



Biotechnology Industry

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Summary:

- **Output value:** Biotechnology industry is little affected by economic downturn. Therefore, the global recession triggered by the global financial meltdown in the second part of 2008 did not have a far-reaching impact on the value of output of biotechnology industry in Taiwan. The outbreak of H1N1 swine flu epidemic in 2009 spurred demand for vaccines, reagents, and other medical disposables. Moreover, a steady rise in sales of seedlings and food biotechnology products further contributed to an increase in the value of output of biotechnology industry in Taiwan in 2009. With the Taiwanese government wholly committed to promoting biotechnology industry in the first part of 2010, the industry made significant progress in biocosmetics, plant biotechnology, and veterinary vaccines. Furthermore, effort to develop overseas markets by Taiwanese firms bore fruit gradually, further pulling up the industry's output value.
- **Investment situation:** Investment funds declined in Taiwan in 2008 on the knock-on effect of the global financial meltdown. However, with a gradual economic turnaround, investment funds staged a slow recovery in 2009. Funds were allocated to new discoveries in emerging biotechnology industry, to gradually maturing new technology for pharmaceutical industry, and to new applications and markets, the main investment targets. By contrast, technology for medical device manufacturing reached a maturity stage because Taiwanese firms joined the sector for quite a long time, leaving limited room for growth. That is, the proportion of medical device manufacturing to overall investment funds was relatively smaller.



Summary (continued):

- **Revenue performance:** Because of a steady increase in overseas orders and strong sales of functional food in the first half of 2010, most Taiwan's biotechnology firms witnessed stronger revenue growth than in the same period a year earlier, with the revenue of Bionet the weakest.
- **Industry dynamics:** Demand for health food increases rapidly in Taiwan on the ageing of Taiwanese society being in the offing and health preservation becoming a trend worldwide. In addition to active investment by biotechnology firms, conventional pharmaceutical and food manufacturers also spare money to strive for a window of opportunity from health food markets. The protracted decline in prices of medicines covered by the National Health Insurance in Taiwan compels pharmaceutical firms to search for other sources of revenues and are those firms active in the development of health food, with Chunghwa Chemical & Pharmaceutical Corporation Limited, Sinphar Group Company, Yung Shin Pharmaceutical Industrial Corporation Limited and Standard Chemical & Pharmaceutical Corporation Limited entering Taiwan's health food market via various distribution channels such as cosmeceutical chains, TV shopping, and their own brand counters.
- **Industry outlook:** Continued increase in overseas orders for flower seeds, health food and reagents, combined with new medicines' completion of clinical trials, stage 2, and license fees to Taiwanese firms by overseas firms, will further contribute to an increase in the value of output of biotechnology industry in Taiwan in the upcoming six months.
- **Industry Development Trends:** The world's major crop producing countries are severely hit by flooding and droughts in 2010, significantly increasing prices of major crops. The increase in prices of agricultural produce not only raises inflationary concerns but also helps revive problems related to food security and draws attention to issues on genetically modified crops. With falling arable land, combined with high frequency of extreme weather, genetically modified crops have the potential for growth in the future.



Overview

- **Increased demand for H1N1 swine flu related vaccines and reagents, combined with a steady growth in sales of seedlings and food biotechnology products boosted biotechnology industry. The value of output of biotechnology industry rose in Taiwan in 2009, with emerging biotechnology sector witnessing the strongest growth. Moreover, the Taiwanese government was active in promoting the industry in the first part of 2010, together with the development of overseas markets further, pulled up the value of output of industry in Taiwan.**

Any establishment engaged in emerging biotechnology, pharmaceutical and medical devices are included herein, according to Taiwan's Ministry of Economic Affairs. In 2009, the overall output value of biotechnology industry rose 4.73 percent year-on-year to NT\$210.5 billion in 2009 (Table 1), with output value of emerging biotechnology industry growing 9.43 percent year-on-year to NT\$58 billion, the largest growth, while those of medical equipment manufacturing and pharmaceutical industry amounted to NT\$82.5 billion and NT\$70 billion, respectively. Because biotechnology industry is little affected by economic downturn, the global recession caused by the global financial meltdown in the second half of 2008 had a minor impact on output value of the industry. Meanwhile, the outbreak of H1N1 swine flu epidemic in 2009 spurred demand for vaccines, reagents and other medical consumables. Additionally, sales of plant seeds and organic food remained on the rise, further boosting sales of biotechnology industry in Taiwan.

