain research, genome study, and next-generation medical infrastructure) to receive the greater part of the investments.

2.2.1.2 MOTIE - Ministry of Trade, Industry, and Energy

- Provided support for the mid-and long term growth of domestic

biopharmaceuticals and converting the industry into an engine of new growth.

- Focal points of development: developing key fields based on 'acquiring original technology' and 'establishing a supportive infrastructure for industrialization, establishing a pan-government system, and creating an environment for the promotion of bio-industries'.
- Developed DDS-based innovative products that are more effective than 1st-generation biopharmaceuticals for a high value-added bio-better and global advance.

2.2.1.3 ME – Ministry of Environment

- Launched the Next-Generation Econ-innovation Technology Development Project (E1 in short) in 2011 and earmarked a total of KRW 1 trillion 533 billion budget until 2020, over 20% of which will be granted to environmental biotechnology.

2.2.1.4 MOF – Ministry of Oceans and Fisheries

- Enacted the 'Preservation, Management, and Utilization of Marine Bioresources Act' (2012) – as part of its effort to systemically develop marine biotechnology.

2.2.1.5 MoHW – Ministry of Health and Welfare

- Promoted the vision of 'Living a Healthy Extended Life, Improving the Quality of Life, Improving Healthcare Industry Competitiveness' to develop a healthy society using Health Technology (HT).

2.2.1.6 MIFAFF - Ministry for Food, Agriculture, Forestry and Fisheries

- Executed the Golden Seed Project, a high value-added food development project, and technology and business support programs to develop technologies and commercialize biological resources.

2.2.2 Bio related R&D centers in cooperation with ministries

2.2.2.1 MOTIE - Ministry of Trade, Industry, and Energy

- 한국산업기술진흥원 (KIAT - Korea Institute for Advancement in Technology): train bio-tech specialist

- 한국산업기술평가관리원 (KEIT - Korea Evaluation Institute of Industrial Technology): biotechnology R&D

2.2.2.2 MSIP - Ministry of Science, ICT and Future Planning

- 한국에너지기술연구원 (KIER - Korea Institute Energy Research): sustainable energy source research
- 경기과학기술진흥원 (GSTEP - Gyeonggi Institute of Science & Technology Promotion): demand oriented technical development
- 한국생명공학연구원 (KRIBB – Korea Research Institute of Bioscience & Biotechnology): technology R&D, domestic and international infrastructure support
- 한국생물공학회 (KSBB – The Korea Society for Biotechnology and Bioengineering): publish papers, host scholarship symposiums

2.2.2.3 ME – Ministry of Environment

- 한국연구재단 (NRF - National Research Foundation of Korea): R&D, Funding, securing new tech, creating high value-added products

2.2.2.4 MOF - Ministry of Oceans and Fisheries

- 한국해양과학기술진흥원 (KIMST - Korea Institute of Marine Science & Technology)

2.2.3 Key associations

2.2.3.1 Korea Bio / 한국바이오협회 (Korea Biotechnology Industry Organization, Seongnam)

- The Korea Biotechnology Industry Organization, a representative body of Korea's bio industry, was founded in 2008 to strengthen ties between fellow bio industry businesses and accelerate technological development and commercialization. The organization's goal is to promote bio-related companies and boost national competitiveness, and subsequently contribute to Korea's economic growth.

2.2.3.2 BPRC / 생명공학정책연구센터 (Biotech Policy Research Center, Daejeon)

- The key role of BPRC is to construct biotechnology policy information basis and support establishment of national policies.
- By constructing policy information infrastructure, BPRC's goal is to contribute in enhancing global competitiveness.

2.2.3.3 KDRA / 한국신약개발연구조합 (Korea Drug Research Association, Seoul)

- Founded by law in 1986 as a non-profit organization, the KDRA represents Korea's R&D-oriented, innovative companies. KDRA supports R&D activities through the planning and management of national policy or private-initiated R&D program in pharmaceutical field, the introduction & distribution of and the guidance to advanced technologies, technological training & education, etc., and contributes to the constitution of infra-structure or optimal R&D foundation needed for optimization of pharmaceutical R&D.

2.2.3.4 KPMA / 한국제약협회 (Korea Pharmaceutical Manufacturers Association, Seoul)

- KPMA has played its central role for the advancement of pharmaceutical industry in Korea since its foundation in 1945. The goals of KPMA are the development of new drugs through R&D and the supply of good pharmaceutical products that contribute to healthier human life.

2.2.3.5 KoNect / 한국임상시험산업본부 (Korea National Enterprise for Clinical Trials, Seoul)

- KoNECT was established in December 2007 with wholehearted support from the Korean government, academics and related business industries in order to meet the increasing demands for clinical trials and to raise national competitiveness by fostering necessary human resources, developing core technology, and building a solid infrastructure to become a global clinical trial hub.

2.2.3.6 KHIDI / 한국보건산업진흥원 (Korea Health Industry Development Institute, Cheongju)

- Korea Health Industry Development Institute (KHIDI) is a public organization that consists of a group of experts dealing with various programs on promoting and developing health industry in Korea, while helping improve the national healthcare services.

2.2.3.7 KoBIA / 한국바이오의약품협회 (Korea Biomedicine Industry Association, Seoul)

- Established for conducting to the global competitiveness of Korean biomedicine industry and for this propose we make the utmost effort to improve the authorization policy of biomedicine. We seek to arrange timely distribution of industry news and our training programs of high-level biomedicines for this propose as well.

2.2.4 Affiliated organizations by region

There are 24 affiliated organizations across the country to serve as a boost to spread biotechnology and regional economic growth.

