The Transformation of the Sugar Industry and Land Use Policy in Taiwan

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Abstract

This paper examines the relationship between the sugar industry and land use patterns in Taiwan from an extended historical perspective (1624–2008), covering the colonial era, the period of industrial development, and the island's current status as a newly industrialized country. Description and analysis of historical factors are used to provide insight into how an agricultural society copes with the pressures of development, industrialization, and urbanization, as well as the key factors pertaining to land use conversion, the land crisis, and the overall condition of rural industry. This paper focuses on the development of the sugar industry and the sugarcane plantations, and also includes an examination of the relationship between the sugar industry and nation's land use policies. By analyzing the related materials, we hope to reappraise the sustainability of current land use practices, and offer insight on how appropriate land use policies can be used to promote a new vision of urban planning and industrial heritage reuse during the course of rural industry transformation.

Keywords: sugar industry; land use policy; rural industry; colonialism; Taiwan

1. Introduction

While social, political and economic changes are occurring in a developing agricultural country, farmland is affected by both urbanization and industrialization. This process also gives rise to certain changes in the human environment and leads to changes in land use patterns that can result in overuse and natural environmental degradation. The history of the sugar industry in Taiwan over the past few centuries provides a snapshot of the overall development of the island's agricultural society, and how the sugar industry played a key role in the transition from a developing country to a newly industrialized country. Previous research on Taiwan's sugar industry has focused on preserving certain vestiges of the industry for the development of industrial heritage sites (historical architecture, sugar industry rail lines, and related facilities). This study investigates the changing historical relationship between the sugar industry and land use in order to shed more light on the influence of government policies on rural industry and land use patterns. Developing countries need to anticipate the influence that changes in land use will have on both the human and natural environment, keeping in mind that careful consideration of the land use policies relating to rural industry is a long-term undertaking.

A review and analysis of historical documents helps to determine the essential historical factors, making it possible to clearly map out the transformations of the sugar industry and the sugarcane plantations; it also offers insight into the different effects the implementation of land use policies has had on the development of the sugar industry. With respect to the period of urbanization and industrialization, the changing relationship between the sugar industry and land use policies can be divided into four transitional stages: the asset requisition and reconstruction period (1945–1949); the farmland expansion and readjustment period (1950–1989); the land diversification and transformation period (1990–1999); and the multifaceted land use period (2000 to the present).

Furthermore, this research seeks to elucidate how the rural industry land policies of a developing country need to take into account the new vision of urban planning and industrial heritage reuse.

2. Development of the Sugar Industry in Taiwan

Sugar production in Taiwan began with the Dutch occupation and colonization of Taiwan in the early 17th century, and was modernized at the beginning of the 20th century under Japanese colonial rule. Thus the early sugar industry in Taiwan was closely linked to its colonial history, and the industry's fortunes have been closely linked to political and economic factors related to the regime changes, which took place over

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four centuries. Japanese economist and educator Tadao Yanaihara (1893–1961) has written: "The history of the sugarcane industry is the history of colonialism," (Yang, Y.Q., 2001) making explicit the close relationship between colonialism and sugar production in Taiwan.

2.1 Sugar production during the colonial period

2.1.1 The legacy of colonialism

A colony's economic potential inevitably attracts outside investors and settlers who, due to preferential treatment by the colonial authorities, easily gain an upper hand in the colony's economic and political affairs. Over the past four centuries Taiwan's sugar industry has been closely linked to both of its colonial periods, and the policies of the colonial administrators of various periods have had a marked influence on the development of Taiwan's sugar industry. The results of these policies have included a large supply of inexpensive labor and mass production. Thus, right from the start, unlike in other countries, the sugar industry in Taiwan has always been fueled by economic speculation, with the planting of sugarcane and the production of sugar being determined by world markets. Furthermore, the majority of sugarcane growers were contract farmers who would plant sugarcane or other crops, depending on the price of sugar.