With the Taiwanese government committed to promoting the development of biotechnology industry in the first half of 2010, the industry made substantial progress



in various sectors such as biotechnology pharmaceutical products, seed biotechnology, and veterinary vaccines. Moreover, the output value of biotechnology industry further increased as Taiwanese firms remained active in developing overseas markets.

Table 1: Output Value and Annual Growth Rate of Taiwan Biotechnology Industry

Unit: NT\$100 million; %

Item	2005	2006	2007	2008	2009	
					Amount	YoY
Emerging biotechnology industry	386	434	483	530	580	9.43
Pharmaceutical manufacturing	624	660	680	690	700	1.45
Medical equipment industry	590	697	749	790	825	4.43
Total	1,600	1,791	1,912	2,010	2,105	4.73

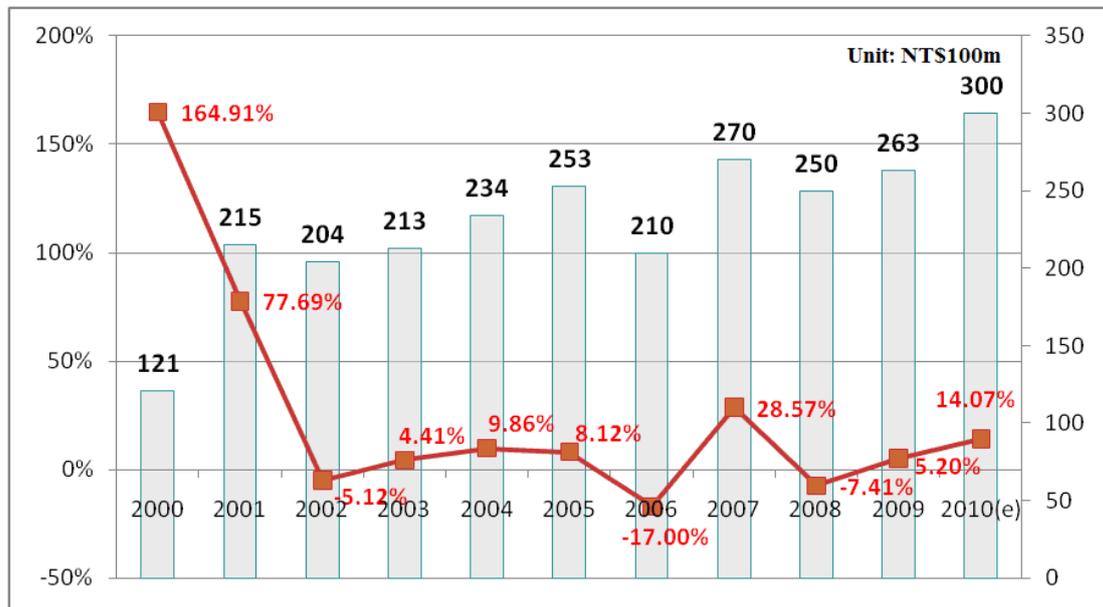
Source: Industrial Development Bureau, Ministry of Economic Affairs, Taiwan, R.O.C., Arranged by Taiwan Industry Economics Services, July 2010.