Figure 4 Affiliated organizations by region



Table 13 Affiliated organizations by region

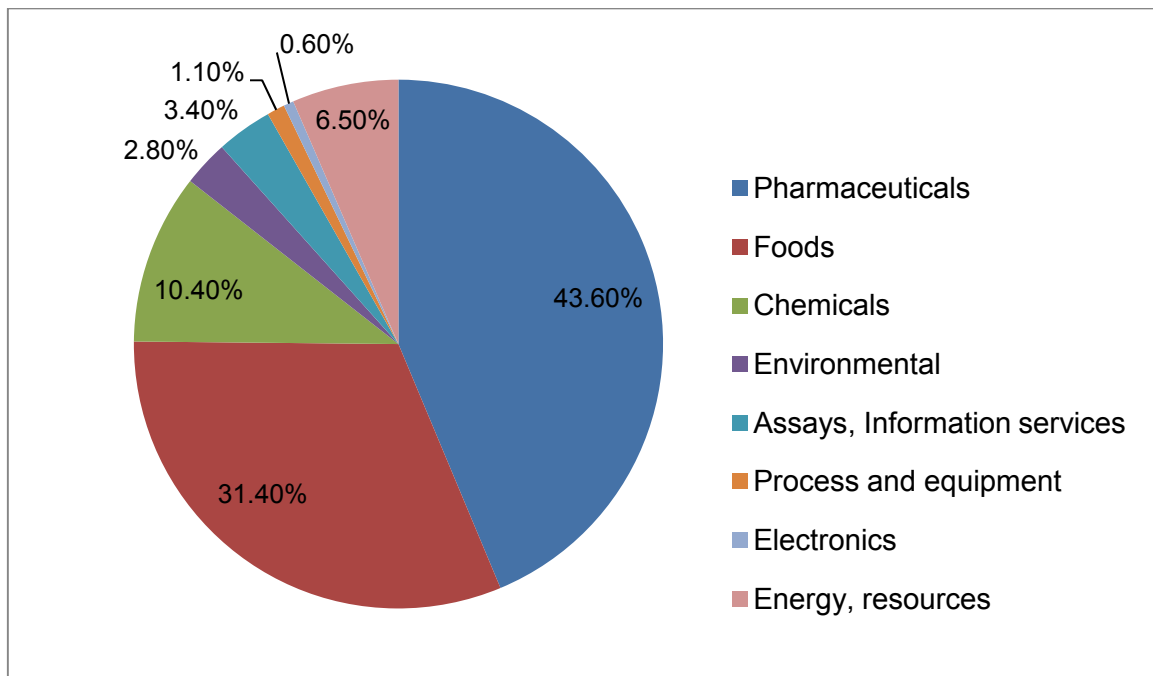
Region	Organizations
Ganwon-do	<ul style="list-style-type: none"> ▪ Chuncheon Bioindustry Foundation ▪ Gangneung Science Industry Foundation
Gyeonggi	<ul style="list-style-type: none"> ▪ Gyeonggi Biocenter
Daejeon	<ul style="list-style-type: none"> ▪ Daejeon Technopark Bio-Center
Chungnam	<ul style="list-style-type: none"> ▪ Chungnam Technopark Animal Resource Research Center
Jeonbuk	<ul style="list-style-type: none"> ▪ Jeonbuk Bioindustry Foundation ▪ Soonchang Microbial Institute for Fermentation Industry
Jeonnam	<ul style="list-style-type: none"> ▪ Jeonnam Nano-bio Research Center ▪ Jeonnam Biopharmaceutical Research Center ▪ Jeonnam Food Industrial Research Center ▪ Jeonnam Biological Control Center ▪ Jeonnam Marine Biotechnology Research Institute ▪ Jeonnam Institute of Natural Resources ▪ Jeonnam Korean Traditional Medicine
Gyeongbuk	<ul style="list-style-type: none"> ▪ Gyeongbuk Institute for Bio Industry ▪ Pohang Center for Evolution of Biomaterials ▪ Daegu Technopark Bio-Convergence Center ▪ Daegu Technopark Herbal Medicine Industry Support Center
Gyeongnam	<ul style="list-style-type: none"> ▪ Jinju Bioindustry Foundation ▪ Busan Technopark Marine Bio-Industry development Center
Jeju	<ul style="list-style-type: none"> ▪ Jeju Technopark Bio-convergence Center

3. Biotechnology Sectors

3.1 Biotechnology Categories and Applications

- The biotechnology industry in Korea has 8 sectors in total. The following are the sector shares based on domestic sales. Bio-pharmaceuticals(43.6%), Bio-foods(31.4%), Bio-chemicals(10.4%), Bio-environmental(2.8%), Bio-electronics(0.6%), Bio-process and equipment(1.1%), Bio-Assays, Information service (3.4%) and Bio-energy, resources(6.5%).

Chart 1 Biotech industry domestic sales by category



<Biotechnology in Korea 2014>, MSIP, BPRC, 2014

3.1.1 Bio-pharmaceuticals: Industrial activities to produce pharmaceuticals or medical supplies that are used for diagnostics, prevention, and treatment of human or animal diseases utilizing biotechnology at the stage of research, development, or manufacture.

Table 14 Bio-pharmaceuticals sectors

Sector	Sub-sector	Contents
Bio-pharmaceuticals	Antibiotics	Substances related medical products that control perish growth and multiplication of microbes
	Vaccines	Antigen to immune human or animals from infection
	Hormones	Substances related medical products to treat specific diseases utilizing hormones' biological

Sector	Sub-sector	Contents
		characteristics
	Animal medication	Medicine for animal disease, infection, treatment and prevention
	Diagnostic kit	A kit to diagnose symptoms of patients-medicine included
	Anticancer medications	Basic substances and medical products to treat malignant tumor
	Immunotherapeutic	Basic substances or related medical products such as protein materials-to control the bio-immune activity
	Hemotherapeutics	Basic substances or related medical products to treat patients with symptoms due to lack of protein, which are extracted from blood or produced by biotechnological methods
	Growth factors	Various types of polypeptides to stimulate growth, cell division or eruption
	New therapeutics	New types of treatments that is different from the existing ones

<Biotechnology Industry, Statistics and Policies in Korea>, Dongsoo Lim, Asian Biotechnology and Development Review, Vol.11 No.2, pp 1-27, 2009

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

3.1.2 Bio-chemicals: Industrial activities to produce chemicals or substitutes by means of extraction and purification from organisms or biotechnological process.