2.1.2 Political changes and sugar industry policies

i) The first colonial period

Following the Dutch colonial period, Taiwan came under the control of the Ming dynasty and then the Qing dynasty, the respective sugar industry policies of which will now be described in brief. Eager for increased trade with the Orient, the Dutch established a branch of the Dutch East India Company (Vereenigde Oost-Indische Compagnie) in Taiwan. The Dutch colonial period lasted from 1624 to 1661, during which time rock sugar soon became Holland's main source of income. The Company took a range of measures to increase sugar production, including the opening of new agricultural lands, tax exemptions, the provision of land and tools to farmers, the importation of laborers from mainland China, and the introduction of oxen and improved farming techniques from southern China. The sugar industry policies of the Dutch colonial era were characterized by the promotion of increased sugarcane cultivation and the continued use of traditional sugar manufacturing techniques (Fig.1.). This was the formative period in the history of the sugar industry in Taiwan, setting the stage for much of the industry's later development.

Ming dynasty rule of Taiwan lasted from 1661 to 1683. Following the fall of the Ming dynasty and the establishment of the Qing dynasty, the Ming loyalist Koxinga (1624-1662) expelled the Dutch from Taiwan, turning the island into his base of operations for retaking the mainland. In need of financial resources to carry out raids on his Qing dynasty enemies, Koxinga encouraged the expansion of agricultural land and the stockpiling of grains, and also had his soldiers engage in agricultural work. Koxinga's administration implemented a government monopoly on sugar, which was sold to Japan in exchange for copper and lead needed for the manufacture of armaments, turning the sugar industry into a key strategic resource. But political instability and natural disasters resulted in a 20% drop in sugar production compared to the Dutch period.

The Qing dynasty ruled Taiwan from 1683 to 1894. Although the Qing dynasty included Taiwan in its territory it had little interest in the island's economy. During this period Taiwan was largely isolated from the outside world, and the sugar export market was limited to Japan and northern China. The period beginning with Qing rule up to the second half of the 19th century saw extreme fluctuations in sugar production. American and European competition for markets in the Far East at the beginning of the 19th century led the Qing government to open China to foreign trade around 1860, resulting in a rapid increase in Taiwan's sugar production. Afterwards, natural disasters and hostilities between China and France resulted in a decrease in the price of sugar and an unprecedented drop in sugar production. During this 200-year period, despite intense fluctuations in sugar production due to political instability, the sugar industry continued to develop. Moreover, during this period of reduced political and economic regulation, Taiwan's sugar industry became free from government monopoly for the first time, resulting in a liberalized era in which sugarcane farmers set up individual or cooperative sugar houses (tangbu) (Fig.2.). According to the records, there were 1,275 sugar houses in Taiwan at the time. During the Japanese colonial period the sugar houses were amalgamated into private commercial enterprises, and could thus be said to be the predecessors of the Taiwan Sugar Corporation (Taisugar).

ii) The second colonial period

The Japanese colonial era lasted for exactly half
a century (1895–1945). The colonial, industrial and commercial relationship between Taiwan and Japan was largely based on political factors, and less on economic factors, with the Japanese government playing the leading role from start to finish. At first Japan's guiding principle towards its colonial possession was "industry for Japan, agriculture for Taiwan." During the 1930s, however, due to the exigencies of World War Two, this changed to "industry for Taiwan, agriculture for Southeast Asia."

At the beginning of this period, Taiwan's sugar industry was mostly controlled by foreign business concerns, but by the time Kodama Gentarô (1852–1906) was appointed as governor-general in 1898, the development of the sugar industry was poised to become a key element in Japan's plan to expand Taiwan's industrial and economic output. The colonial government used its powerful position to help Japanese capitalists expand the sugar industry, and following a Japanese victory in the Russo-Japanese war in 1905 many Japanese sugar manufacturing companies sprung up in Taiwan and were nurtured by the protection of the colonial administration.