- **Economic turnaround in Taiwan in 2009 spurred investment recovery in biotechnology industry, with emerging biotechnology industry and pharmaceutical manufacturing being the main targeted sectors.**

Looking at changes in investment funds for biotechnology industry over the past 10 years, after the dotcom bubble during the 1999-2001 period, global capital rapidly moved to biotechnology industry presenting promising prospects for growth. Additionally, the Taiwanese government was committed to the development of biotechnology industry, resulting in high growth in investment funds for biotechnology industry. Growth in investment funds for biotechnology industry was quite stable during 2002 through 2005 period. Because the Biotech and New Pharmaceutical Development Act was about to be enacted in 2007, total investments in biotechnology industry fell significantly in 2006 before recovering in 2007. Total investments slid to NT\$2.5 billion on the global financial meltdown (Figure 1). With a gradual economic recovery in 2009, total investments rose progressively to NT\$26.3

billion.

In 2009, NT\$10.921 billion were invested in emerging biotechnology industry, accounting for 41.56 percent of total investments in biotechnology industry, while medical equipment manufacturing and pharmaceutical industry accounted for 26.50 percent and 31.94 percent to NT\$6.963 billion and NT\$8.396 billion, respectively. Investment spread reveals that technologies for both emerging biotechnology industry and pharmaceutical industry gradually has reached a maturity level, prompting both industries to keep developing new applications and new markets, the main investment targets. By contrast, technology for medical equipment manufacturing has already reached a maturity status, and the sector has developed in Taiwan for quite a long time, leaving little room for growth in the future. Therefore, the proportion of medical devices manufacturing to overall investment is relatively smaller.



Source: Biotechnology & Pharmaceutical Industries Program Office, Ministry of Economic Affairs, Taiwan, R.O.C., Arranged by Taiwan Industry Economics Services, July 2010.

Figure 1: Trend in Investment in Biotechnology Industry in Taiwan, 2000~2010



- **A steady increase in overseas orders and strong sales of health food in the first six months of 2010 gave Taiwan's biotechnology firms a boost. Most of firms witnessed a stronger revenue growth in the first half of 2010 than in the same period a year ago, with GenMont Biotec Incorporation and Abnova Corporation the best performers in terms of profits in the first quarter of 2010.**

Boosted by a continued increase in overseas orders and strong sales of health food in the first half of 2010, most of firms witnessed revenue growth in the first half of 2010. But revenue performance of Bionet was quite weaker. The revenue of MicroBio Corporation Limited skyrocketed 286.26 percent to 248 million in the first part of 2010 on strong sales of health food, success in entering the China market and the company's providing RT-Mart with OEM orders for health food. In addition, GenMont Biotec Incorporation was active in developing and setting up distribution channels, joining the production of health food and in taking OEM orders for probiotics raw materials, thereby boosting revenue which soared 83.15 percent year-on-year to NT\$168 million. As for Abnova Corporation, a large antibody production manufacturer, the revenue rose steadily by 24.66 percent year-on-year to NT\$241 million on increased sale of antibodies worldwide and continued growth in sale of test reagents. By contrast, the revenues of GenMont Biotec Incorporation, MicroBio Corporation Limited, Bionet, and DR.Chip Biotech, Inc. were quite weaker in the first part of 2010. DR.Chip Biotech, Inc. was boosted by strong demand for reagents in the first half of 2009 considered the higher-base year, and with new products missing expectations, revenue of DR.Chip Biotech, Inc. changed little in the first half of 2010 from the same period a year earlier. Bionet, a well-known company for its cord blood stem cells saw a 23.85 percent year-on-year decline in revenue to



NT\$217 million on fierce competition, and the company's active effort to the development of genetic testing contributed little to the revenue.

