Sustainable Economic Development
Plan for Tainan County Coastal Area

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Executive Summary

The coastal region of Tainan County, including the townships of Chi-Gu, Chiang-Chun and Pei-men, has long been known for its fishery, agriculture and salt production, religious festivals, and natural coastal scenic beauty. It is also the winter home of a famous endangered bird, black-faced spoonbill. In recent years, however, like many other rural areas in Taiwan, the region has been under pressure for development and change. With the ongoing proposal for building a heavy industrial park in the center of its coastline, the residents of the region are now faced with two choices: to accept the proposed industrial zone that contains a major petrochemical plant and a steel mill and join the ubiquitous industrialization along the West coast of Taiwan, or to pursue an alternative development strategy that aims to create long-term economic prosperity while protecting local environment and community integrity.

This study is intended to assist the residents of the region and the responsible officials in making this important decision, a decision that will shape the future development and character of the region and the lives of its residents in generations to come.

Following an identification of the existing local resources and the analysis of important development trends and impacts of the heavy industrial zone, this study outlines a plan for an alternative regional development based on eco- and cultural tourism, improved agriculture and fishery, and green industry. Based on analysis of existing data, comparable case-studies, and economic projection, this study concludes that the current heavy industrial zone proposal possesses great environmental and health risks while offering relatively little economic benefit to the coastal communities. In addition, it also creates a major conflict with the development of high-technology industry that the county is currently pursuing, not only in terms of water resource, but also in terms of maintaining the overall environmental amenities to attract the high-tech businesses and workforce.

On the other hand, the region possesses great potentials for development of eco- and cultural tourism that will not only create economic opportunities for the coastal communities, but also support the regional development of high-tech industries. Based on projections, the tourism industry is capable of generating an annual gross revenue of more than NT$14 billion and over 30,000 jobs, a number comparable to the proposed Binnan Industrial Zone and the Tainan Science Park. Unlike the proposed industrial zone, most of the tourism revenue will stay in the region, and the jobs will be accessible to the local residents. Together with improved agriculture and fishery production and addition of green processing and manufacturing industry, the recommended economic development plan presents a feasible and favorable alternative to the heavy industrial zone.

TCCP, 1996.

Sustainable Economic Development Plan for the Tainan County Coastal Area.
To facilitate implementation of the recommended plan, the study makes a series of specific policy recommendations that include the following.

1. Designate the coastal area as a National Nature Reserve to protect the important ecology and the scenic tourism resources. The area should include the entire coast of the county, West of Route 17. Separate designations of Wildlife Protection Areas also needs to be established to protect the endangered wildlife habitats including the Black-faced Spoonbill. The Designation should be accompanied by an effective management plan to implement the protection mechanism and enhance quality of existing habitats.

2. Reject the proposal for Binnan Industrial Zone and other development proposal which will threaten the integrity of the coastal ecology and environment and the region’s eco- and cultural tourism development resources.

3. Terminate constructions of West Coast Highway to prevent loss of natural habitats and scenic resources, and make Route 17 a scenic corridor.


5. Designate development zones to manage growth from tourism development and limit impact on existing communities and important environmental and tourism resources.

6. Provide regulatory and financial incentive for starting tourism and green industry related small business.

7. Clean up and eliminate pollution in local rivers and creek. Restore the river and creek to serve as natural habitats and scenic tourism resources.
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6.1 Policy Recommendations
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1. Identifying Local Resources
1.1 Site Location

This study covers the townships of Chi-Gu, Chiang-Chun and Pei-Men, located along the coast of Tainan county. The area is separated from the Tainan City, the fourth largest city in Taiwan, by Tseng Wen River, a main river running through Tainan County. The area is about 30 km from North to South and 14 km from East to West, thus forming a ladder-shaped plain. Chi-Gu is the largest of the three townships.
1.2 Social and Demographic Background

Population

Although population in Tainan County is growing steadily, the population in Chi-Gu, Chiang-Chun, and Pei-Men is decreasing slowly. Because of low income and lack of employment opportunities, young people have immigrated to cities in search of better jobs or better education, causing the outflow of local people of all three townships, mostly between the age of 20 to 49. Elderly and children now make up a significant percentage of the population. The percentage of people above age 65 in total population of all three townships is 13.56%, indicating a growing trend of aging population.

<table>
<thead>
<tr>
<th>Townships</th>
<th>Population</th>
<th>Average yearly population growth rate</th>
<th>% percentage in Tainan County</th>
<th>Population density * persons/km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Gu</td>
<td>27,432</td>
<td>-5.52%</td>
<td>2.75%</td>
<td>238.54</td>
</tr>
<tr>
<td>Chiang-Chun</td>
<td>24,434</td>
<td>-9.00%</td>
<td>2.56%</td>
<td>558.23</td>
</tr>
<tr>
<td>Pei-Men</td>
<td>15,069</td>
<td>-11.79%</td>
<td>1.56%</td>
<td>224.91</td>
</tr>
<tr>
<td>Total</td>
<td>66,926</td>
<td>-</td>
<td>6.87%</td>
<td>297.45</td>
</tr>
<tr>
<td>Tainan County</td>
<td>1,059,023</td>
<td>6.31</td>
<td>-</td>
<td>525.31</td>
</tr>
</tbody>
</table>

Table 1.1 Population of three townships, 1993 (TCCP, 1996)
* Area of Tainan County: 2,016.0075 km²

Figure 1.1 Shift of age structure in Chi-Gu (1969 & 1993)
The population of the three townships in 1969 was 34,813; in 1993, the number has decreased to 27,432. There is a significant decline in the younger age groups.

Occupation Structure

The occupations in the three townships are mainly in agriculture and fishery, comprising about 60% of total employment (TCCP, 1996). A number of people also worked in manufacturing and other industries. However, most of these jobs are located outside the three townships.

Fishery Population in Tainan County

![Fishery Population in Tainan County](image)

Figure 1.2 Fishery population in Tainan county, 1994 (TFB, 1995)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Agriculture, fishery, livestock farming</th>
<th>Manufacturing and Industry</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational percentage (County)</td>
<td>36.5%</td>
<td>35%</td>
<td>28.5%</td>
</tr>
</tbody>
</table>

Table 1.2 Occupational Structure, Tainan County (TCCP, 1996)
1.3 Natural Resources

The coastal region of Tainan County contains a wealth of natural ecosystems and resources. They include the last remaining functioning lagoon on the West coast, sand dunes, beach, mangrove forests, and shoreline forests, providing important habitats for both marine and terrestrial wildlife. Among the numerous species of migrating birds that winter here is the famous endangered Black-faced Spoonbill. The tidal mud flats in the lagoon and mangrove forest at the river mouths provide important habitat and spawning ground for a wide variety of wildlife.

In addition, man-made landscape objects such as salt ponds and aquacultural ponds also attract a great amount of sea birds, which together with natural wetland and mangrove forests forms a unique coastal landscape which is both scenic and productive.

1.4 Economic Resources

Because of the coastal location, the economic activities in Chi-Gu, Chiang-Chun, and Pei-men have historically been based on fishery and agriculture.

(1) Fishery

The fishery in Tainan County is based on aquaculture whose production is the second highest in Taiwan. The area leads the nation in the production of carp, tilapia and milkfish, mainly supplying Taipei, Chiayi, and Taichung. In addition, the area has also become a main supplier of fish fry in Taiwan and neighboring nations such as Japan. The industry supports 5,725 households in the county, mostly located in the three coastal townships. The total annual value of production reaches NT$3.2 billions in 1994 (TCCP, 1996). The 36 km long coast line provides the three townships with abundant fishery resources. Small fishing harbor and fishing villages line the coast of the three townships. The main harbors are Pei-Men Harbor, Chiang-Chun Harbor, and Ching-Shan Harbor, respectively located in each of the three townships. Another major harbor is currently under construction.

Aquaculture production in the area mainly consists of marine culture on the open water and inland culture in the constructed ponds.