One of the first acts of the Japanese colonial administration was to establish the Provisional Taiwan Sugar Board. In 1901 agricultural economist Nitobe Inazô's (1862–1933) "Suggestions for Improvements to the Sugar Industry" (Sugar Industry Corporate Society (Japan) editor, 1962) set the pace for the reform and modernization of sugarcane farming and sugar refining in Taiwan. In the following year the Japanese colonial administration began to take concrete steps to carry out its agricultural policies, announcing its Sugar Industry Incentive Regulations, which included subsidies for the opening of new lands for agriculture, and also for making improvements to farming and production techniques, organizational structure, and marketing. The three main elements of this policy were capital assistance; designating the districts from which raw materials could be obtained; and market protection. These measures were highly successful in encouraging a large number of sugar merchants to invest in the modernized sugar industry, at the same time playing a key role in the transformation of Taiwan's sugar industry from rural, locally managed undertakings to large-scale capitalist enterprises. In order to increase the quantity of sugar exports, Japan introduced the latest industrial technology from the West. 1910 was the beginning of the golden era for Taiwan's sugar refining factories, and by 1912 there were 29 newly-established factories using state-of-the-art technology (Fig.3.).

Taiwanese and Japanese sugar companies underwent a series of mergers, and in 1943 the entire sugar industry in Taiwan was in the hands of three Japanese consortiums: Dainihon, Mitsui, and Mitsubishi. Further mergers led to Taiwan's sugar refining industry coming under the control of four joint-stock corporations: Japan Sugar Enterprises, Taiwan, Meiji, and Yanshui Harbor. With the end of the Japanese colonial period these four companies were merged into the Taiwan Sugar Corporation.

2.2 Development of the Taiwan Sugar Corporation

In 1945 the ROC (Republic of China) confiscated all of the assets of the four Japanese joint-stock corporations controlling the sugar industry in Taiwan, including 42 sugar refining factories, nearly 120,000 hectares of sugarcane fields (Fig.4.), over 3,000 kilometers of railways, and 300 million Japanese yen in capital. In 1948 the government officially reorganized these assets into the Taiwan Sugar Corporation.

Taisugar is a major state-run enterprise, and there has always been a close relationship between its overall development and the political, economic and social changes taking place in Taiwan. There has been a close relationship between the rise and fall of Taiwan's sugar industry and the island's transformation from a developing country to a developed country. The fortunes of the sugar industry have largely been determined by two factors: international fluctuations.
of the price of sugar; and domestic industrialization and urbanization. The over 60 years of development of Taisugar can be divided into four transitional periods, as shown in Table 1. The changes which took place during these four periods are closely related to the development and use of agricultural land.

i) International fluctuations of the price of sugar

During the colonial era Taiwan's sugar industry was developed by outsiders. This had the advantage of greater access to foreign markets, and the industry continued to develop despite several periods of political instability, as shown in Fig.5. Following restoration (the return of Taiwan to Chinese rule following World War Two), in response to international fluctuations of the price of sugar, Taisugar reorganized its production process several times and developed new products related to sugar refining. During the post-war period (1945-1949) sugar factories that were damaged or destroyed during the war were repaired and again began producing sugar, and in 1947 sugar began to be exported to Japan and mainland China. With greater political stability after 1950, and following several personnel reorganizations, in order to deal with fluctuations in the international sugar market, Taisugar entered the International Sugar Organization and began to actively strive for a share of the international sugar market.

In 1966 Taisugar was faced with another drop in the international price of sugar, as well as the effects of industrialization and urbanization. Yet, due to the reorganization of its sugar refining factories, Taisugar continued to expand its operations. As a result, when international sugar prices surged in 1977 Taisugar's sugar production reached an all-time high of 1,069,547 metric tons. Afterwards, as the international price of sugar steadily dropped, the cost of domestic sugar production began to exceed the international price of sugar, resulting in a greater emphasis on domestic sugar sales and less emphasis on sugar exports. In 1985 sugar production was only 662,030 metric tons, leading Taisugar to begin to pay more attention to the development and sales of related food products such as processed sweets.