On the profit front, because of increase in revenue and a steady rise in gross margin, the operating income of GenMont Biotec Incorporation jumped 627.61 percent year-on-year to NT\$32 million in the first quarter of 2010. Net profit amounted to NT\$45 million, while earnings per share reached NT\$0.94, a strong profit performance. Meanwhile, although a sharp increase in revenue of MicroBio Corporation Limited spurred gross margin, expenditures on research and development of new products continued to rise, combined with increased sale expenses, the company made loss of NT\$21 million. Taking into account a NT\$104 million profit from financial asset evaluation, net profit after tax totaled NT\$85 million, and earnings per share were NT\$0.38. Abnova Corporation, an antibody manufacturer, saw staged an increase in revenue, while gross margin slid marginally. As a consequence, operating income reached NT\$32 million, net profit NT\$42 million; profit continued to rise. Meanwhile, revenues of Bionet and DR.Chip Biotech, Inc. failed to rise substantially in the first quarter of 2010, leading to losses of NT\$14 million and 0.07 and NT\$7 million, respectively.

Table 2: Profit and Loss Accounts of Major Biotechnology Firms in Taiwan, 2010

	GenMont Biotec Incorp. (3164)	MicroBio Corp. Ltd. (4128)	Bionet (1784)	DR.Chip Biotech, Inc. (4131)	Abnova Corp. (4133)
Jan-Jul Revenue (NT\$100m)	1.68	2.48	2.17	0.16	2.41
YoY (%)	83.15	286.26	-23.85	1.82	24.66
Gross margin (%)	69.53	56.13	63.30	65.15	58.45
Operating income (NT\$100m)	0.32	-0.21	-0.09	-0.08	0.32
YoY (%)	627.61	—	—	—	40.71
Net profit (NT\$100m)	0.45	0.85	-0.14	-0.07	0.42
YoY (%)	308.50	—	—	—	71.75
EPS (NT\$)	0.94	0.38	-0.33	-0.14	0.71

Note: January-June earnings figures excluded, the remaining data covered the Q1 2010 period.

Source: Market Observation Post System, Arranged by Taiwan Industry Economics Services, July 2010.

Industry Dynamics

- **Located in a tropical climate, Pingtung Agri-Biotech Park is good at agricultural technology by virtue, attracting many biotechnology firms to establish strongholds there. The turnover of Pingtung Agricultural Biotechnology Park is expected to increase significantly in 2010 with the completion of agricultural biotechnology and veterinary vaccine facilities.**

Although the Taiwanese government is committed to promoting biotechnology industry and Taiwan enjoys a high standard of agricultural technology, labor costs keep going up annually and the industry faces tremendous transformation. As a consequence, biotechnology has become one of the sectors in which firms are actively involved. Agricultural biotechnology industry mainly covers seedlings, aquaculture,



animal biotechnology, science and technology for Chinese herbal medicine, bio-pesticides and fertilizers, veterinary vaccines, reagents, animal and plant molecular farms, and biotechnology services. In 2009, global output value amounted to NT\$37.4 billion, with market size growing 14 percent annually. Pingtung Agricultural Biotechnology Park is located in Taiwan's tropical weather region, and the park's state-of the art agricultural technology standard attracts many biotechnology firms such as Health Bank, Tuadiao, TCI Corporation Limited, Makuang, among others, suggesting a promising prospect for development.

Regardless of the number of newly registered firms, total investments, number of tenant businesses, or leases of land, all more than doubled in 2009 (Table 3), according to figures from Pingtung Agricultural Biotechnology Park. The park previously invested NT\$1.45 billion in setting up Asia's largest agricultural biotechnology facility (workshop). The construction works were gradually completed during March through May 2010. Additionally a veterinary vaccine facility will be completed in the nearest future aiming at attracting new tenants. That is, Pingtung Agricultural Biotechnology Park's turnover is expected to see a staggering growth in the future.

Table 3: Pingtung Agricultural Biotechnology Park Investment Overview

	2008	2009	YoY
Number of newly approved businesses	11	17	163%
New investments (NT\$100 million)	5.5	13.5	270%
Number of tenants	1	8	700%
Lease area	2.78	10.31	370%

Source: Pingdong Agricultural Biotechnology Park, January 2010.