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1 In 1992, Black-faced Spoonbill was listed as an endangered under Wildlife Conservation Act in Taiwan, where two thirds of the known world population winter (Severinghaus, et al., 1995).
EGRET FOREST & MANGROVES
MANGROVES
FISH & SHELLS

SALT PONDS ATTRACTING A GREAT AMOUNT OF BIRDS HERE TO PASS THE WINTER

TAINAN STRAIT

BLACK FACE SPOON BILL HABITAT

Map 1.2 Map of Natural Resources
Sustainable Economic Development:
Plan for Tainan County Coastal Area
Map 1.3 Existing Land Use

Sustainable Economic Development: Plan for Tainan County Coastal Area
Marine Aquaculture

Oyster and clam are the main production occupying 2,045 hectare of the Chi-Gu lagoon area and at the mouths of local rivers. The coastal sand in the area is well-suited for clam farming from October to December.

<table>
<thead>
<tr>
<th>Types of Fishery</th>
<th>Quantity (M. Ton)</th>
<th>Value (NT$1,000)</th>
<th>Value (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inland Aquaculture</td>
<td>33,173</td>
<td>2,529,056</td>
<td>93,668,741</td>
</tr>
<tr>
<td>Brackish Water</td>
<td>7,637</td>
<td>763,464</td>
<td>28,276,444</td>
</tr>
<tr>
<td>Freshwater</td>
<td>25,147</td>
<td>1,751,756</td>
<td>64,879,852</td>
</tr>
<tr>
<td>Cage culture</td>
<td>5</td>
<td>101</td>
<td>3,741</td>
</tr>
<tr>
<td>Other</td>
<td>384</td>
<td>13,735</td>
<td>508,704</td>
</tr>
<tr>
<td>Marine Aquaculture</td>
<td>3,904</td>
<td>402,947</td>
<td>14,923,963</td>
</tr>
<tr>
<td>Coastal Fishery</td>
<td>3,357</td>
<td>272,269</td>
<td>10,084,037</td>
</tr>
<tr>
<td>Off-shore Fishery</td>
<td>1,226</td>
<td>948,909</td>
<td>35,144,778</td>
</tr>
<tr>
<td>Far Sea Fishery</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41,660</strong></td>
<td><strong>3,299,171</strong></td>
<td><strong>122,191,519</strong></td>
</tr>
</tbody>
</table>

Table 1.3 Fishery production in Tainan county (TFB, 1995)

Inland Aquaculture

Inland culture occupies a total of 13,838 hectares and presents a major land use in the region. The main productions are milk fish, shrimp, tilapia, and clam. The inland production presents a major source of income for the coastal region. The total value of inland production reaches NT$2.5 billions in 1994, 78% of total fishery value (TFB, 1995).

(2) Agriculture

Agriculture is the secondary economic activity in Chi-Gu, Chiang-Chun, and Pei-Men. The main production in these townships includes the following:

**Chi-Gu:** Cantaloupe, rice, sweet potato, tomato, sugar cane, garlic, corn, Sorghum.
Chiang-Chun: Carrot production is 54.38% of the nation’s total; tomato, rice, corn, sorghum.

Pei-Men: Sorghum, rice, corn, garlic

<table>
<thead>
<tr>
<th></th>
<th>Total Area</th>
<th>Total Farmed Area</th>
<th>Rice Field</th>
<th>Dry Farm</th>
<th>% of Dry Farm</th>
<th>Forest</th>
<th>Fish Ponds</th>
<th>Salt Ponds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Gu</td>
<td>11,015</td>
<td>3,019</td>
<td>1,954</td>
<td>1,065</td>
<td>80</td>
<td>213</td>
<td>5,576</td>
<td>1,448</td>
</tr>
<tr>
<td>Chiang-Chun</td>
<td>4,198</td>
<td>1,931</td>
<td>1,570</td>
<td>362</td>
<td>71</td>
<td>57</td>
<td>524</td>
<td>963</td>
</tr>
<tr>
<td>Pei-Men</td>
<td>4,410</td>
<td>1,019</td>
<td>502</td>
<td>518</td>
<td>65</td>
<td>112</td>
<td>2,845</td>
<td>409</td>
</tr>
<tr>
<td>Tainan County</td>
<td>201,601</td>
<td>99,251</td>
<td>52,247</td>
<td>47,005</td>
<td>49</td>
<td>33,534</td>
<td>12,412</td>
<td>2,819</td>
</tr>
</tbody>
</table>

Table 1.4 Agriculture Land Use and Farmed Area (hectares), 1994 (TCCP, 1996).

In recent years, agriculture is becoming a secondary occupation to many farming households. Work in manufacturing and other industries is contributing a significant proportion of income for the farming households.

<table>
<thead>
<tr>
<th></th>
<th>Farming Population</th>
<th>Total Income</th>
<th>Agricultural</th>
<th>% in Total Income</th>
<th>Non-Agricultural</th>
<th>% in Total Income</th>
<th>Income (NT) per person</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>45,400</td>
<td>237,845</td>
<td>84,784</td>
<td>35.65%</td>
<td>153,062</td>
<td>64.35%</td>
<td>52,341</td>
</tr>
<tr>
<td>1993</td>
<td>32,400</td>
<td>446,194</td>
<td>179,462</td>
<td>40.22%</td>
<td>266,732</td>
<td>59.78%</td>
<td>137,762</td>
</tr>
</tbody>
</table>

Table 1.5 Agriculture and Non-Agriculture Incomes in Tainan County

Husbandry

Husbandry including mostly pig and chicken farming has been one of the fastest growing economic sector in the county, producing an annual gross revenue of NTS 18.8 billions in 1994, exceeding agriculture. However, most of the husbandry operation in the area is only limited to Chi-Gu.
Industry

Industry in the coastal area are limited to food processing, textile, and other small-scale manufacturing.

Chia-Li: Food processing, textile
Hsue-Chia: Food processing, textile
Chi-Gu: Food processing, plastic manufacturing
Chiang-Chun: Textile, steel manufacturing

Map 1.4 Distribution of factories in Tainan county (TCCP, 1996)
1.5 Cultural Resources

As the earliest developed region in Taiwan, Tainan County is rich in cultural resources, especially temples and folklore. The prominent temples in the coastal area include the Nan-kuen-shen Temple in Pei-Men, Dai-Tien Temple in Ma-Dou, and Tseji Temple in Hsue-Chia. Together, these temples attract millions of pilgrims to the region every year. The number of visitors to Nan-kuen-shen Temple has already reached 4.5 millions a year (TCCP, 1996). Other important cultural heritage includes fireworks' festival in Yen-Shui, burning King Boat in Shi-Kang, Siraya evening ritual, etc.

<table>
<thead>
<tr>
<th>Date (lunar calendar)</th>
<th>Festival</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/14, 1/15</td>
<td>Yen-Shui Fireworks Festival</td>
</tr>
<tr>
<td>1/10</td>
<td>Greeting Buddha in Dong-Shan</td>
</tr>
<tr>
<td>Late January</td>
<td>King Boat Festival and exchange of incense in Chia-Li</td>
</tr>
<tr>
<td>3/9-3/11</td>
<td>Local ritual and exchange of incense in Hsue-Chia</td>
</tr>
<tr>
<td>Memorial Day 4/5</td>
<td>Bou-Kung Temple Spring Festival</td>
</tr>
<tr>
<td>Middle April</td>
<td>King Boat Festival and exchange of incense in Hsi-Kang</td>
</tr>
<tr>
<td>Late April, Middle June, and Middle August</td>
<td>Pei-Men Nan-kuen-shen Temple : Birthday celebration of Deity Lee and Deity Fain.</td>
</tr>
<tr>
<td>7/15</td>
<td>Ghost Lantern Festival in Hsue-Chia</td>
</tr>
<tr>
<td>10/14-10/15</td>
<td>Siraya Aboriginal Evening Ritual</td>
</tr>
<tr>
<td>Middle October</td>
<td>Liou-Ying King Boat Festival</td>
</tr>
</tbody>
</table>

Table 1.6 Cultural Calendar for Tainan's Coastal Region
CULTURAL RESOURCES MAP

PEI MEN
- Nankuenshan Temple
- Kuenyi Poet Society
- Ghost Lantern Festival
- Pei-Men salt
- Literature Camp
- garlic/garlic festival
- seafood/milkfish oo-fish
- salt ponds
- fish pond
- herding ducks

TAIWAN STRAIT

CHIANG-CHUN
- Carrot/Carrot Festival
- net fishing
- fish ponds
- old temples

CHIA-LI
- KING BOAT FESTIVAL
- gu-bou cherry
- folk rituals
- the Huang's family temple

HSUE-CHIA
- Tseji Temple
- Lantern Festival
- Tsuehia Incense
- remote pig farm
- the Sue's family residence
- historical village
- old temples
- ruins

SUSTAINABLE ECONOMIC DEVELOPMENT:
Plan for Tainan County Coastal Area

Map 1.5 Map of cultural resources
2. Important Economic Development Trends
The entire Tainan County and region are currently undergoing rapid changes, as result of several internal and external factors. An understanding and analysis of the recent trends shaped by these factors will help produce a more intelligent development strategy for the coastal area.