ii) Urbanization and industrialization

The 1990s constitute the third period of Taisugar, when Taiwan's sugar industry reached an all-time low. By this time, the transformation of Taiwan from an agricultural to an industrial society was largely complete. In the newly liberalized economic environment, workers and farmers had much more latitude to choose their occupations, and the decreasing price of sugar made sugarcane farming an increasingly unattractive option. Add to this the mass migration from the countryside to the cities, and it's not surprising that the amount of land under sugarcane cultivation was quite small by this time (Fig.6.). Faced with such an operating crisis, Taisugar had little option but to find new ways to use its vast land holdings. Thus Taisugar gradually began to close its sugar refining factories around the island, and today there are only three factories still in operation, located in Huwei, Nanjing, and Shanhua (Fig.4.), all of which refine sugar and also carry out research and development.

In 2004 Taisugar began to carry out organizational restructuring, resulting in the implementation of a
divisional organization and the establishment of eight main divisions, eight administrative departments, and three main centers.

3. Development of the Taiwan Sugar Industry Land

3.1 The Taisugar land acquisition process

The sugar industry modernization carried out during the Japanese colonial period resulted in increased productivity, making it necessary to bring more land under sugarcane cultivation. This, in turn, raised the question of how to select and develop new land. Following restoration, the sugar industry was nationalized virtually overnight, making the lands held by the sugar industry the largest part of state-owned lands. The income generated by Taisugar was used to stimulate national economic development, and as Taiwan was striding headlong in the direction of industrialization and urbanization, Taisugar lands played a key role in the implementation of an array of national construction projects. While the sugar industry lands underwent various transformations during the 20th century, what sort of relationship developed between the sugar industry lands and what it was producing?

i) Defining public lands

At the beginning of the Japanese colonial period the Japanese colonial government implemented a measure known as the Land Survey, one result of which was the abrogation of a long-standing phenomenon that began during the Qing dynasty known as "one field, two owners." (Yang, Y.Q., 2001). The results of the Land Survey provided a basis for the expansion of public lands, and this had a major influence on the ability of Japanese entrepreneurs to gain hegemony in Taiwan's sugar industry. In 1898 Taiwan's governor-general announced the Taiwan Cadastral Regulations and later in the same year established the Provisional Taiwan Land Survey Department, which systematically carried out surveys and mapping over a period of seven years. Promulgated in 1904, the Large Tenant Rights Arrangement resulted in the purchase of all tenant rights, compensating large tenants with government bonds. Afterwards, in order to eliminate fallow farmland and the "one field, two owners" system, land ownership rights were simplified, and land surveys were used to acquire large tracts of state-owned land for the purpose of development.

ii) The expansion of privately owned sugar industry land

In 1902 the Japanese colonial administration announced its Taiwan Sugar Industry Incentives Regulations. These Regulations also allowed for the transfer to Japanese sugar enterprises of land partially owned by government, including the land on which sugar factories were located, sugar company farms, and villages in which Japanese immigrants resided. In order to carry out its plans for the modernization of the sugar industry, the Japanese colonial administration had to first secure sufficient land for growing sugarcane and refining sugar. At that time large Japanese sugar companies acquired huge tracts of land, mostly due to generous government subsidies for the expansion of farmland, and also by purchasing the land of the sugar houses and sugar merchants. The result of this process was that the four large sugar industry joint-stock corporations succeeded in gaining possession of the lion's share of sugar industry lands. Thus, the colonial administration made use of land surveys to acquire and develop public lands, measures which had a far-reaching effect on the future direction of Taiwan's sugar industry lands.

iii) Conversion to public land

Following restoration in 1945, all of the assets of the four Japanese sugar-producing joint-stock corporations were nationalized, including 118,206 hectares of sugarcane fields. Afterwards, the new government of Taiwan carried out three land surveys. The 1960s and 1970s were the peak years for the sugar industry, and up until the 1980s Taisugar continued to expand its agricultural landholdings by bringing more land under cultivation and carrying out mergers. When the sugar factories began to close in the 1990s, this agricultural land became Taisugar's most important usable asset, much of which was used by the government to carry out its national development plans. Faced with the steady decline of the sugar industry, and in accordance with national policy, Taisugar's farmland began to be converted from agriculture to construction.