Table 15 Bio-chemicals sectors

Sector	Sub-sector	Contents
Bio-chemicals	Biopolymers	Materials produced from biomolecules such as protein, nucleic acid, and polysaccharide
	Industrial enzymes and reagents	Products produced that have industrial value by enzyme extraction or biotechnology
	Enzymes and reagents for research	Reagent, buffer solution, polymerase, reagent kit, DNA vector, and gene manifestation system
	Biocosmetics and home & personal care chemicals	Household items like soap, detergent, and functional cosmetic products
	Biological agrochemicals and fertilizers	Microorganisms to stimulate growth of crops
	Other bio-chemicals	Other biochemical products that are not classified above

<Biotechnology Industry, Statistics and Policies in Korea>, Dongsoo Lim, Asian Biotechnology and Development Review, Vol.11 No.2, pp 1-27, 2009

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

3.1.3 Bio-foods: Drinks, foods, and feeds that humans or animals can consume, extracted from living organisms or biotechnological means are applied at the stage of R&D, manufacture or production.

Table 16 Bio-foods sectors

Sector	Sub-sector	Contents
Bio-foods	Functional health foods	Foods that are use functional materials or substances which are helpful for the human body
	Amino acids	Amino acids used for medical products, food, and feed additives
	Food additives	Seasoning, perseverant, nucleotide, peptide
	Fermented food	Products that are fermented- food pastes, liquors, pickles
	Feed additives	Various food additives for animal farming, fisheries, nutrition and feeds
	Other bio-foods	Other bio-foods products that are not classified above

<Biotechnology Industry, Statistics and Policies in Korea>, Dongsoo Lim, Asian Biotechnology and Development Reviw, Vol.11 No.2, pp 1-27, 2009

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

3.1.4 Bio-environmental: Industrial activities to provide goods, systems, Industry pollution assessments, and structures for cleaning, restoring, and protecting environment using biotechnology

Table 17 Bio-environmental sectors

Sector	Sub-sector	Contents
Bio-environmental	Microbial treatment agents	Sales and construction service of microorganism treatment kit to prevent pollution and purification
	Microbe-immobilized materials and equipment	Microorganism filters for wastes, waste water and deodorization treatment
	Bioenvironmental agents and systems	Wastes, waste water, deodorization treatment, environmental restoration and resource recycling
	Measuring apparatus for environmental pollution	Equipment to measure water, soil and air pollution level
	Other bioenvironmental productions and services	Other bio-environmental products that are not classified above

<Biotechnology Industry, Statistics and Policies in Korea>, Dongsoo Lim, Asian Biotechnology and Development Reviw, Vol.11 No.2, pp 1-27, 2009

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

3.1.5 Bio-electronics: Manufacture of medical- or non-medical devices and apparatus making use of bio-informatics, biotechnology, nanotechnology, and electronic technology

Table 18 Bio-electronics sectors

Sector	Sub-sector	Contents
Bio-electronics	DNA chips	Detection device with immobilized DNA
	Protein chips	Detection device with immobilized protein
	Cell chips	Detection device with immobilized cell and cell analysis kit
	Biosensors	Detection device based on a number of functions the living body provides
	Bio-MEMS	Microelectromechanical systems (MEMS) for medical purposes and R&D such as biotechnology, medical examination, drug injection
	Other bio-electronics	Other bio-electronics products that are not classified above

<Biotechnology Industry, Statistics and Policies in Korea>, Dongsoon Lim, Asian Biotechnology and Development Review, Vol.11 No.2, pp 1-27, 2009

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

3.1.6 Bio-process and equipment: Apparatus and plants that utilize living organisms, materials derived from living organisms, or biotechnology for R&D, manufacture, or production process. Instruments and apparatus that are used for research that are used for research and experiment

Table 19 Bio-process and equipment sectors

Sector	Sub-sector	Contents
Bio-process and equipment	Bioreactors	A tool to perform biological reaction to produce useful material
	Biomedical and diagnostic apparatuses	A device to examine or diagnose body and physiological functions for medical purposes
	Bioprocess and analysis equipment	Experimental, R&D devices
	Plant and process design	Services to provide system construction and plant design using bioprocess technology, device and equipment
	Other bio-processes	Other bioprocesses and equipment products

	and equipment	that are not classified above
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3.1.7 Bio-energy and bio-resources: Industrial activities utilizing organisms or biotechnological processes for obtaining energy sources. Investigation of organisms having novel functions, creation of organisms by breeding and genetic transformation, cultivation, or farming

Table 20 Bio-energy and bio-resources sectors

Sector	Sub-sector	Contents
Bio-energy and bio-resources	Biofuel	Replacement fuel produced from conversion process of biomass
	Artificial seeds and seedlings	Artificial seeds, revised seeds, mushroom seeds and energy crops used for forestry and agriculture
	Experimental animals	Experimental animals like insects, mice, rats
	Transgenic animals and plants	Animals and plants with characteristic conversion
	Other bio-energy and bio-resources	Other bioenergy(biogas) products that are not classified above

<Biotechnology Industry, Statistics and Policies in Korea>, Dongsoon Lim, Asian Biotechnology and Development Review, Vol.11 No.2, pp 1-27, 2009

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

3.1.8 Bio-assays and information service: Bio-assays, informatics service

Table 21 Bio-assays & information service sectors

Sector	Sub-sector	Contents
Bio-assays and information service	Bioinformatics services	Services that provide solutions to the clients based on bioinformatics
	Gene analysis services	Gene analysis
	Protein analysis services	Protein analysis
	R&D services (ex. drug development services, etc.)	Services and technological consulting
	Biosafety and efficacy evaluation services	Preclinical studies or clinical trials services

	Diagnosis and preservation services	Disease diagnose service, cell preservation service using biotechnology
	Other bioassays, bio-informatics services	Other bio-assays and information service products that are not classified above