2.1 Regional Industrialization and Urbanization

High-Technology Industrial Development

In addition to the proposed Binnan Industrial Zone\(^1\) in the center of the county's coast line, there are several other major projects that are expected to greatly expand the urbanization and industrialization surrounding the Tainan City, into the predominantly agricultural areas. These projects include the Tainan Science Park in Hsin-Shih, An-Nan Industrial Zone -- a 'science-based industrial park' in the An-Nan district of Tainan City, and two mixed-use industrial and commercial zones in Hsin-Yin and Ren-Te. The establishment of Tainan Science Park is considered as a major victory for the county administration to reshape the course of development for the county in the direction of high-tech industry. The proposed science park is expected to reproduce the success of an existing science park in Hsin-Chu, now a powerhouse for Taiwan's fast-growing high-tech industry. Already, several major corporations have announced plans to expand operations into the proposed park.

Transportation

In addition to development of industrial zones, several major transportation upgrades and expansion projects are also underway, and are expected to expand the region's industrialization and urbanization. These include constructions of the high-speed rail, the second national freeway, the West Coast Highway along the county's coast line, and several 'rapid' roads that will link the more remote parts of the county, including several popular tourist destinations, with the main transportation network. With these projects scheduled to be complete within the next five to ten years, the cumulative result is expected to be a much expanded industrial and urban area centering on Tainan City and along the major freeway and railway corridor.

Role of the Coastal Area

The projected expansion of industrialization and urbanization has ramifications for the development of coastal area as well. There are two choices for the development of the coastal area.
Map 2.1 Trend of regional urbanization
Development Along Taiwan's West Coast

- Kwan-Yin Industrial Zone Off-shore Expansion
- China Petroleum Industrial Zone
- Da-Tang Industrial Zone
- Sian-San Reclaimed Land Development
- Tong-Shiao Reclaimed Land Development
- Taichung Port Expansion and Industrial Zone Development
- Taichung Power Plant
- Compacted-waste Landfill
- Chang-Ping Industrial Zone
- Chang-Ping Recreation Area
- Formosa Plastics Petrochemical Plant No. 6
- Yun-Ling Industrial Zone
- Tung-Se Coastal Mixed-use Industrial Zone
- Asia-Pacific Enterprise Center
- Bin-Nan Industrial Zone
- Tainan Science-based Industrial Zone
- Hsin-Da Power Plant
- Kaohsiung Urban Area Land Reclamation

Map 2.2 Industrial development along Taiwan's West coast
coastal area -- either to become part of the ubiquitous industrialization, or to find an appropriate and alternative role within the framework and the trend of regional industrialization and urbanization, specifically by turning its unique natural, economic and cultural resources into a regional advantage. What the coastal area has and others do not are the beautiful natural scenery and the unique landscape of fish ponds and farmland. As the entire region becomes ever more industrialized and urbanized, these resources will become a precious asset and advantage for development in the coastal area. However, if the proposed heavy industrial zone is approved, the region will lose this important competitive development advantage.

2.2 Agriculture and Fishery Production

Despite the general decline in profitability, agriculture and fishery have continued to be an important part of the county's economy and sources of employment. In fact, Tainan county continues to be the top producer of many agricultural products in the nation, such as bean, sugarcane, and a variety of fruits and vegetables (TCCP, 1996). The annual total value of Fishery production exceeds NT$3 billions (TFB, 1994). In addition, the county has a thriving husbandry industry with an annual gross revenue of NT$ 18.8 billions\(^2\) (TCCP, 1996). The agricultural base of the county is supporting the nation’s top food processing industry that generates an annual gross revenue of NT$ 49 billions (ibid.).

Agriculture

Faced with the pressure to compete with foreign imports under the imminent WTO\(^3\) trade agreement and to maintain certain degree of self-sufficiency under the concern of national security, the county still possesses several advantages to improve and continue its agricultural production. Compared with other counties, Tainan already has a well-established agricultural infrastructure, several major agriculture research institutes, and skilled workforce. Several areas of improvement have also been pointed out that will increase the profitability of county's agricultural production. These include improving marketing and distribution practice, producing value-added products locally, and development of recreational agriculture (ibid.).

Aquaculture

The aquaculture sector in the coastal area is also experiencing similar crisis and opportunities. Aquaculture production has been notorious in Taiwan for causing groundwater depletion and subsequent problems of land subsidence and saltwater

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\(^2\) 1994 figure.

\(^3\) World Trade Organization.
Map 2.3 Land subsidence in Taiwan (TCCP, 1996).
intrusion. Subsidence of up to 1.46m in a 15-year period has been reported in counties along the Southwest coast, including certain areas in the Pei-men township. Along the Southwest coast, Chi-Gu and Chiang-Chun, because of the denser substrate, have been the few exceptions to severe subsidence problem. With the expected down-sizing of aquaculture operation along most of coastal areas in coming years, the lessening of competition may help increase the profitability of production in Tainan county. By converting most of the freshwater ponds into salt water operation and by improving water management techniques, the coastal area in Chi-Gu and Chiang-Chun may become one of few sustainable aquaculture production areas in Taiwan. The location of a main station of Taiwan Fishery Research Institute in Chi-Gu provides an important research resource for the region. Already the station is helping to establish the area as the major regional supplier of fish fry in East Asia (ibid.).

In addition, similar to fresh produce, the aquaculture sector is also currently experiencing the problem of low profit despite the high productivity. The unit value of aquacultural products is only half of the national average (ibid.). There are also opportunities to improve the current marketing and distribution practice, to increase the economic value of the present production. In addition, problem of water pollution from industrial and husbandry sources upstream is also threatening the production of the aquaculture ponds and coastal fry production.

In the coastal region, where agriculture has served as a significant part of the local economy and an appropriate land use, to completely forego with agriculture would be to abandon an important development advantage. Similarly, with effective water resource and wastewater management, aquaculture can still be an appropriate land use for the coastal region in Chi-Gu and Chiang-Chun, where it provides both economic opportunities for local communities and important habitats for wildlife.

2.3 Tourism and Economic Development -- International Trends

The scenic beauty and abundant natural and cultural resources in the county's coastal area call for attention to the potentials of tourism development. In assessing the possibility of developing tourism, it is important to observe the trends in the tourism industry, on both international and regional levels.

Tourism -- Top Industry in the World

On the international level, tourism is now reported to be the world's largest industry, "surpassing automobiles, petroleum, and weaponry" (TES, 1996). It has been reported that tourism employs 204 million people worldwide, constituting 10.6% of the global
workforce and 10.2% of the world’s GNP (ibid.). Tourism is also the leading producer of tax revenue at US$655 billions (ibid.).

In many areas of the world, tourism has become the most important sector of the local and even national economy. In Hawaii, 67% of the annual income stream in 1990 come from the US$13 billions brought in by 6.5 million tourists (Rohter, 1994). In Kenya, tourist is one of the top three industries and the largest earner of foreign currency (Ecosource, 1997). In the U.S., from small rural towns to major cities such as New York and Washington D.C., tourism has increasingly played an important role in local economy. Internationally, tourism industry is growing at a steady pace of 4.5% in arrivals and 7.6% in earnings in 1996 (WTO, 1997). The industry is expected to create 100 million new jobs in the next decade (ibid.).

Eco-tourism

Within the industry, eco-tourism has been the fastest growing sector, at rate of 10-15% a year (Ecosource, 1996). Typically defined as "responsible travel to natural areas which conserves environment and sustains the well-being of local people", eco-tourism creates an annual gross revenue of over US$2 billions (ibid.). To many places in the world, eco-tourism is considered as an answer to the need for generating jobs and income for local communities while protecting local wildlife, ecosystems, and important environmental and cultural heritage. Eco-tourism is seen as an alternative to the rampant over-development that produces major environmental and social costs alongside the economic gains.