3.2 Changing uses of sugarcane plantations

In accordance with Taisugar policy changes regarding land use and development, the post-war period can be divided into four transitional stages: the asset requisition and reconstruction period (1945–1949); the farmland expansion and readjustment period (1950–1989); the land diversification and transformation period (1990–1999); and the multifaceted land use period (2000 to the present). During the first three periods there was a very close relationship between Taisugar's land use policy and the volume of sugar production, but in the fourth period Taisugar's land use and new undertakings have been increasingly influenced by the larger social environment. The land area, sugar production volume, business activities, and land use types of each period appear in Table 1., and are described in the following section.

Period I: the asset requisition and reconstruction period (1945–1949)

Many sugarcane plantations fell into disuse during World War Two when the sugar refineries which
managed them were severely damaged by Allied bombing raids. Thus in 1946 and 1947 there were only 32,937 hectares of sugarcane fields under cultivation, and only 30,883 metric tons of sugar were produced. Accordingly, during the first few years following reoccupation, the ROC government made a concerted effort to rehabilitate sugar industry facilities, at the same time conducting a cadastral survey.

Period II: the farmland expansion and readjustment period (1950–1989)

During this key period of far-reaching social change and rapid economic development, the substantial wealth of Taisugar became a financial basis for the government to carry out its development policies. Due to an increasingly close relationship between land, on the one hand, and social change and government policy, on the other, and in view of the fact Taisugar lands were the largest amongst all the state-run industries, Taisugar was required to relinquish large amounts of land in accordance with government policy. Even though Taisugar lost much land between 1960 and 1980, during the same period, in order to maintain enough sugarcane fields for sugar production, it also expropriated land at no cost and brought unused land under cultivation. Besides, in response to numerous fluctuations in the international price of sugar, Taisugar began to diversify by developing some of its land into completely self-managed livestock farms, marking a significant change in the company's management style.

Taisugar benefitted from land use and development in two main ways. Firstly, the government's urban land readjustment policies gave Taisugar the opportunity to allot land for construction purposes. Second, under the expansion of land area measures, Taisugar obtained unused land free of charge, while the government continued to regard Taisugar as an agricultural concern. Moreover, the favorable measures which allowed the use of land adjacent to farms to carry out sales expanded the area and facilities of Taisugar's self-managed farms. Finally, the comprehensive farmland surveys carried out between 1986 and 1989 were of major importance to the transition to the following