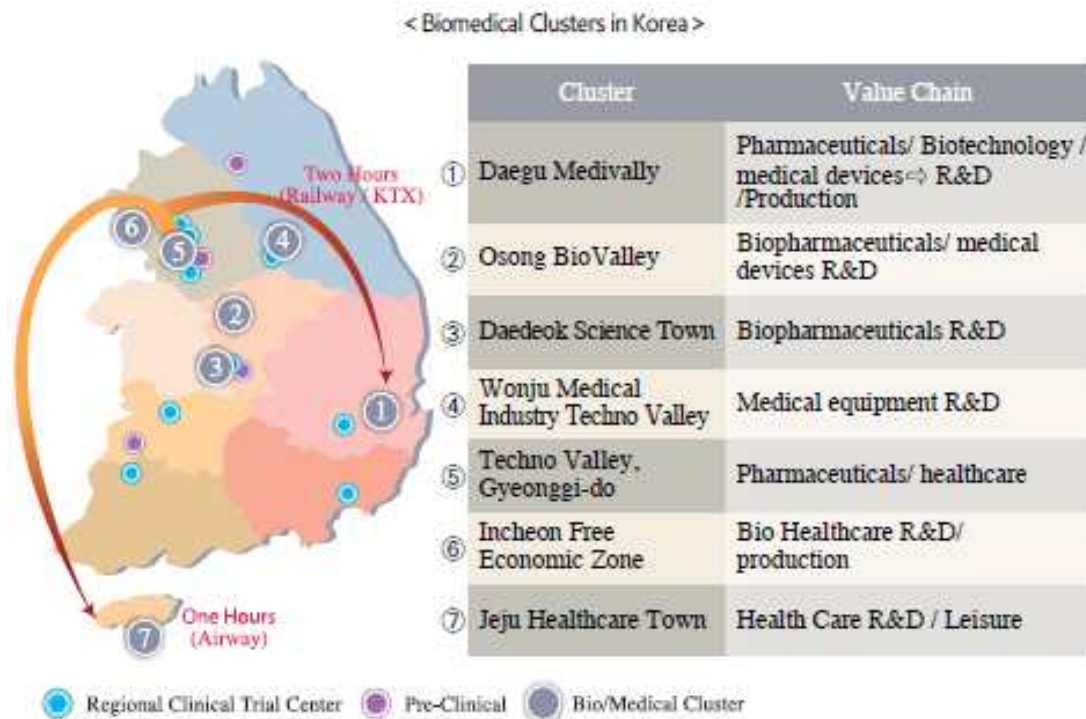
<Biotechnology Industry, Statistics and Policies in Korea>, Dongsoo Lim, Asian Biotechnology and Development Review, Vol.11 No.2, pp 1-27, 2009

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

4. Bio-clusters

4.1 Biomedical Clusters in Korea

Figure 5 Biomedical clusters in Korea



<Biotechnology in Korea 2013>, MSIP, BPRC, 2013

4.1.1 National medical industry R&D hub – Daegu-Gyeongbuk High-tech Medical Complex

- The Daegu-Gyeongbuk High-tech Medical Complex is currently being built on a 1,030,000m² lot with a total budget of KRW 4.6 trillion (approximately US\$ 4 billion). Upon its completion, the new complex will consist of four centers including the Drug Research Support Center, Cutting-edge Medical Equipment Development Support Center, Animal Experiment Center, and Clinical Test and New Drug Production Center, and will concentrate on the development of new drugs and medical devices and the application of new technologies up to the clinical test stages.
- The complex will also conduct specialized research on the synthesis of new drugs and IT-based medical devices in conjunction with the cutting-edge clinical test infrastructures of twelve clinical trial hospitals, and on light sources (Pohang).

4.1.2 Global medical hub – Osong Bio Valley

- Osong Bio Valley specializes in developing biopharmaceuticals and Biotechnology -based medical devices in collaboration with the nearby Korea Research Institute of Bioscience and Biotechnology in Daedeok Science Town, and five other government-affiliated institutes.

4.1.3 Convergence technology/R&D cluster – Pangyo and Gwanggyo Techno Valley in Gyeonggi-do

- Gyeonggi-do is part of Seoul's metropolitan area along with Incheon. The province is a leader in Korea's innovative technology and is well known for its heavy investment in R&D. Pangyo Techno Valley and Gwanggyo Techno Valley, Korea's leading incubators of innovative ideas, are dedicated to Biotechnology, IT, NT, and other forms of convergence technology.
- Pangyo Techno Valley is a cutting-edge innovative cluster situated on a 661,925m² site within Pangyo New Town in Seongnam. Its main goal is to establish a 'convergence techno valley' that integrates research, human resources, information, and trade.
- Gwanggyo Techno Valley is a cutting-edge R&D complex built on a 11,272,727.3m² site in Suwon. Integrating elements of BT, IT, and NT, this techno valley was established to stimulate the local economy, train professional research personnel, and increase national competitiveness.

4.1.4 Incheon Free Economic Zone (IFEZ)

- Incheon Economic Free Zone is an international city strategically developed by the Korean government as an international business hub that guarantees an optimized business environment. The 169.5km² zone, first declared in August 2003, encompasses Incheon International Airport and harbor. It was the first economic free zone to be established in Korea.
- Promising investment areas in the IFEZ include business, distribution, cutting-edge industries, medibio, education, and tourism. Also situated within the zone is a cluster specializing in medibio whose goal is to place Korea in the world's top three in the field of regenerative medicine by 2020.
- Bio-Medi Park is a research facility comprising overseas medical institutes that is responsible for organizing the construction of Yongjong Medi City and the International BIT Port.

4.1.5 Daedeok Science Town

- Daedeok Science Town spans Yuseong-gu and Daedeok-gu in Daejeon Metropolitan City. It consists of Daedeok Techno Valley, which comprises the Daedeok Research Complex and the Cutting-edge Industry Complex, and Daejeon Industrial Complex. Covering approximately 67.8km² it is the largest R&D complex in Korea.
- Daedeok Science Town's basic plan, originally established in 1973, focused on the research of basic science and other specialized fields. R&D facilities started moving into the science town in 1978, and there are now some 30 government-funded research institutes, 11 public offices, 14 national institutes, 5 universities, and 1,306 companies, amounting to 1,399 tenants that hire over 60,000 professional employees (2011).
- Daedeok Science Town houses many government-funded research facilities in biotechnology, IT, nanotechnology, robot technology, and space engineering. It is a major research hub that offers an optimum environment for small and medium businesses to grow. Many new businesses specializing in new technologies take off here at the science town. DRAM & SRAM chips, LCD modules, mobile phone technology, wireless wide area network, and other commercialized technologies are available at Daedeok Science Town.