Tainan county’s coastal area’s scenic natural, agricultural, and aquacultural landscape presents a unique opportunity to develop a nature, agriculture and aquaculture based eco-tourism. The scale and diversity of resources in the coastal area are unique in the rapidly industrializing coasts of Taiwan.

2.4 Tourism and Economic Development -- National and Regional Trends

We will now look at the domestic trends and market.

Growing Domestic Market

In Taiwan, as the society in general becomes more affluent, demand for recreation and leisure activities has been growing rapidly. Domestic tourism has been growing at rates from 3% in 1994 to 8.4% in 1995 (MOTC, 1995). According to one survey, 94.7% of respondents have traveled at least once a year; 60% have traveled at least once per season.
(ibid.). Outbound overseas tourism has been growing at even higher rate, 10.1% in 1995, with over 5 million trips, the second highest in Asia-Pacific region (MOTC, 1996). The industry is expecting NT$3.6 billions of domestic travel spending annually after 1996. (ibid.)

**Major Tourism Development**

To take advantage of the huge market, development of theme parks is proliferating throughout the country. In several projects, developers are investing billions of NT dollars in either constructing new sites or expanding existing facilities to attract repeat visits. Construction is soon to begin at a NT$17.6 billion, 100 hectare project in central Taiwan. The project will include theme park, water park, shopping mall, hotel, country club, brewery, and a convention center (CT, 1997). The existing leading theme parks such as Six Flags and Taiwan Folk Park are also undergoing multi-million dollar expansion. Even the national government is currently constructing a hybrid theme park and education center in I-Lan county, across from the famous Dong-San River Water Park.

**Local Tourism**

At the local level, tourism industries are also developed to revitalize local economy. In I-Lan, the county government has made tourism development one of its top-priority administrative policy. Through organized efforts, the county has successfully utilized its scenic resources to transform itself from a secluded countryside to one of the most popular travel destinations in the nation. In summer of 1996, a weekend international event attracted more than 100,000 visitors and brought in NT$100 million revenues for the county (CWM, 1996).

At a smaller scale but in a similar fashion, efforts are occurring elsewhere. In Wu-Chi, Taichung, a direct fish market and seafood mall attract thousands of visitors from the nearby Taichung City to a small fishing harbor. The project is generating a monthly gross revenue of NT$54 millions and a monthly net income of NT$100,000-$150,000 for a typical vendor in the market (CWM, 1996). The success of Wu-Chi is fostering a new trend of converting traditional fishing harbor to mixed-use recreational and fishing seaports. In Ping-Lin, a tea-producing hilltown near Taipei, with assistance from the Commerce Division of the Ministry of Economy, the local merchants have organized a make-over of the area's business image. The improved image is drawing more tourists and has increased sale by 30% (CT, 1997). The gross revenue is expected to double by 1998, when the project finalizes (ibid.). In historic towns, temple festivals are also increasingly becoming popular tourism attractions. In Hsin-Gan, pilgrimage to the local temple has become itself a tourism industry and helps support the local economy.

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*See CWM, no. 184, 1996.*
Problem and Prospect

Under the huge demand for recreation and tourism, overcrowding has been a major problem at almost all the popular travel destinations, and has discouraged many potential visitors. Nevertheless, with continuing industrialization and urbanization, the demand for recreation and leisure is expected to grow. With improvement in transportation and service quality, and the expected national labor policy of 5 work-day a week, domestic tourism can expect to grow at even higher rate than present. Tourism will become an important market and economic sector especially for rural areas that possess scenic qualities appealing to the increasingly urbanized population.

In the coastal area, the Nan-Kuen-Shen temple located in Pei-Men is already drawing more than 4 million visitors a year. (See graph below) The number far exceeds even the most popular theme parks in the nation, and underscores the tourism potential of the region.

Figure 2.1 Comparison of current number of visitors with that of top national tourist destinations (1995; *1993; **1994) (MOTC, 1996; TCCP, 1996)
2.5 Conclusion

Eco- and Cultural As a Development Strategy for the Coastal Region

The coastal region of Tainan county, with its vast natural scenery, rich coastal ecosystems, agricultural and aquacultural landscape, as well as popular temples and religious festivals, holds great potentials for development of tourism, specifically eco- and cultural tourism. As the area surrounding the Tainan City is expected to become more industrialized and urbanized, the openness, rural character and natural scenic beauty of the coastal region are an important asset rather than an obstacle to economic development. Preserving the area as the region’s window to nature and recreation will be a key economic development strategy, not only for the coastal region, but also the county as a whole. The environmental and recreational amenities are important in attracting and keeping high-tech business and educated workforce. On the other hand, the proposed heavy industrial zone will surely take away this critical advantage and leave the region to compete with other areas around the Tainan that already have an established industrial infrastructure and network.

In addition to tourism, there are also advantages for aquaculture and agriculture production in the area if necessary steps are taken in areas such as water resource management and improvement in marketing and distribution. The production will continue to be an important and major part of the local economy, and is crucial part of the tourism development.
3. Impacts of Binnan Industrial Zone and West Coast Highway
3.1 Content of Binnan Industrial Zone

The project proposed in Chi-Gu will include a petrochemical plant, steel mill, and an industrial port which will need 2,367 hectares for factories and 542 hectares for port. The project location is currently a lagoon for oyster cultivation, salt field, and sand dunes. The investment for Chi-Gu project all together will reach ten billions US$. Right now, the exact location and boundary of the proposed industrial zone are not yet certain.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Developer</th>
<th>Area (Hectare)</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrochemical Plant No. 7</td>
<td>Tuntex Consortium</td>
<td>1,331</td>
<td>Naphtha Cracker, Oil Refinery</td>
</tr>
<tr>
<td>Compact Integrated Steel Mill (CISM)</td>
<td>Yailung Consortium</td>
<td>1,036</td>
<td>Steel Mill</td>
</tr>
<tr>
<td>Industrial Port</td>
<td>Joint Development</td>
<td>542</td>
<td>An exclusive port for direct imports and exports of materials and products</td>
</tr>
</tbody>
</table>

Table 3.1 Content of Binnan Industrial Zone (EIS, 1996)

3.2 Risks of Petrochemical Plant

This section of the report looks into the possible risks of siting Petrochemical Complex No. 7 in the Chi-Gu district of Tainan County. There are two basic sources of pollution from petrochemical plants. First, pollution resulting from leaks, accidents or spills which result in the discharge of oil (refined or crude) to water or land. Second, pollution resulting from leaks or accidents which result in the discharge of toxic chemicals to air or water. Both these basic types of pollution affect the ecology of the region. For example the discharge of oil will adversely affect the existing aquaculture and bird habitat in Chi-Gu, Chiang-Chun and Pei-men districts. The discharge of chemicals like selenium and dioxins, the two most common hazardous pollutants from petrochemical plants, will impact human health and can cause birth defects, weight loss, cancer, nervous disorders. These chemicals are also known to affect shellfish and birds. Between 1990 and 1994 the Chevron USA refinery in

1 The planned facilities also include an independent power plant.
2 The effects of various chemicals are reviewed in section 3.2.
Map 3.1 Proposed Binnan Industrial Zone (EIS, 1996) (The exact location is still indeterminate.)
North Richmond, California alone has had thirty small and large accidents which have in one way or the other impacted human, wildlife, and marine lives.

Sources of Pollution

There are a number of sources for contaminants (spilt oil or discharged chemicals) from petrochemical plants:

Firstly, after an oil tanker finishes unloading its oil cargo at a port, water is pumped into the ballast for cleaning out any oil traces that may be stuck to the side walls of the ballast. The wastewater resulting from the cleaning process is flushed discharged in open waters. This wastewater inevitably contains some amount of oil. The oil becomes invisible in approximately two hours and the oil goes undetected and untreated.

The second source of occurs from an oil spill due to an accident or a leak from oil tankers. This sort of pollution is more hazardous if the spill occurs in open ocean or near sea shores because the currents and tidal action of the water make cleanup difficult. Studies have shown that a 10,000 gallon oil spill in still water will have an initial diameter of 0.6 km, doubling in size by the end of the first day, extend to 2 km in a week, and reaching up to 6 km in a month. In open seas or near the sea shore the movement of oil would be much more rapid and possibly move greater distances. Figure 3.1 and 3.2 shows the potential paths spilt oil would take in the case of an off-shore mishap in Tainan County. Furthermore, during high tides spilt oil will disperse over sand dunes and into the lagoon, the aquaculture ponds, and other low lying areas.