- **Demand for organic agriculture rises gradually in Taiwan on growing health awareness, attracting a large number of businesses to engage in the development of agricultural biotechnology products.**

With health awareness coming to the fore, demand for organic agricultural market rises progressively, attracting many operators to be involved in the development of agricultural biotechnology products (Table 4), with Uni-President, Yuen Foong Yu Group and Teco Group relying on Cooper contract models to produce organic vegetable and fruit, while Advanced Green Biotechnology Inc. was bullish about the prospects for the future passage of the biological fertilizer law, prompting Advanced Green Biotechnology Inc. to be active in joining the production of biological fertilizers.

Regarding organic vegetables and fruits, Yuen Foong Yu Group, was the first firm engaged in organic vegetables and fruits in Taiwan and set up an organic recreation farm in Nan-Ao, Ilan. In addition to planting organic vegetables and fruits, Yuen Foong Yu Group also owned a pilot production base for biological agents, and the Group signed a contract with Uni-President to jointly cooperate on a project in Ilan. Currently, Yuen Foong Yu Group and Uni-President Group cooperate in the production of organic vegetables and fruits and rely on the Internet channels to provide general consumers with the products needed. Meanwhile, Teco Group together with farmers to produce organic ingredients in Yulin and Hualien to provide Mos Burger, a company in which the group holds share in to promote healthy safe ingredients In addition to developing sale channels for organic products, MicroBio Corporation Limited, meanwhile, is also active in promoting organic ingredient certification for farmer production.



With regard to fertilizers, the Taiwanese government is been active in rolling out biological fertilizer laws given that organic crops have become a trend worldwide. When the laws come into force, firms that focus on chemical fertilizers will loose competitiveness, prompting Advanced Green Biotechnology Inc. to be active in engaging in research and development of biological fertilizers. Advanced Green Biotechnology Inc. has come up with a plan to set up 16 ferment troughs (with a capacity of 50 tons). For the first phase, four ferment troughs with capacity of 50 tons have already been operational, and the company is expected to become Asia’s largest biological fertilizer producer by 2015.

Table 4: Taiwanese Firm Involvement in Agricultural Biotechnology

Manufacturer	Product development	Sale target
Uni-President Enterprises	Vegetable, fruits, and food	General public
Yuen Foong Yu Group	Vegetable, fruits, and food	General public
Teco Group	Vegetables and rice.	Provide Mos Burger, an invested company, with ingredients needed.
Taiwan Fertilizer Corp. Ltd.	Fertilizers.	Farmers.
Sinon Corporation	Pesticides.	Farmers.
Fwushow Industry Corp. Ltd.	Feeds and organic fertilizers.	Farmers.
Huikwang Corp.	Plant protection agents.	Farmers.
Advanced Green Biotechnology Inc.	Biological fertilizers.	Farmers.
MicroBio Corp. Ltd.	Organic certification.	Farmers.

Source: Aforementioned firms, Arranged by the Commercial Times, May 2010.

- **Demand for heath food has rapidly risen in Taiwan with the ageing of Taiwanese population and health preservation coming to the fore worldwide, attracting many Taiwanese pharmaceutical, food, and biotechnology firms to be active in positioning themselves to take advantage of the rapidly growing market.**



With ageing society and health preservation being in the offing, demand for health food has increased so rapidly in Taiwan. In addition to active involvement by local biotechnology firms, conventional pharmaceutical and food manufacturers have established related units to strive for business opportunities from health food. Adversely affected by the decline in prices of medicines covered by the National Health Insurance, Taiwanese pharmaceutical firms such as Chungwa Chemical & Pharmaceutical Corporation Limited, Sinphar Group Company, Yung Shin Pharmaceutical Industrial Corporation Limited, Standard Chemical & Pharmaceutical Corporation Limited, among others, have been forced to search for new sources of revenues by being active in the development of health food. Those firms rely on various distributional channels such as cosmeceutical chains, TV shopping platforms and their own brand counters to strive for growing health food market in Taiwan.