4.1.6 Jeju Healthcare Town

- Jeju Healthcare Town is a district specializing in medical tourism. Located on Jeju Island amid a beautiful natural environment, visitors receive medical treatment and rest in the same place. The Healthcare Town will be built over a 1.5 million m² lot with a budget of KRW 784.5 billion. Construction work began in 2011 and is scheduled for completion by 2015.
- Jeju Healthcare Town consists of three themed zones: Wellness Park, Medical Park, and R&D Park.
- Wellness Park is a medical resort complex comprising condominiums, a waterpark, and a wellness mall within its perimeter.
- Jeju Medical Park is a medical complex that offers cutting-edge medical services from international clinics and hospitals specializing in cosmetic surgery, dentistry, and cancer-related treatments. Senior citizens can move into the Long-term Care Town or visit the Retirement Community Center.
- The R&D Park will be a research complex dedicated to the biotechnology and medical fields. The park will accommodate medical R&D centers, anti-aging centers, and rehabilitation centers.

4.1.7 Medical Equipment Hub – Wonju Medical Industry Techno Valley

- Wonju Medical Industry Techno Valley Foundation was founded in 2003 by Wonju-si's municipal government and the central government in a bid to transform Wonju into an industrial complex specializing in the development and production of medical devices.
- Product and technology development, product authorization, new product manufacturing, international and domestic marketing, clinical and preclinical trial support, securing of sites for business incubators and business research institutes, rental of apartment-type production plants, rental of specialized plants, and other types of business support are provided through industry-academia collaboration to further Korea's domestic medical devices industry and stimulate the local economy.

Table 22 Biomedical clusters in Korea

Cluster	Value chain	Area (ft ²)	Business environment	Development period
Daegu Medivally	Pharma / BT / Medical device, R&D production	11,000,000	<ul style="list-style-type: none"> ▪ 8 comprehensive hospitals with 5 qualified hospitals 50 ventures ▪ 106 general hospitals (13,273 beds) ▪ 7 R&D Institutes 	2009~2038
Osong Biohealth Technopolis	Bio-pharma, medical device, R&D	12,000,000	<ul style="list-style-type: none"> ▪ 36 pharma ▪ 18 medical device companies ▪ 6 government agencies (KFDA etc.) 	2009~2038
Daedeok Innopolis	Bio-pharma, R&D	760,000,000	<ul style="list-style-type: none"> ▪ 898 ventures ▪ 448 R&D institutes ▪ 7 comprehensive hospitals 	2006~2015
Wonju Medical Device Cluster	Medical device, R&D production	4,600,000	<ul style="list-style-type: none"> ▪ 50+ medical device companies ▪ 35 ventures ▪ High-tech medical instrument techno valley 	1998~2014
Gyeonggi-do Technovalley	BT, pharma, healthcare, R&D production	3,000,000	<ul style="list-style-type: none"> ▪ 280 pharma companies ▪ 300 bio-ventures ▪ 5 R&D institutes ▪ University hospitals and 48 comprehensive hospitals 	2004~2007 (Gwanggyo) 2009~2014 (Pangyo)

Cluster	Value chain	Area (ft ²)	Business environment	Development period
IFEZ Bio-Complex	Bio-healthcare. R&D production	1,800,000,000	<ul style="list-style-type: none"> ▪ Bio companies ▪ International business center & IT business ▪ Global campuses (Yeonsei Univ. etc.) ▪ Bio research complex 	2003~2020 (In Songdo Biomedical Hub)
Jeju Healthcare Town	Healthcare, R&D, leisure	16,600,000	<ul style="list-style-type: none"> ▪ Greenland Group (China) ▪ 6 comprehensive hospitals including SNU hospital, National Institute on antiaging, Korea Institute of Oriental Medicine, etc. 	2008~2015

<Promising Investment Opportunities: Medical / Bio>, InvestKorea, 2013

5. Private Sector

5.1 Domestic Market Trends and Promising Sectors

5.1.1 Industry

- Total supply and demand in Korea's biotechnology industry amounts to KRW 8.1 trillion. 81.5% of the production is in Korea worth KRW 6.6 trillion, while imports account for 18.5% of the supply, worth KRW 1.5 trillion (2011).
- Production and demand of biotechnology industry have grown at an average rate of 10%~11% per year respectively, from 2009 to 2013.
- Domestic demand accounts for 65.1% of the market and is worth KRW 5.3 trillion. Korea exports KRW 2.83 trillion which accounts for 34.9% of supply and demand.

5.1.2 General trends

- Biopharmaceuticals alone accounts for over half of the entire biotechnology sector in Korea. Therefore a major portion of government funding as well as private investment goes into biopharma. Following are some of the key trends and potential market opportunity hot spots.
 - **Bio-diagnostics**
The market for bio-diagnostics is expanding; especially because people are more aware of healthcare. Specific areas of interests are; a. personalized medicine, b. gene (Stem-cell studies) and genetic medicine, widening the scope to studies on diseases and illnesses
 - **Biologics**
This sector can be divided into three areas: original drugs, integrated medicine development, and generic drugs. In generic drug, the focus is on bio-better and bio-similar areas. Companies the biologics space are working on developing and commercializing such products.
 - **Bio-electronics & bio-energy**
These two areas account for only a small portion of the entire biotechnology pie, but they are consistently being developed. Bio-electronics is also related to above two sectors as it focuses on diagnostic devices and general healthcare. Bio-energy sector is working on increasing efficiency of bioenergy.

5.1.3. Imports & Exports

Table 23 Bio-products imports (2012)

Rank	Product	Import	Portion (%)
1	Vaccine	1,088,476	21.8
2	Anti-cancer drugs	373,617	18.0
3	Bio-process and assays devices	251,849	11.8
4	Other biomedical products	245,145	10.0
5	Blood products	133,110	9.3
6	Hormone drugs	89,843	7.6
7	Immunizing drugs	89,959	5.1
8	Diagnostic kit	70,614	3.7
9	New concept diagnosis	69,374	2.2
10	Other biochemical products	68,069	2.0
11	Other bio-foods	19,942	1.3
12	Industrial enzyme and medicine	18,139	1.2

<2012 Korea Biotechnology Survey Report>, MOTIE, Korea Bio, 2014

- Out of 51 domestic bio-products and services, there are 12 products that exceed 1.0% of total imports.
- 8 out of 12 products are biopharmaceutical products, and they constitute 77.7% of total import value.