The third source is from coastal refineries. Coastal refineries use significant amount of water from the sea for processing oil. The wastewater effluents are rich in contaminants, and if the wastewater is not treated properly before discharge it can prove harmful to the bird habitat and the aquaculture ponds. Refineries also are responsible for much of the toxic air pollution in its region.

Effects of Spilt Oil

Spilt oil may affect the structure of natural communities by tilting the balances which have established through long environmental processes. Oil slicks in water reduce the penetration of light, especially in closed water systems, and adversely affect regeneration of oxygen in the water. Deprived of oxygen, marine species die of asphyxiation. Additionally, the oil absorbs heat in the day and radiates the absorbed heat in the night. This results in significant day-night temperature fluctuations which is detrimental to marine life. Spilt oil generally forms a mousse-like blanket on the water surface and inhibits the movement, respiration and feeding of small animals. Oil contains hydrocarbons, and these hydrocarbons dissolve or are dispersed in water and can easily reach unprotected surfaces.

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Nelson-Smith, 1973
A 10,000 Gallon Offshore Oil Spill - Area Of Influence
(Winter Conditions)

Map 3.2 Impact of oil spill (Winter)

Sustainable Economic Development: Plan for the Tainan County Coastal Area
A 10,000 Gallon Offshore Oil Spill - Area of Influence
(Summer Conditions)

1 Hour (0.6 km)
1 Day (1.2 km)
1 Week (2 km)
1 month (6 km)
Threatened Area

(Note: Distances mentioned above were measured in still water conditions)

Map 3.3 Impact of oil spill (Summer)

(Sustainable Economic Development:
Plan for the Tainan County Coastal Area)
like delicate skin or fish gills. Oil which is emulsified by agitation at sea can also coat the
gills of fish and cause suffocation and a loss of equilibrium. Other organisms such as
barnacles and bivalves which feed on small suspended particles may intake tiny oil droplets
which enter their gut and eventually cause death of the organism. Furthermore these oil
droplets enter the food chain. Mussels and clams have been observed to retain an oily taste
for several months after oil exposure. Hydrocarbons also interfere with the cell structure of
plants and can adversely affect its survival by restricting the passage of materials in and out
of the cell. Seaweed's, like most plants and unlike most animals can suffer damage over a
considerable area without losing their capacity to recover. Therefore any adverse effects of
oil spills on seaweed's are only short-term.

A very large number of birds die as a result of oil pollution. It has been observed that more
birds are killed through chronic pollution than are due to a single oil disaster. Almost
450,000 sea birds have died in the North sea and North Atlantic sea from the presence of
oil. Feathers of the birds help maintain constant body temperature, buoyancy, and serves
as excellent insulation. When oil soaks into the layer of feathers the resulting disturbance
in the structure enables water to enter the air spaces, which reduce both the insulation
properties and the buoyancy of the bird. The oil weighs down the bird disabling them from
swimming or flying. The bird species most susceptible to oil spills are clumsy fliers like
ducks.

Effects of Selenium

Selenium is a chemical element similar to sulfur which is found in the earth's crust and in
crude oil. It is an essential nutrient for some species, but at increased concentration
selenium can poison fish, birds and humans. In the San Francisco Bay Area oil refineries
cause up to 95 percent of all selenium discharged in the north Bay during the dry season.
Selenium poisoning has resulted in birth defects in birds, deformation of hair and nails in
harbor seals, and retarded growth in salmons. In humans it can cause skin irritation,
nervous disorders, and cold like symptoms.

Selenium is also of great concern because it can bioaccumulate in high concentrations in
food resources that are eaten by animals and people. People and birds dependent on fish
from the aquaculture ponds and the lagoon for food are particularly susceptible to selenium
poisoning.

Effects of Dioxins

Dioxins enter the Bay water through wastewater discharged from oil refineries. Dioxins are
a combination of more than a hundred different dibenzodioxins, dibenzofurans, and
biphenyls that contain chlorine and bromine. Some of the compounds are toxic in

\[ ^4 \text{Nelson-Smith, 1973} \]
\[ ^5 \text{Ibid.} \]
extremely small amounts, but together they exacerbate each others’ toxicity. Like selenium, dioxins also accumulate in the food chain and are toxic in extremely small amounts. Dioxin exposure has been associated with causing cancer, reproductive impacts, developmental impacts, decreased sperm count, diabetes, and decreased birth weight and growth. Dioxin accumulates in breast milk, therefore nursing infants are exposed to 10 to 20 times more dioxin than the average person is. Families which rely on fish for food and who eat up to a pound a day of fish could have a dioxin concentration level that is 10 times the average human exposure.

The effluents, which are rich in contaminants, are usually put through an extensive treatment process which is time consuming. During an emergency, contaminants are sometimes burnt and the resulting effluents are discharged in the air through tall smoke stacks. In the San Francisco Bay Area it has been observed that plant operators cut corners to maximize profits and often resort to burning the contaminants as the process is easy and fast, though not effective enough to achieve desired emission standards. Regional regulatory authorities have the legislative power to take erring refineries to task, but are unable to do so because of the power of the industrial lobby and the weakness of the agencies enforcement mechanism. It is only in cases when the discharge has been high enough to pose a threat to life that the regional authorities have taken the refineries to task.

Conclusions

The siting of Petrochemical Plant Complex No.7 in Chi-Gu District can have the following impact:

1. If recent trends in the San Francisco Bay Area are any indication of the frequency of accidents from one single petrochemical plant, then Chi-Gu district could experience an average of 7.5 accidents per year. These accidents could range from small leaks, or fires to even explosions.

2. The burning of chemicals result in the emission of smoke from smoke stacks of the plant. This could possibly affect the migratory patterns of the endangered spoonbill and other birds which have their habitat along the coast.

3. Small leaks or accidents like the one in Chevron USA Plant (California) resulted in the emission of black soot comprising nickel and vanadium. Nickel in particular is carcinogenic. The black soot could travel all the way to Highway 17, and to adjacent cities (depending on wind patterns and intensity). Black soot which settles on aquaculture ponds and on the lagoon will poison fish and oysters, leading to disruption in the farming cycle. Similar large leaks may necessitate the evacuation of people from the vicinity.
Gas Leak - Area Of Influence

Map 3.4 Impact of gas leak
Sustainable Economic Development: Plan for the Tainan County Coastal Area
4. Refinery leaks have also resulted in the release of hydrogen sulfide gas. Though not life threatening, when exposed to the gas people have complained of nausea, skin irritation, and of burning sensation in the eyes. A similar leak in the San Francisco Bay Area spread the gas a distance of 10 km in the space of six hours. A similar leak in Chi-Gu could result in the gas to disperse south to part of the spoonbill habitat, east almost up to Highway 17, and North near Pei-men. At higher wind speeds the gas could disperse a greater distance and could possibly travel south to the heavily populated Tainan City.

5. Wastewater discharges from the plant will inevitably contain varying quantities of selenium and dioxins. Both these chemicals are carcinogenic. Fish and birds exposed to small quantities of any of these two chemicals experience developmental and genetic disorders. Since selenium and dioxins bioaccumulate, people who rely on the fish for food also are exposed to the chemicals, increasing their risk of cancer. This means the siting of the plant will place nearly 20,000 aquaculture farmers in the region at a higher risk level.

6. Oil spills can result in the destruction of the sand dunes, oyster farming in the lagoon, aquaculture ponds, and bird habitats. It has been observed that prolonged exposures from tankers are inevitable. This means that even without any incident there will be the presence of oil in the waters of the region.

3.3 Impact on Water Resource

The siting of the Petrochemical Plant No. 7 has the following impact on the water resources of the region:

As shown below, the siting of the plant complex will require an additional 8.5 million gallons per day (mgd) or 9,500 acre feet annually (AFY). The operation of the plant itself will require 88 mgd or 98,527 AFY. Since the reservoir capacities are only 45 mgd, this means that the plant complex's daily requirements are double the existing reservoir capacities. In comparison entire nine counties in the San Francisco Bay Area uses only 107,000 AFY of water for industrial use.

Per Capita Consumption 66 gpcd (88,000,000 persons)
gallons/1,330,000 persons)

Additional water demand due to increase in population 8,544,690 gallons per day
(129,465 x 88)

* Refer Figure 3
3.4 Impact of West Coast Highway

The map shows the extent of abiotic and biotic change caused on both sides of a freeway. For a four lane road like highway 17, at least 500 meters on both sides of the road is impacted. The criss-crossing roads not only leads to fragmentation of the land, but also to the lack of continuity of the wildlife corridor.