Table 1. Taisugar's Four Transitional Stages

| Year          | Planned Area (hectares) | Sugar Production (metric tons) | Business Activity | Land Use Policy |
|---------------|-------------------------|-------------------------------|-------------------|----------------|
| Period I      |                         |                               |                   |                |
| 1945-49       | 8,489                   | 86,074                        | 1. Expropriation of Japanese assets, including 42 sugar refining factories. | 1. Nationalization of Japanese sugar industry land. |
|               |                        |                               | 2. Four Japanese sugar joint-stock corporations merged to create the state-run Taiwan Sugar Corporation. | 2. Implementation of cadastral surveys. |
|               |                        |                               | 3. Closure of nine unprofitable sugar refining factories. | 3. Expansion of area under sugarcane cultivation. |
|               |                        |                               | 4. Sugar factory enlargement and consolidation. |                |
|               |                        |                               | 5. Development of subsidiary products and enterprises. |                |
|               |                        |                               | 6. Organizational restructuring and personnel downsizing. |                |
| 1950s         | 10,812                 | 250,176                       |                   |                |
|               |                        |                               | 2. Entry into the International Sugar Organization. |                |
|               |                        |                               | 3. Closure of nine unprofitable sugar refining factories. |                |
|               |                        |                               | 4. Sugar factory enlargement and consolidation. |                |
|               |                        |                               | 5. Development of subsidiary products and enterprises. |                |
|               |                        |                               | 6. Organizational restructuring and personnel downsizing. |                |
| 1960s         | 27,934                 | 324,179                       |                   |                |
|               |                        |                               | 2. Closure of 3 unprofitable sugar refineries. |                |
|               |                        |                               | 3. Sugar refinery expansion and consolidation. |                |
|               |                        |                               | 4. Development of subsidiary products and enterprises. |                |
|               |                        |                               | 5. Increasing production by self-managed farm plan. |                |
|               |                        |                               | 6. Streamlining of sugar refinery organizational structure. |                |
| 1970s         | 21,837                 | 397,341                       |                   |                |
|               |                        |                               | 2. Closure of 2 sugar refineries. |                |
|               |                        |                               | 3. Expansion of pig farms and pork exports. |                |
|               |                        |                               | 4. Adjusting processed food subsidiaries. |                |
|               |                        |                               | 5. Development and marketing of processed sweets. |                |
|               |                        |                               | 6. Development of flower and vegetable farms. |                |
| 1980s         | 100,756                | 277,216                       |                   |                |
|               |                        |                               | 2. Closure of 2 sugar refineries. |                |
|               |                        |                               | 3. Reduction of agricultural subsidiaries and animal husbandry. |                |
|               |                        |                               | 4. Development and marketing of processed sweets. |                |
|               |                        |                               | 5. Development of flower and vegetable farms. |                |
| 1990s         |                         |                               |                   |                |
|               | 59,715                 | 409,093                       | 1. Establishment of the Land Development Agency. |                |
|               |                        |                               | 2. 12 sugar refineries closed. |                |
|               |                        |                               | 3. Addition of enterprises unrelated to sugar or agriculture (construction, industry, commerce, and tourism). |                |
|               |                        |                               | 4. Development and marketing of processed sweets. |                |
|               |                        |                               | 5. Development of flower and vegetable farms. |                |
| 2000-08       |                         |                               |                   |                |
|               | 31,516                 | 189,095                       | 1. Closure of 9 sugar refineries, leaving only 3 sugar refineries in operation. |                |
|               |                        |                               | 2. Organization restructuring into eight divisions: granulated sugar, hypermarkets, biotechnology, specialty crops, animal husbandry, oil products, recreation, and merchandising. |                |
|               |                        |                               | 3. Provision of large tracts of land for government construction projects, including transportation facilities, city parks, industrial parks, new cities and towns, new residential areas, zone expropriation, and workers dormitories. |                |
|               |                        |                               | 4. Government requests comprehensive plan for sugar factory land; in 1995 the land of closed factories begins to be used for other purposes. |                |
|               |                        |                               | 5. 1996: 10,400 ha. of land made available for public investment. |                |
|               |                        |                               | 6. 1993: government sets in motion its new development program, including leasing land held by state-run industries and the establishment of the Superfactories Act. |                |

Statistics

| Year          | Statistics                              | Policy                              |
|---------------|-----------------------------------------|-------------------------------------|
|                | Land Use Policy                          |                                    |
| 1963          | 2. Transfer of 60,000 ha. between 1953 and 1973 in accordance with government policy. |                                    |
| 1965          | 3. Self-administered land readjustment:  |                                    |
| 1966          | a) 1963–1968: government coordinated farmland readjustment. |                                    |
| 1967          | b) 1960 onwards: government coordinated urban land readjustment. |                                    |
| 1968          | 4. Urban factory site land readjustment: |                                    |
| 1969          | from 1976 onwards, self-construction and sales of high-density housing units. |                                    |
| 1970          | 5. 1960s to 1980s: farm expansion and reclamation amounts to 8,412 ha. (including over 3,000 ha. acquired without consideration, and 4,071 ha. of farmland purchased). |                                    |
| 1971          | 6. 1985: measures enacted for the sale of land owned by state-run agricultural units. |                                    |
| 1972          | 7. 1983: Taisugar is allowed to develop land for tourism and provide land for construction in accordance with urban planning. |                                    |
| 1973          | 8. 1989: approval of state-run enterprise land for construction. |                                    |
| 1974          | 9. 1989: approval of state-run enterprise land for sale in accordance with national development plan. |                                    |

Period III (1960–1989)

- Comprehensive land surveys carried out in 1953, 1966, and 1986–1989. After the transfer of 60,000 ha. between 1953 and 1973 in accordance with government policy. The favorable measures which allowed the use of land adjacent to farms to carry out sales expanded the area and facilities of Taisugar's self-managed farms. Finally, the comprehensive farmland surveys carried out between 1986 and 1989 were of major importance to the transition to the following
period of multifaceted management.