Table 24 Bio-products exports (2012)

Rank	Product	Export	Portion (%)
1	Animal feed additives	1,281,878	41.9
2	Immunizing drugs	324,728	10.6
3	Food additives	232,123	7.6
4	Vaccine	202,313	6.6
5	Diagnostic kit	125,803	4.1
6	Other biomedical products	98,973	3.2
7	Bio sensor	97,574	3.3
8	Blood product	89,655	2.9
9	Anti-cancer drugs	81,859	2.7
10	Hormone drugs	78,532	2.6
11	Antibiotic	78,410	2.6
12	Amino-acids	61,536	2.0
13	Animal cure	43,919	1.4
14	Enzyme/medicine for R&D experiments	33,260	1.1
15	Health functional food	29,748	1.0
16	Artificial seeds and tree	29,250	1.0

<2012 Korea Biotechnology Survey Report>, MOTIE, 2014

- Out of 51 domestic bio products and services, there are 12 products that exceed 1.0% of total exports.
- 9 out of 16 products are biopharmaceutical products and 4 are bio-foods.

5.2 Private Companies Ranking

5.2.1 Top 20 large-sized private companies (Percentages in the bracket represents biotech market share by sales value.)

Table 25 Top 20 large-sized private companies

Rank	Organization / Portion (%)	Activity
1	SK Biopharmaceuticals (14.9%)	<ul style="list-style-type: none"> • Development of drugs: organic synthesis, catalytic reaction, enzymatic reaction, hazardous reaction, and R&D on CNS diseases and metabolic diseases • CMS business: active pharmaceutical ingredient (API), pharmaceutical intermediate manufacturing, process development of API and intermediate used in a clinical phase, chiral synthesis, continuous low temperature reaction, high pressure hydrogenation reaction, core biocatalyst technologies, QA/QC documentation and DMF filing
2	Dong-a Pharmaceutical (9.5%)	<ul style="list-style-type: none"> • Biotech research center: launch of products such as Interferon-alpha, Growsupin-II injection, Eporon, Leucostim, and Gonadotropin using gene recombination and animal cell culture technologies • Innovative-new-drug research center: anticancer drugs, medicines for Alzheimer's disease and pain medicines • Dong-a dementia center: diversification of research area such as medicines for dementia, innovative new drugs, stem cell therapies, vaccine development and medical equipment technologies through a collaboration with universities, companies, government research institutes and hospitals • Biosimilar, biobetter and new bio drugs: medicines for infertility, arthritis, hemophilia, cancer, diabetes and osteosynthesis
3	SK Chemicals (6.5%)	<ul style="list-style-type: none"> • ECOZEN: Eco-friendly + Zenith = Bio-copolyester • Biodiesel (EcoPrime): palm BD fractionation materializing low CFPP (cold filter plugging point) <ul style="list-style-type: none"> • ECOPLAN - Film, paper coating, sheet, thermoforming, felt (diaper, sanitizer, mask, gown), shopping bag, packing materials - Food container, capsules for coffee, cosmetics container, household items, toy & stationery, electronics • Eco-friendly total healthcare solution, number 1 in the Korean vaccine market share
4	Green Cross (6.1%)	<ul style="list-style-type: none"> • Green cross research center: development of IVIG, Green Plast, its own hemophilia medicines and hunter syndrome medicines
5	Hanall Biopharma (4.8%)	<ul style="list-style-type: none"> • Biobetter medicines, anticancer drugs in biguanide line, diabetes drugs and functional composition drugs <ul style="list-style-type: none"> • Italian partners -Rotta: nonsteroidal anti-inflammatory drugs (NSAIDs) – product name: Afloxan (ingredient: proglumetacin)

Rank	Organization / Portion (%)	Activity
		- Alfa Wassermann: GI Antibiotics – product name: Normix (ingredient: Rifaximin)
6	Samsung Electronics (4.3%)	<ul style="list-style-type: none"> • Samsung Biologics & Samsung Bioepis • On medical products CMO, production and sales of biosimilar
7	Daewoong Pharmaceutical (4.0%)	<ul style="list-style-type: none"> • R&D bio research institute: Easyef (first new bio drug in Korea), Caretropin (biosimilar), Eposis, Novosis (bio convergent medical equipment), Natoba (Botulinum toxin type A) • Italian R&D partners: Rotta, Bruschetti, Italifamaco, Calao
8	Hanmi Pharmaceutical (4.0%)	<ul style="list-style-type: none"> • LAPSCOVERY (Long Acting Protein/Peptide Discovery Platform Technology) + New biologics ⇒ Next generation products (diabetes, obesity, human growth hormone and neutropenia)
9	CJ Cheiljedang (3.4%)	<ul style="list-style-type: none"> • Industrial microbial strain, fermentation and purification process, bio based platform chemicals research and research on biomass • Major products: feed additives (for animals), food additives (taste enhancer - IMP, GMP, MSG), amino acid for food additives (Arginine)
10	Yuhan Corporation (2.7%)	<ul style="list-style-type: none"> • New synthetic medicines, new bio drugs, active pharmaceutical ingredient and incrementally modified drug • Major products <ul style="list-style-type: none"> - Medicine: antihypertensive drugs, anticancer drugs, antibiotics, biologic products, insecticides and hair dye - Health supplement food: drink and supplement food (vitamins and minerals) - Cosmetics: skin care for women and bio oil - Household items: bleaching agent and environment-friendly detergent - Medicine for animals: anti-virulence products and anesthetic for livestock, fishery and pets
11	LG Electronics (2.4%)	<ul style="list-style-type: none"> • Air conditioners and air purifier with bio-enzyme filters
12	Hyundai Heavy Industries (2.2%)	<ul style="list-style-type: none"> • Hyundai Energy & Resources • Plant: in cooperation with Korea Research Institute of Chemical Technology (KRICT), Hyundai Heavy Industries developed a small plant that extracts methanol from CO₂. Methanol is the main fuel of biodiesel
13	Kolon Life Science (2.1%)	<ul style="list-style-type: none"> • Degenerative arthritis: in development process using cell and gene therapy, pain medicine for cancer patients, cancer vaccine and gene therapeutic medicine
14	Ildong Pharmaceutical (2.0%)	<ul style="list-style-type: none"> • New bio drug research: continuous treatment for diabetes (biobetter), peptide anticancer drugs with new action mechanism, QOL-typed fusion protein and peptide drugs, and anticancer and antibody treatments • Bio raw material development: hyaluronic acids and derivatives, raw materials of drugs by an organic catalysis, proteins deriving from microorganisms, antibiotics by the