The map also shows the noise impact of the new proposed highway at two points, one in the south near the spoon bill habitat, and the other in the north near bird habitats along the coast. It is estimated that trucks moving at 55 mph will have a sound level adjacent to the road, of 86 decibels (db). At a distance 1.5 km away the noise level will be in the range of 66-71 db, equivalent to the sound from a pneumatic drill at 50 feet distance. At a distance 2.5 km away the noise level is estimated to be in the range of 64-66 db, similar to the sound from a vacuum cleaner at 10 feet distance. Therefore, we conclude that the sound impact from trucks on the highway will be enough to affect the bird habitats.
Impact Of Highway - Zones Of Biotic And Abiotic Change

Map 3.5 Impact of Highway

Sustainable Economic Development: Plan for the Tainan County Coastal Area
4. Recommended Economic Development Plan
4.1 Development Principles

To address the needs of local communities and the long-term interest of the region, the economic development of the coastal area should adhere to the following principles. It is important to constantly remind ourselves of these important values and concerns.

(1) Enhancing Community Integrity

- Family Reunification
- Neighborhood Services
- Equity
- Education
- Public Health
- Public Participation

The development shall help bring family reunification by attracting young generations to stay in the communities. The development shall help improve quality of education, public health, neighborhood service, and social equity in the communities. Residents shall be encouraged to participate in the planning and implementing process.

(2) Creating Long Term Economic Prosperity

- Diverse Economic Base
- Retaining Revenues in the Region
- Well-paying Jobs for Locals
- Wise Use of Locally Available Resources

The development shall bring about long-term economic prosperity by creating well-paying jobs for the locals, retaining revenues in the region, and by maintaining a diverse and robust economic base. The types of development shall be those that make sustainable use of locally available resources.

(3) Protecting Health of Environment

- Clean Water and Air
- Reducing Land Subsidence Rate
- Reducing Waste
- Conserving Energy
• Conserving Nature

The development shall not endanger the quality of air and water in the region. Plans shall be included to conserve energy, environmental and cultural resources, natural habitats, and to reduce land subsidence rate in the region.

4.2 Overall Development Strategy: Eco-cultural Tourism, Improved Agriculture and Fishery, Green Industry

Based on analysis of local resources, development opportunities and constraints, and regional trends, this study recommends an overall development strategy that combines eco-cultural tourism, improved agriculture and fishery, and green industry.

(1) Eco- and Cultural Tourism

Given the necessity for creating economic opportunities, while utilizing and protecting existing natural and cultural resources, eco- and cultural tourism is presently the most effective way to satisfy these multiple needs. By definition, eco- and cultural tourism will create a tourism industry based on the available natural and cultural resources. This necessarily entails the protection and enhancement of the resources as well as the local way of life. Provided with numerous resources in the region, we estimate that an economy based on eco- and cultural tourism will in the long term far exceed the economic benefit from the proposed heavy industrial zone\(^1\). In addition, a properly managed eco- and cultural tourism will help protect the environmental qualities, vital to the well-being of the communities and the existing agriculture and aquaculture production, that supports thousands of jobs in the region.

Immediate Benefits

In the short term, eco- and cultural tourism will create the needed jobs that do not require significant retraining, and will provide additional income for the agriculture and aquaculture sector by locally creating an expanded market. The increased direct sale to tourists and nearby restaurants will greatly increase the income of farmers and fishers.

\(^1\) See 4.4 Economic Assessment
Long Term Benefits

In the long term, increased revenue being retained in the region, including taxes and user fees, will help the townships and county improve local education, infrastructure, and various social services. In addition, tourism will also help promote local industries and locally produced goods to a much larger market outside the region. Proper protection and management of resources under eco- and cultural tourism also ensure that the economic prosperity can be maintained in the long term.

In terms of specific strategies, in order for tourism to create equitable economic opportunities in the region, the developments need to take place at strategic locations in all three townships. However, in order to avoid repetition and unnecessary competition within the region, each zone needs to develop its own character and theme of tourist activities.

Specific Strategies

In Chi-Gu, the famous migrating black-faced spoonbill, the last remaining natural lagoon in the West coast, coastal mangroves, and aquaculture and salt ponds can together support a tourism industry based on combination of natural and aquacultural experiential attractions. Additions of small local museum and information center can help increase the recreation and education values of tourist activities in the area. Various small villages can participate in family-run beds & breakfasts, lengthening visitors' stay in the area. The famous seafood street can also become a major tourist attraction.

In Chiang-Chun, proximity to beaches and the construction of a major seaport can support a variety of waterfront development, including water-related active recreation, off-shore fishing and boating, and fish markets. In the inland area, agricultural experience can become a theme for developing tourist activities and services.

In Pei-men, the famous Nan-Kuen-Shen Temple is already attracting more than 4 million visitors a year and will continue as the driving engine the tourism industry in the area. In addition to religious attractions, the area also possesses rich natural scenery along the coast, as well as other cultural resources such as the original salt ponds in the area, house of the famous folk painter, Hong Tong, and the popular poetry camps. Developments that make connection of these natural and cultural resources will make Pei-men an even more prominent tourist attraction, lengthening visitors' stay and expanding local revenue. Through effective planning and coordination, the temple-based tourism can also support a local industry specializing in religion-related hand-crafts and mass products.

(2) Improved Agriculture and Fishery
Continued agriculture and aquaculture production is important not only for supporting the development of eco- and cultural tourism, but also to maximize and diversify the local economic capacity while maintaining the rural scenic character. In fact, despite the foreseen impact of WTO agreement, the region possesses several market and technological advantages as described in Chapter 2. However, to materialize the advantages, there has to be a coordinated effort to improve several areas of current practice. The suggested improvements include development of cage culture, drastic reduction of freshwater culture, conversion to less water-demanding crops, and reorganization of marketing and distribution practice in fishery and fresh produce. In addition, steps need to be taken to prevent industrial and animal wastewater from discharging into the upper reaches of the local waterways, especially Chi-Shue Creek and Chiang-Chun Creek, that threatens the production and ecology of the coastal area.

In terms of integrating with tourism development, recreational agriculture and aquaculture can also be developed to generate additional income for the farmers. To strengthen the identity and special character of various places in the region, villages can promote its specialty crops to represent the area. For example, Chi-Gu can choose to promote its cantaloupe production; Chiang-Chun, one of the largest producer of carrots in the country, can promote carrot production and attract tourists to purchase locally.

(3) Green Processing and Manufacturing Industry

Diversifying the Economic Base

In order to create a more resilient economy, the region needs to develop a diversified economic base. The less dependent the region is on one particular industry, the less the impact will be if any one industry experiences a slack in the fluctuating market. This study recommends the strategy to establish a 'Green' processing and manufacturing industry in addition to tourism, agriculture and aquaculture. By definition, 'Green' industry makes sustainable use of local resources, reduces, reuses and recycles materials and energy, employs local people, provides fair and equitable opportunities for employees and commits to the long term health of the region. These characteristics make it an appropriate industry in this environmentally sensitive and economically deprived region. By utilizing and adding values to locally available resources and products, the 'Green' industry will be mutually compatible and beneficial to the other proposed and existing economic sectors.

The proposed 'Green' industry may include manufacturing and food processing using locally produced agricultural and aquacultural products and materials. Given the already established food processing and textile manufacturing base and the proximity to major regional and inter-regional transportation network, the nearby townships of Chia-Li and Hsuei-Chia provide an appropriate location for a designated 'Green Industrial Zone'. This
will leave most of the coastal area open for tourism development while creating an industrial base and additional source of employment in the region.

Figure 4.1 Concept diagram of local economy
4.3 Detailed Development Proposals

Proposal A -- Development of Strategic Areas

Strategic Tourism Development Areas

- Major tourism developments and tourist services concentrate at 3 tourism development zones -- Chi-Gu Seafood district, Central Seaport district and the Temple district in Pei-Men. The 3 locations, each supporting a different theme, will become centers of transportation and various tourism-related services and activities and the start points for in-depth tours of the region. The 3 centers will distribute developments equally among the 3 townships and thereby reduce impact in any particular area.