On the other hand, in addition to the domestic market, Taiwanese biotechnology firms are also active in developing the China market, with MicroBio Corporation Limited, a Taiwanese firm, cooperating with China Rt-Mart International Corporation Limited Group resulting in the launch of a new brand “Er Yue Hong”. The company will keep coming up with new products in the future, while Sagittarius Life Science relies on its main shareholders Kelti International Corporation Limited who has 4,000 distribution channels in China to develop the China market, and GenMont Biotec Incorporation and Center Laboratories, Inc. jointly invested in the production and resale of probiotics.

Moreover, Taiwanese biotechnology firms have also been very active in engaging in the development of health food by adding functional ingredients to food to enhance food value and to further expand product sale to consumer groups. In addition to

health food, Taiwanese food manufacturers are also involved in genetically modified orchid, fishery, and aquaculture feed to say the least. To develop biotechnology products, Kuang Chuan Corporation set up Kuang Chuan Corporation's biotech unit in 2007 and stationed at the Pingtung Agricultural Biotechnology Park. Uni-President, meanwhile, also set up Uni-President Biotech to develop Metamin health 3D and completed Taiwan's Department of Health certification, while AGV Products Corporation and Hey Song Corporation actively launched health drinks to get share of a pie provided by the domestic market.

Table 5: Investments in Health Food by Taiwanese Firms

Pharmaceutical firms		Biotech firms		Food firms	
Firms	Project Development	Firms	Projects Development	Firms	Project Development
Chunghwa Chemical & Pharmaceutical Corp. Ltd.	General health products.	Grape King Inc.	Linzhi Wang and Probiotics.	Kuang Chuan Corporation.	PROLite.
Yung Shin Pharmaceutical Industrial Corp. Ltd.	General health products.	MicroBio Corporation Limited.	Herbiron and Chang da ren.	Uni-President Enterprises.	Metamin health 3D.
Sinphar Group Company.	General health products.	GenMont Biotec Incorporation.	Probiotics.	AGV Products Corporation.	Nutrition and food series.
Standard Chemical & Pharmaceutical Corp. Ltd.	General health products and agent for vitamins.	Sagittarius Life Science.	Kampo health food.	Hey Song Corporation.	Sleeping princess beauty drink and slimming capsules.

Source: Aforementioned Firms, Arranged by Taiwan Industry Economics Services, July 2010.

Industry Outlook

- **A further increase in the value of output of biotechnology industry is**



expected in Taiwan on a steady rise in overseas orders for flower seeds, health food and reagents, on the completion of the second phase of clinical trials of newly developed medicines by Taiwanese firms, and on Taiwanese biotech firms' granting patents to large international firms.

The industry will benefit from a steady increase in overseas orders for flower seeds, health food and reagents in the upcoming six months. Additionally, new medicines developed by Taiwanese firms have completed the final stage of clinical trials, and Taiwanese firms have successfully granted foreign firms patents in return of patent fees, boding well for a further growth in output value of biotechnology industry in Taiwan in the next six months. With regard to the overall industry environment, because the authority has lowered barriers to entry for biotechnology industry, venture capital will speed up the development of the industry by small and medium size biotechnology firms in Taiwan. Additionally, biotechnology related fields will be among the topics during the sixth round of Jiang-Cheng negotiations on an economic cooperation framework agreement (ECFA) conducive to the development of the China market by Taiwanese biotech firms. Overall, with the industry environment maturing gradually and Taiwanese firms' research and development technology improving steadily, the output value of Taiwan's biotechnology industry is expected to witness a stable growth.