Rank	Organization / Portion (%)	Activity
		microorganism cultivation and production, raw materials of lactobacillus drugs, and various materials using lactobacillus
15	LG Life Sciences (1.9%)	<ul style="list-style-type: none"> • Bio medicine: Valtropin (human growth hormone), vaccine, growth hormone, medicine for osteoarthritis, fertility treatment and development of biosimilar • Italian partner: Recordati – launch of Zanidip (Iercanidipine)
16	Hanwha Chemical (1.7%)	Bio-similars production and development
17	Dongkook Pharmaceutical (1.6%)	Prescription medicine, biomedicine R&D
18	JW Pharmaceutical (1.5%)	High-quality medicine and supplies for dermatology, urology, pediatrics, and otolaryngology, bio-medicine development
19	Kolmar Korea (1.3%)	Cosmetics, medicine R&D (ODM, OEM)
20	GS Caltex (1.3%)	Biochemical, biofuel

5.2.2 Top 20 small and medium-sized private companies

Table 26 Top 20 small and medium-sized private companies

Rank	Organizations	Money amount (\$1 million)	Portion (%)
1	Genexine	4.8	1.6
2	Cha Biotech	3.8	1.3
3	Ahngook Pharm.	3.5	1.2
4	Medipost	3.5	1.2
5	ViroMed	2.6	0.9
6	Koh Young Technology	2.4	0.8
7	Meere Company	2.3	0.8
8	AminoLogics	2.1	0.7
9	Lutronic	2.0	0.7
10	Daesang	2.0	0.7
11	Medytox	1.8	0.6
12	Dentium	1.7	0.6
13	Hanpoong Pharm & Foods	1.6	0.6
14	Neopharm	1.6	0.6
15	LegoChem Biosciences	1.6	0.6
16	ClairPixel	1.6	0.6
17	Alpinion Medical Systems	1.6	0.6
18	ED	1.6	0.6
19	Bionet	1.5	0.5
20	MEK ICS	1.5	0.5
Total amount		49.6	

<2013 Biotechnology White Paper>, MSIP, 2013>

6. International Investment & Partnerships

6.1 International Benchmarking & Partnerships

Biotechnology is a global trend. The followings are key medium and long term strategic plans some of the world's leading countries have set up to prepare for the arrival of bio-economy.

Table 27 Leading countries' key biotechnology strategies

Nation	Key strategies	Main investment sector
U.S.A	<ul style="list-style-type: none"> ▪ 2012 National Bioeconomy Blueprint, USD 30.7 billion (National Institute of Health budget) ▪ Growth potential of bioeconomy and social convenience 	<ul style="list-style-type: none"> ▪ Food safety, health ▪ Bioenergy ▪ Bio-medical (stem cells)
EU	<ul style="list-style-type: none"> ▪ Europe2020, EUR 79.2 billion ▪ Bio-tech based sustainable growth, resource efficiency and competitive economy 	<ul style="list-style-type: none"> ▪ Food safety ▪ Non-food biotechnology (Energy, material, catalyzer)
U.K	<ul style="list-style-type: none"> ▪ Bioscience 2015, GBP 440 million 	<ul style="list-style-type: none"> ▪ Bioscience ▪ Bioenergy ▪ Industrial biotechnology
Germany	<ul style="list-style-type: none"> ▪ Bioeconomy 2030, EUR 2.4 billion ▪ International market competitiveness, knowledge-based bio economy development 	<ul style="list-style-type: none"> ▪ Food security ▪ Sustainable agricultural production ▪ Biomass based energy
Japan	<ul style="list-style-type: none"> ▪ 4th Science & Technology Basic Plan ('11~'15) ▪ Enhance investment on bio sector through Green-Life Innovation policy 	<ul style="list-style-type: none"> ▪ Regenerative medicine ▪ Stem cells ▪ Post genome for aging population
China	<ul style="list-style-type: none"> ▪ Bio-industry Development Plan ('13~'15) ▪ 20% increase on gross production output 	<ul style="list-style-type: none"> ▪ Overall biotech industry

<2013 Biotechnology White Paper>, MSIP, 2013

6.1.1 Foreign direct investment into Korea

- **Venture investment of Novartis (2008-2010), Switzerland:** From 2008 to 2010, Novartis selected three of Korea's bioventures (Neomics, Pharmabcine, Quroscience) through KOTRA's Global Alliance Project and made equity participation.
- **Joint venture of GlaxoSmithKline (2010), UK:** GSK engaged in equity participation (9.9 percent) in Dong-a Pharmaceutical, establishing a division (joint venture) dedicated to GSK's products. This division will continue to discuss how to maximize the synergy effect if using the infrastructure and expertise of GSK for Dong-a products' penetration into the global market, jointly developing and commercializing generic drugs and fostering stronger cooperation.
- **Joint venture of Quintiles and Samsung Biologics (2011), USA:** Samsung Biologics and Quintiles, a global CMO company, established a joint

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venture and constructed a CMO factory in the Incheon Free Economic Zone, with the goal of developing innovative new drugs after developing biosimilars of global blockbusters.

6.1.2 Setting up of global research institutes

- **GE Healthcare (2007, 2009)**
 - GE Healthcare founded the Electronic Medical Recording R&D Center (2007). The EMR project GE is conducting in Korea includes solutions to manage intensive care units, operating rooms and emergency rooms, electronic charts and the interworking of inspection equipment.
 - GE Healthcare founded U-Health Global R&D Center in Songdo, Incheon, in 2009, with the support of matching funds from the Ministry of Knowledge Economy and Incheon City. It plans to make a 6 billion won investment for six years.
- **Institute Pasteur Korea (IPK, 2004), Pangyo Techno Valley, Gyeonggi Province**
 - Jointly founded by the Institute Pasteur, a French research institute for life science and biotechnology, and the Korea Institute of Science and Technology. IPK conducts research on developing vaccines and medicines and identifying causes of diseases commonly seen in Korea including leukemia, hepatitis and gastritis and diseases seen around the world, such as malaria.