Period III: The land diversification and transformation period (1990–1999)

The 1990s were a period of gradual decline for the Taiwan sugar industry. In the past, however, Taisugar land was regarded as primarily agricultural, and despite the land sales and uses of the previous period, Taisugar was still bound to the land use regulations of state-run enterprises which stipulated that its land continued to be used primarily for agriculture. Still, in accordance with its goal of land use diversification, the government successively amended its regulations regarding state-run enterprise land use and sales, prompting Taisugar to officially establish its Land Development Department in 1990 and to begin to actively expand its land development activities.

Much of the Taisugar farmland that was used for government construction projects was gradually converted into non-agricultural land, in line with Taisugar's land diversification plan. Thus, over a period of ten years, as its sugar refining factories across the island began to close, Taisugar's profit base gradually shifted from the export of granulated sugar to the development of non-agricultural land. Afterwards, Taisugar made a concerted effort to find ways to turn its land assets into its main source of income and basis for transformation.

Period IV: the multifaceted land use period (2000 to the present)

At the turn of the century, Taisugar was still in the midst the changes brought on by factory closures and land diversification. By the time market reforms related to Taiwan's entry into the WTO allowed the importation of granulated sugar, Taisugar was compelled to face three major global issues of the 21st century: industrial heritage preservation, agricultural diversification, and ecological protection.

Despite its exit from the international sugar export market, due to its possession of a rich array of historical and cultural assets left behind by the previous century of sugar production in Taiwan, Taisugar is in an ideal position to enter the new world-wide trend of industrial heritage preservation. Moreover, global agricultural development policies are shifting towards the promotion of diversity and specialty agriculture, and environmental and agricultural sustainability. As a result, and since its three main industries—sugar, animal husbandry, and processed foods—were already in a state of decline, Taisugar has begun to consider the potential of specialty agriculture. Thus in recent years, apart from 15,000 hectares under sugarcane cultivation, all of Taisugar’s arable land has been converted to high-value commercial crops, nurseries open to the public, and reforestation land in accordance with a flatland afforestation project expanded by the Ministry of Agriculture 1996.

4. Discussion

From the foregoing it can clearly be seen that during the 400-year history of sugar production in Taiwan, the value of the sugar industry land has been closely tied to the changing fortunes of the sugar industry. Greater awareness of environmental issues and the importance of preserving industrial heritage sites make it clear that any plans for the future of the sugar industry land must take into consideration the interrelated factors of economic production, social needs, and ecology. The four main themes which emerge from the research on the relevant historical documents are as follows:

i) The influence of national policy on rural industry

Many of the features of the history of the Taiwan sugar industry are held in common with other developing agricultural countries, largely because in the process of development and urbanization they inevitably face the issues of the decline of rural industry and land use and redevelopment. Over the past decade, even though the price of Taisugar land has been set at the market value for rural land in accordance with government large-scale construction policy, foreign investors have been interested in the land for development opportunities. It's important to recognize the way in which rural industry is affected by changes in the social and economic structure, and what sort of industrial and land policies can be implemented to curb the decline of rural industry. The diversification of national land development policies is a crucial factor. In light of the particular history of Taisugar and the sustainable development trend, the Taisugar land should be used not only for new construction projects, but also in a way which gives due consideration to the revitalization of rural industry and culture. The promotion of specialty crops, organic farming and a variety of leisure farms will all help to invigorate rural industry and agricultural villages.

ii) Sustainable productivity of industry land

The sugar industry has played an extremely important role in Taiwan's development, and Taisugar's land holdings continue to exert an influence on the nation's future. The present challenge for the government is how to break free from its traditional reliance on the wealth of the sugar industry, and instead begin to promote the sustainable production capacity of sugar industry assets.