- Riverfront Restoration and Development. Extending from the 3 development centers are waterfront parks and recreational facilities along nearby creeks, forming nature and recreational corridors, connecting the service centers with areas of recreation and nature reserve along coast. (See Chi-Gu Creek Corridor)

- Connecting with the development centers and riparian parks is a network of small agricultural and fishing villages where smaller-scale ecolodges and family-run 'bed & breakfast' are located. The villages host seasonal festivals.

<table>
<thead>
<tr>
<th>District</th>
<th>Pei-Men Temple District</th>
<th>Central Seaport District</th>
<th>Chi-Ku Seafood District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme</td>
<td>Religion, culture, crafts</td>
<td>Fresh seafood, active recreation</td>
<td>Restaurants, river park</td>
</tr>
<tr>
<td>Facilities &amp; attraction</td>
<td>Nan-Kuen-Hsen Temple Shops -- local crafts &amp; products Summer/Winter Camps Produce Market/ Food Mall Restaurants Hotels Tourist Information Parking &amp; Transportation Nearby attractions: Chi-Shui Creek Park Salt Museum</td>
<td>Fishing Harbor Seaport Market/ Mall Recreational Harbor -- sports fishing Fishing supplies Boat Tour/ Rental Tourist Information Parking &amp; Transportation</td>
<td>Oyster Market Seafood Restaurants Tea Houses by the River Night Market Lagoon Tour Aquaculture Tour Hotels Tourist Information Parking &amp; Transportation Nearby attractions: Chi-Ku Creek Park Chi-Ku Lagoon Tseng-Wen Estuary -- Black-faced Spoonbill</td>
</tr>
</tbody>
</table>

Table 4.1 Strategic development areas
Transportation

- The proposed West Coast Highway is rerouted to join with existing Route 17 to become a scenic corridor connecting the development centers and major roads in the area.

- Weekend buses will make stops at major tourist sites in the area; regular scheduled buses will take visitors among the 3 districts and Tainan city. In long term, the plan proposes that a light passenger railroad be built to connect Tainan city and the Temple district.

- Visitors coming by automobiles are required to park their cars at the designated areas around the 3 districts and take local transportation to explore the areas.

- Boats and bicycles will provide alternative modes of transportation for the visitors to explore the rural and coastal scenery.

- Lagoon and ocean cruise provides addition transportation and tourist attraction.

Industries

- A ‘Green Industrial Belt’ is proposed along route 19 between Chia-Li and Hsuie-Chia, for the proximity to No. 1 Freeway and relative distance from the proposed main scenic corridor along route 17.

- Maintaining and improving operation of aquacultural ponds for production and as a tourism resource.

- Retaining salt field operation for production and as a tourism resource.

Chi-Gu Creek Corridor

- A complete development of the Chi-Gu Creek Corridor will include the following:

  | Scenic corridor -- river walk | Chi-Gu Canoe |
  | Chi-Gu Canoe work; craftspeople's galleries | Coastal Sustainability Center |
  | Wildlife scooping nests | Bird watching; wildlife observatory |
  | Fishing charter and boat tours; kayaking | Orchid gardens |
  | Fishery Science Center | Bike rental |
  | Ecolodges | Seafood restaurants |
  | Camp ground | Tourist Information |
Map 4.1 Proposal A - Development of Strategic Areas
Map 4.2 Proposal A - Development of Chi-Gu Creek Corridor
Proposal B -- Diverse Economic Base

At the core of the conceptual framework for this proposal is the diverse economic base and local resources of the three districts. This proposal enhances the existing economy and land use, and provides basic infrastructure to support the 4.5 million tourists visiting the area annually. In addition it provides minimum disruption to the existing population and their occupations.

Land Use and Industries

The proposed land use, in general, preserves the existing aquaculture and dryland farming in the region and supports the creation of additional industries which will add value to the farmed goods. These value adding industries are situated mostly to the East of Highway 17, and concentrated around the three main towns of Chi-Gu, Chiang-Chun and Pei-men. Map 4.4 shows the proposal for utilizing the existing land use and resources to generate a diverse economy. The five basic existing land uses in the region that contribute to the economy are the towns (industries, tourism), farms (dryland, wetland), salt ponds, fish ponds (Milk fish), and the lagoon (oyster and clams). In addition this plan proposes the use of the ocean for seaweed cultivation that is a high revenue generating industry. Figure 4.2 shows us how the produce from a land use type may be made marketable. For example, farms would produce cane sugar, rice, vegetables, flowers and fruits. Some of these would be sold as fresh produce in local farmers' markets. The vegetables could be processed into value added goods like pickles and chips and sold commercially. Flowers could be sold as bouquets, and cane sugar could be processed into salt water taffy and exported.

Tourism

The plan taps into the existing tourist base of nearly 4.5 million people and creates infrastructure which will encourage the visitors to spend time and money in the region. Following are some of the attractions which this proposal takes advantage of:

1. The Nan-kuen-shen temple festival in Pei-men
2. The spoon bill habitat to the South - This preserve which is home to nearly 400 black faced spoonbill will be a nature preserve, where visitors could recreate and bike in trails.
3. The Yenshui fireworks festival in Chiali
4. Fish pond and lagoon recreation - Visitors could boat and fish in the lagoon. Alternatively the visitors could watch or assist the farmers and get hands on experience in harvesting fish and oysters.
5. The spring carrot festival in Chiang-Chun
6. Visits to the Wan Yeh sand dune preserve and the salt museums.
The plan encourages the building of small bed and breakfast hotels which are spread throughout the region at strategic locations like near the spoon bill habitat, the beaches, and near aquaculture ponds for those visitors interested in obtaining hands on experience.

Transportation

The transportation plan advocates the creation of a new rail loop which will connect to the existing passenger rail system linking Tainan City and Hsing-Yin. The new rail line will pass through Chi-Gu, Chiang-Chun, Pei-men, and Yenshui. The rail would give easy access for people who travel from other parts of the country to the region. The rail line will also be a fast and effective way for people to travel between the main towns in the region, and also provide relief from the developmental impacts on the existing road network in the region.

Visitors could use the rail network to arrive at the main towns, and then have the following options which will give them the mobility to explore the region:
Renting bicycles
Para-transit network from the main towns to the coastal areas except near the spoon bill habitat. Non-motorized boats which will give them access to the lagoon and the spoon bill habitat. Motorized transportation is not encouraged near the spoon bill habitat. To gain access to the coastal areas, the only form of motorized transportation the plan encourages is para-transit. Private motorized forms of traffic will not be allowed.
LOCAL ATTRACTIONS OF THE THREE TOWNSHIPS

Draft Plan for
Peimen, Chiangchun & Chiku, Taiwan
March 1997

THEMES

Map 4.3 Proposal B -- Local Attractions
LAND USES AND INDUSTRIES

Map 4.4 Proposal B -- Land use and industries

Sustainable Economic Development:
Plan for Tainan County Coastal Area
TOURIST ATTRACTIONS & TRANSPORTATION MAP, TAINAN COUNTY

Draft Plan for Peimen, Chiangchun & Chiku, Taiwan
March 1997

Map 4.5 Proposal B – Tourist attractions and transportation

Sustainable Economic Development:
Plan for Tainan County Coastal Area
A DIVERSE ECONOMY BASED ON LOCAL RESOURCES

- Sport Shop
- Fish Market
- Export Group
- Boat Sales
- Restaurants
- Bed & Breakfasts
- Fruit & Veggie Market
- Flower & Fashion Market
- Nori Sheets
- Pickled Fish
- Smoked Fish
- Rock Salt
- Saltwater Taffy
- Sweet Potato Chips
- Fresh Bouquets
- Sun Glasses
- Canned Fish
- Dried Fish
- Table Salt
- Fresh Produce
- Pickled Melon Rind
- Boats
- Recycled Clothing
- Seaweed
- Oysters
- Eel
- Shrimp
- Oo Fish
- Salt
- Cane Sugar
- Veggies & Grains
- Organic Produce
- Flowers
- Plastic Factory
- Used Clothing
- Sea Fish
- OCEAN
- LAGOON
- FISH PONDS
- SALT PONDS
- FARMS
- TOWNS
Proposal C -- Themes of Tourist Activities

This proposal focuses on the development of various themes of tourist activities based on special characters and available resources at different locations throughout the coastal areas. The overall concept is to develop activities along the four local rivers, in attempts to strengthen the natural structure of the region. Four major themes are proposed here, including Pei-Men Cultural Heritage District, Chi-Gu Natural Heritage District, Health Activity District, and the Siraya Aboriginal Culture District. At the mouth of Chiang-Chun river is the main information center which serves both local residents and tourists.