6.1.3 Potential partnership opportunities for Italian players

6.1.3.1 Biopharmaceuticals - the largest biotech sector in Korea

- The future for biotechnology in Korea looks bright, with the government's enthusiastic support.
- 19% of government's total R&D budget, almost 2.6 trillion KRW (approximately 2.4 billion USD) went into biotechnology sector in year 2012. The amount is expected to grow.
- To resolve health problems and social issues stemming from urbanization and ageing society, the government has decided to invest in public welfare technology. It is aiming at improving people's lives and health medical care with integration of various technologies. Support for key technologies in bio-healthcare is also expected to increase.

- Ministry of Health and Welfare's key biopharmaceutical industry support plans are;
 1. Streamlining licensing process of new tech medical products;
 2. Expanding overall government support;
 3. Enhancing efficiency for R&D promotion system;
 4. Financial funding for R&D exports

6.1.3.2 Direct investment into R&D centers and infrastructure

- It was only in 1983 that biotechnology itself was officially recognized. The Korean government is putting considerable emphasis on biotech as a key industry for the future and governmental funding is increasing, and it is far from saturation point. However, the R&D budgets of organizations are not big enough to attract high-quality manpower and carry out long-term research projects.
- There are 7 major bio-clusters and 24 related organizations spread out across the country. The government has chosen biotech as one of the country's next-generation growth engine and plan on becoming the global leader in the area. In accordance with the goal of becoming one of the leading nations in biotech, world-wide cooperation is a must for Korea. Bearing these factors in mind, direct investment-both R&D studies and personnel exchange could be an effective way of collaborating with Korea.

6.1.3.3 Aim for pharmaceutical companies and cooperation

- When launching a new biopharmaceutical product into the Korean market, seek investment opportunities with pharmaceutical companies.
- There are key three actors in the pharma supply chain in Korea: pharmaceutical companies, doctors and pharmacists. A majority of people tend to buy what the pharmacist recommends, instead of actively engaging with doctors or seeking more information. In a lot of cases, regardless of imported or domestically produced goods, it is impossible for the general public to have much information about new products. If the pharmacist does not offer certain products, there is a great chance that they may not be introduced to the market at all.
- Therefore, a potential partnership with Korean pharmaceutical firms is always a viable option.

6.1.4 Core group of Korean firms interested in international partnerships

- Based on a telephonic survey carried out by IBI Research among a screened pool of nearly 70 biotech firms in Korea in December 2014, the following firms were interested in technology and commercial partnerships with biotech firms and research organizations from Europe.

Table 28 List of Korean biotech companies open for collaboration

Organizations	Sector	Description of activity
DNA Link	Bioassays, information services	Exome capture sequencing, whole genome sequencing, target region capture sequencing, de-novo assembly, mRNA sequencing, small RNA sequencing, chip sequencing
MEK-ICS	Bioprocess and equipment	Medical devices, ICU ventilator, transport ventilator, respirare therapy(CPAP), patient monitor, pulse Oximeter
Dong-A Pharmaceutical	Biopharmaceuticals	Pharmaceutical products
Hanmi Pharmaceutica	Biopharmaceuticals	Complex new drugs, hypertensive medicine, hyperlipidemia medicine
Hanwha Chemical Corporations	Biopharmaceuticals	Biosimilars
GeneOne Life Science	Biopharmaceuticals	Biopharmaceutical products CMO, DNA vaccine
Daesung Microbiological Labs	Biopharmaceuticals	Microbial agent, animal medication, vaccine, medical products
Daehan New Pharm	Biopharmaceuticals	Medicine and medical supplies, animal medication
Macrogen	Biopharmaceuticals	Bio-chip, biomedical products
Medifron DBT	Biopharmaceuticals	Biomedical products
Bioland	Biopharmaceuticals	Cosmetic products, health food, medication
Celltrion	Biopharmaceuticals	Biosimilar, animal medication
ChoongAng Vaccine Laboratory	Biopharmaceuticals	Animal medication, diagnostic kit, medicine
JW Shinyak Co.	Biopharmaceuticals	High-quality medicine and supplies for dermatology, urology, pediatrics, and otolaryngology, bio-medicine development
Komipharm Int'l	Biopharmaceuticals	Animal medication, bio-fertilizer
PharmswellBio	Biopharmaceuticals	Raw material medicine production, anti-biotics
SK Chemicals	Biopharmaceuticals, Bioenergy	Bio-diesel, biodrugs, natural substance drugs
CJ Cheiljedang	Biofood	Food additives
NeoPharm	Biochemiclas	Cosmetic products

A separate database of firms covered in the above survey as well as contact information for the above firms have been provided as an addendum to this report.

6.1.5 Korean companies overseas

6.1.5.1 Samsung

- Chose bio-health sector as one of future growth priorities in 2010.
- In 2011, founded joint venture with Quintiles of US for bio-similar industry.

6.1.5.2 LG

- LG Life Science; working on general development of biotechnology industry and bio-similar investment.
- US FDA and Europe's EMEA approved growth hormone product, Valtropin (biogeneric drug).
- 2012, signed joint R&D and sales contract with Japan's Mochida on bio-similar products.

6.1.5.3 SK

- Enhanced healthcare business and founded SK Biopharm focusing on development of new drugs, as one of its affiliated firms.
- Founded a joint venture Health-Connect with Seoul National University.
- In 2013, SK Biopharm signed a joint R&D contract with two of China's leading biotech companies.
 - PKU International Healthcare Group, on development of new drugs
 - Shanghi Medicilon, on medical treatment products for mental diseases

6.1.5.4 Medipost

- Founded a joint venture company in China with Jingyuan Bio, for stem-cell treatment R&D.
- Cartistem is a knee cartilage reproduction medicine which Medipost developed. Through this joint venture, Medipost will own sole rights of exclusive product development and sales. Clinical testing and production of new drugs will also be carried out.

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