The Shanhua Sugar Factory in Tainan County can be taken as an example (Fig.4.). One of the last three sugar refineries still in operation in Taiwan, it is situated near farmland, several small towns, and idle sugar-production facilities. In accordance with the government's six-year development policy, beginning in the 1990s this idle farmland has been used to develop a high-tech hub situated in between the stagnating villages of Southern Taiwan and the already-developed modern cities. At the same time, due to the increasing influence of the culture and creativity industry over the last decade, the nearby sugar industry relics are being transformed into cultural heritage sites. One such site is the Zongye Sugar Refinery. Established in 1911, this factory was formerly the general headquarters of the Meiji period sugar-refining joint-stock corporation to which the Shanhua Sugar Refinery belonged. Its Japanese-style architecture has already been designated as having
historic value and is currently undergoing restoration. Seeking to implement a concrete example of how to create an industrial heritage site, in recent years the government's cultural department and a nearby university of the arts have been actively promoting the revitalization of neglected farming villages through a combination of art events and community building. By making use of the methods of the culture and creative industry, the industrial heritage of this site has been transformed in such a way to provide historical retrospect and promote the sustainable production capacity of the sugar industry land.

iii) Ecological sustainability
During the course of its development, Taiwan's sugar industry has repeatedly felt the impact of political changes and fluctuations in the international price of sugar. Yet it's important not to overlook the vitality of the island's natural environment. The 400-year history of Taiwan's sugar industry demonstrates that the growth capacity of the land has given rise to various regional political and economic effects. While mass production has brought certain benefits to society, it is also clear that the excessive exploitation of natural resources which comes with mass production is exacting a severe toll on the natural environment, making many people reevaluate land use and development policies.

The preservation and reuse of industrial heritage sites creates a cultural space where urban and rural Taiwanese can interact. The 400-year cultural landscape provided by Taiwan's sugar industry creates a fertile environment for the integration of ecology and art. The future development of the Taisugar land is not merely a matter of economics, agricultural productivity, or the market value of land. Rather, what needs to be adopted is a more holistic view which includes the long-term quality of life, as well as productive and ecological sustainability.

iv) Industrial heritage and urban planning
Based on the Land Survey of the Japanese colonial period, the Japanese applied the community design concept to carry out a comprehensive plan for the sugar factory lands. The abundant resources of the sugar industry estates provided the basis for the establishment of new towns in the adjoining areas, as well as the increased prosperity of the nearby farming villages.

An example of a successful industrial heritage reuse is the Ruhrgebiet Industrial Heritage Trail in Germany. In Taiwan the sugar industry has a long history, covers a vast area, and has been highly influential. Moreover, the sugar industry estates are a treasure store of culture, historical architecture, industrial heritage, and natural landscapes. Thus the challenge for Taisugar is how to make optimal use of the industrial heritage potential of its vast land holdings to create a new model for urban planning.

5. Conclusion
This research has taken a long-range historical approach to examine the use and development of sugar industry land during the process of industrial conversion. The results of this research show that the transformations of rural industry and land use are long-term phenomena.

In the past, the land use policies of Taiwan's sugar industry were based on the vicissitudes and exigencies of the sugar market. A reorientation of the value of the sugar industry land based on the considerations of culture, history, and ecology needs to take into account the following three factors: 1) Social life. Revitalization of farming villages can be carried out through the construction of new residential areas and the redevelopment of traditional villages. Historical industrial architecture needs to be preserved to bear witness to history, and can also be used as a place for art and cultural activities. 2) Economic productivity. Idle land can be developed into ecological science parks, and monoculture farms can be transformed into organic farms cultivating a variety of crops. 3) Ecology. Many of the vast land holdings of Taisugar can be converted into eco-parks to promote the rejuvenation of Taiwan's endangered wildlife. Based on ecological awareness, productivity can be brought into a sustainable relationship with all aspects of life.

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