- **The outbreaks of SARS and H1N1 swine flu epidemics spread panic worldwide, shifting attention on human vaccines. Moreover, progress in research and development technology and improvement in production ability by Taiwanese vaccine firms will spur the active development of overseas markets.**

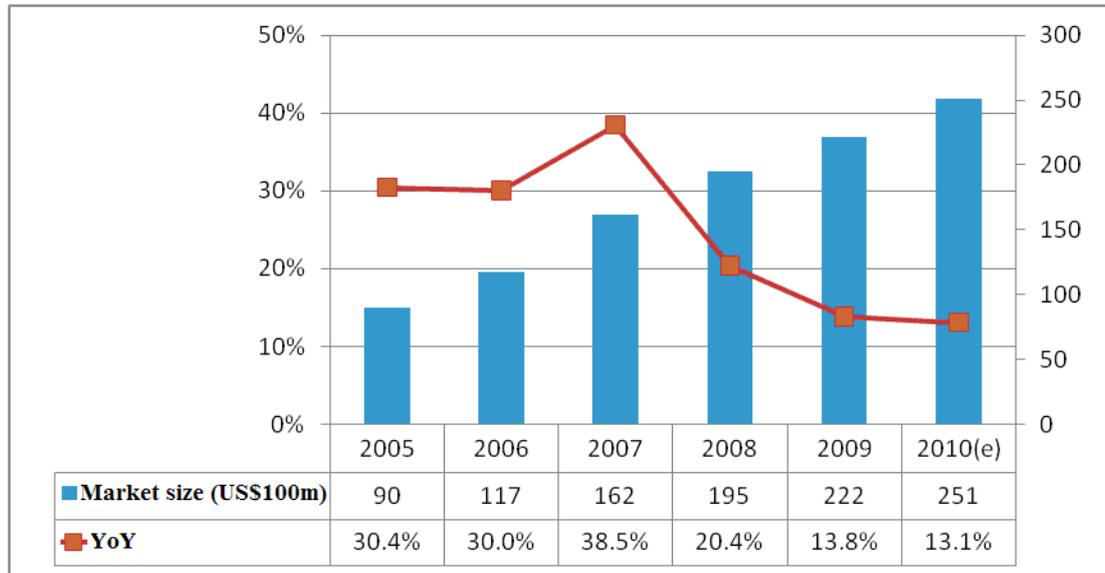
The outbreaks of bird flu, swine flu and H1N1 swine flu epidemics have caused panic



worldwide in recent years, further spurring demand for vaccines. In the past, high medical needs were the main targets for research and development of vaccines. To spot the industry's future momentum growth, worldwide firms devoted to the development of vaccines will continue to focus research on cancer and other regional diseases. In addition to the existent vaccine suppliers, other large European and American biopharmaceutical manufacturers and their peers in Asia's emerging countries are active in research and development of vaccines, encouraged by promising prospects for vaccine markets.

The global market of human vaccines totaled US\$22.2 billion in 2009, up 13.8 percent from the same period a year earlier, and the market size is expected to rise at an annual rate of 13.1 percent to US\$25.1 billion in 2010, according to Kaloram Information. In 2008, vaccines for children accounted for 52 percent of sales, while those for adult took up 48 percent. With upward trend in demand for general vaccines and other influenza vaccines from adults, the market for adult vaccines will be stronger than the market for pediatrics vaccines.

To cope with growing demand worldwide, Taiwanese firms such as Taiwan Adiminue Corporation, Medigen Biotechnology Corporation, and Mycenax Biotech Inc. are active in developing new vaccines, with Medigen Biotechnology Corporation in a joint venture with National Health Research Institutes developed new flu vaccines which underwent clinical trials. Mycenax Biotech Inc., meanwhile, together with Vaxin, a US firm, also developed a new vaccine, and Taiwan Adiminue Corporation is also active in developing cell culture vaccines. Progress in research and development technology and improved production ability will allow Taiwanese firms develop the international markets aggressively.



Source: Kalorama Information, Arranged by Biotechnology Center, Industrial Technology Research Institute (ITIS).

Figure 2: Global Market Share and Annual Growth of Human Vaccines, 2005-2010

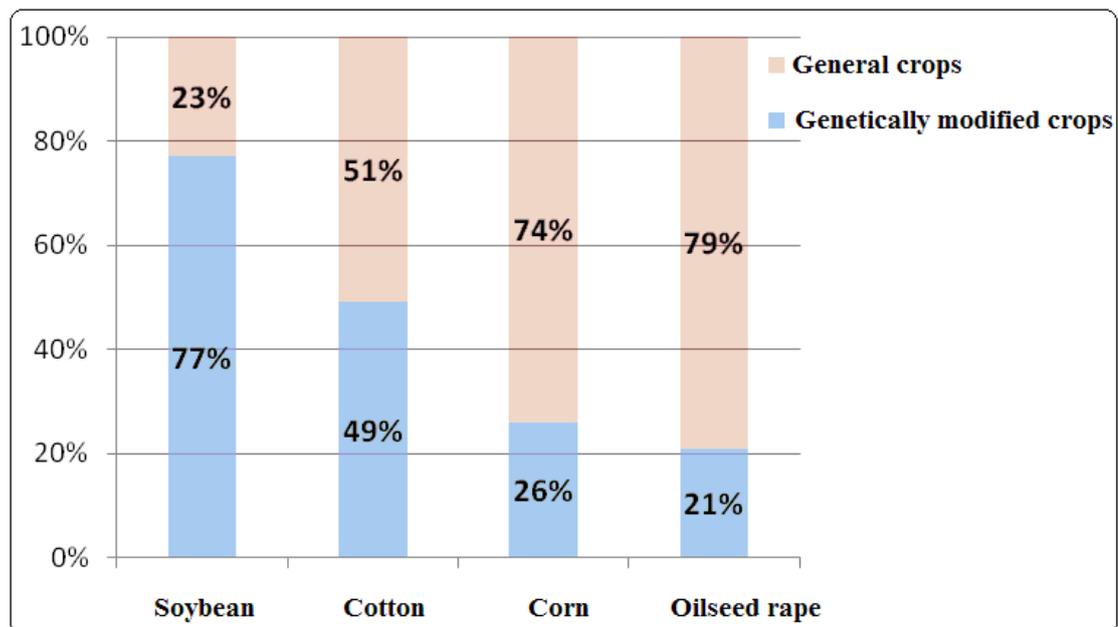
- **Global warming and climate change have transformed farming environment, increasing planting costs, causing unstable harvests, heightening price fluctuations, and popping up the importance of genetically modified crops.**

With growing populations worldwide, a dearth of land, and scarce resources, to keep raising crop supply and to deal with energy demand have become a more pressing issue for each country. Moreover, biofuel has become an important topic worldwide since 2008 on soaring oil prices. With global warming and climate change, the farming environment has changed a great deal, not only raising farmers' costs, but also destabilizing crop production and creating market volatility.

The global genetically modified crops rose at annual pace of 7 percent to 134 million hectares in 2009, and soybean, cotton, corn, and oilseed rape were the main genetically modified products, accounting for 40 percent of the total crops, according

to ISAAA (Figure 3). Genetically modified soybean accounted for 77 percent of cultivable areas in 2009, while genetically modified cotton, corn, and oilseed rape accounted for 49 percent, 26 percent and 21 percent of the global farming areas, respectively. As showed above, conventional soybean and cotton varieties are gradually being replaced by genetically modified crops. With regard to corn and oilseed rape, although their proportions of genetically modified crops are less than 30 percent, increased land for corn and oilseed rape has been used for the cultivation of genetically modified corn and oilseed rape.

Flooding and droughts have destroyed crops in the world's major producing regions, fuelling a sharp increase in prices of major crops in 2010, sparking concerns about inflationary pressure, popping up food security worries, and shifting renewed attention to genetically modified crops. With falling cultivable land and increased common occurrence of extreme weather, genetically modified crops have potential for growth.



Source: ISAAA (2010), and Industrial Economics & Knowledge Center (IEK), Industrial Technology Research Institute (ITIS), Arranged by Taiwan Industry Economics Services, July 2010.

Figure 3: Global Share of Genetically Modified (GM) Crops, 2009