(1) Pei-Men/Chiang-Chun Cultural Heritage District

Main Attractions include:

- Nan-Kuen-Shen
  Historical temple, art museum, temple festival (4/26-27; 6/10; 8/15; 9/10), poem writing summer camps

- Pei-Men
  Tourist fish market and farmer’s market, temple festival (11/1 King Boat Festival -- sending God of Pestilence), local historical museum, service facilities: hotels, restaurants.

- Shan-Liao-Wan
  Regional port, auction market, temple festival(1/11 Paper Boat Festival)

- Pei-Men Port
  Kayak/canoe station, bike shop

- Egret Park Visitor Center
  Information station, traditional net fishing site, beach camp site

- Fishery Museum
  Passive Activities -- introducing the ecosystem of fishery production in Pei-Men, Chiang-Chun and Chi-Gu, history of fishery evolution, exhibitions of precious fish species.
  Active Activities -- tourist fishing at open lagoon, waterfront park in lagoon area, seafood cooking demonstration, seafood festival, wetland ecological tour.

- Environmental Protection Museum
Passive Activities -- tracing the local environmental history, display of the pollution from the development of heavy industry in Taiwan

Active Activities -- experiencing the pollution in our daily surroundings by the indicator equipment which can measure water and air pollution, showing the disasters from environmental pollution by multi-media exhibition.

- **Hong Tong Residence**
  Re-create folk artist Hong Tong's residence and the life of little village, display of Hong Tong's paintings, exhibition area for local artists, making documentary film of Hong Tong.

(2) Health Activity District

- **Hsue-Chia**
  Temple festival (3/11)

- **Chiang-Chun**
  Health food center (carrot juice, garlic wine, nu-ban tea), recycled glass art factory, Green industry district.

- **Salt Bath Health Center**
  Salt processing interpretation center, Salt shop -- products & souvenir, Salt Bath

- **Constructed Waste Water Treatment Wetland**
  Interpretation center, canoe stop

- **Ling-Zhi-Liao**
  Traditional comforter making

(3) Siraya Aboriginal Culture District

- **Chia-Li**
  Siraya tribe aboriginal landing site, Pei-Pu Temple festival (9/5 Adopted Son Ceremony)

- **Van-Ar-Wan**
  Siraya tribe festival, lodging: Siraya stilt cabin.

- **Du-Gu Boating Restaurant**
(4) Chi-Gu Natural Heritage District

Main Attractions include:

- **Chi-Gu**
  Fish/farmer’s market, seafood street -- restaurants, bike/canoe station

- **Chi-Gu Lagoon Outdoor Eco-Museum**

  The environmental education and information center of the Lagoon Museum will be located in the Long-Shan Village, with Long-Shan Harbor as main entrance of lagoon. The Chi-Gu wetland is the site for Lagoon Museum and the tourists can experience the geographical change of seashore, the interrelation of ecosystem and aquaculture activities. In addition, it also provides water-related activities. The museum will be divided into nine zones and seven themes.

  a. **Lagoon Entrance : Main entrance and transition area**
     Environmental Education Center
     Chiang-Chun Temple : the religion of the aquaculturists
     Long-Shan Fishing Harbor Course : experiencing the tidal change

  b. **Chi-Gu Lagoon Area : Theme of Lagoon**
     bird watching/star watching
     experiencing tidal change
     boat house
     experiencing net fishing and oyster farming

  c. **Sand Dune Area 1 : Theme of Sand Dune**
     the landscape of sand dune
     intertidal change
     egret forest
     water-related activities

  d. **Sand Dune Area 2 : Theme of Seashore Development 1**
     the ruin of old water gate
     bird watching
     the landscape of sand dune
     Chi-Gu light house
     tide watching
     fishing
     water-related activities
e. Little Lagoon Area: Theme of Seashore development 2
   catching the fry of eel and milk-fish
   black face spoon bill watching
   shoreline recess observation

f. Chi-Gu Creek: Theme of Creek and Aquaculture
   the ecosystem of mangroves
   the old course of Tseng-Wen River
   lagoon watching
   clam digging
   experiencing fish ponds
   aquaculture exhibition

g. Ma-Chia Creek: the secondary entrance of lagoon
   old course of Tseng-Wen River
   drying seaweed
   old architecture
   mangroves

h. Chiang-Chun Waterfront Park: Theme of Water-related activities
   beach
   artificial beach
   lagoon watching
   bird watching at salt ponds
   experiencing fish markets
   water-related activities

i. Pei-Men Lagoon Area: Theme of Environmental Pollution
   experiencing river pollution
   mangroves
   fish markets
   lagoon watching
   experiencing fishing village
   egret forest
   ecological interpretation for inter-tidal zone and wetland
Map 4.6 Proposal C -- Areas of tourist activities
THEMES OF TOURIST ACTIVITIES

PEI-MEN CULTURAL HERITAGE DISTRICT
- Nan-Kuen-Shan Temple Festival
- Poem Writing Summer Camp
- Pei-Men Tourist Fish & Farmer's Market
- Pei-Men Port
- Egret Park Visitor Center
- Fishery Museum
- Environmental Protection Museum
- Hong Tong Residence

CHI-GU NATURAL HERITAGE DISTRICT
CHI-GU SEAFOOD STREET,
FISH/FARMER'S MARKET
CHI-GU LAGOON OUTDOOR ECO-MUSEUM
- lagoon entrance: environmental education center
- theme of lagoon: bird watching, boating, hiking
- theme of sand dunes: ecological education
- theme of creek and aquaculture
- theme of water-related activities

SIRAYA ABORIGINAL CULTURAL CENTER
- Chia-Li Siraya Tribe Aboriginal Landing Site
- Van-Ar-Wan: Siraya Tribe Festival
- Du-Gu Boating Restaurant

Map 4.7 Proposal C -- Themes of tourist activities
4.4 Economic Assessment

Based on comparative case-studies and existing data, the following economic projections are made to examine the validity and effectiveness the proposed plan. The study will specifically look at the economic impact of eco- and cultural tourism, fishery, and agriculture whose related data are available.

Eco- and Cultural Tourism

Based on a job-to-visitor ratio\(^2\) obtained from comparable case-studies in England and Ireland that share similar economic and tourism characteristics, it is projected here that if the annual total visitor number reaches six millions with an average stay of 2.5 day, a total of 24,000 to 38,400 jobs can be generated. With visitor number increased to 7 million a year, the number of jobs will be between 28,000 and 44,800. This number is comparable to the estimated number for the Binnan Industrial Zone at 30,930 and the Tainan Science Park at 30,000 (TCCP, 1996).

Tourism Employment Projection

![Tourism Employment Projection](image)

Figure 4.2 Tourism employment projection

\( ^2\) See Appendix 3.
A more detailed projection that includes a breakdown of visitor number for different locations within the region in Table 4.2 also shows a similar result. The visitor numbers used here are based on information of comparable tourist destinations in Taiwan that share similar characteristics. These include national parks, beach, seafood markets, etc. The length of stay in each location is reduced to avoid overlapping. Based on a daily spending of NTS 1,200 (US$ 44) per person, the industry can expect to generate an annual gross revenue of NTS14.6 billions (US$541 millions).

The total numbers here reflect the development of the Temple district, camps, seafood district, fish market, beach and birdwatching activities, as specified in the detailed proposed plan. The significantly high ratio between gross revenue and job number as compared with existing agriculture and aquaculture suggests a potentially higher income for tourism related jobs.

<table>
<thead>
<tr>
<th>Attractions</th>
<th>Total Visitor-trip per Year</th>
<th>Visiting Days/trip</th>
<th>Total Visitor-days</th>
<th>Gross Revenue (NT$1 mil.)</th>
<th>Gross Revenue (US$1 mil.)</th>
<th>Jobs$^4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temple District</td>
<td>5,500,000</td>
<td>1.3</td>
<td>7,150,000</td>
<td>8,580</td>
<td>317.8</td>
<td>18,590</td>
</tr>
<tr>
<td>Camps</td>
<td>100,000</td>
<td>6</td>
<td>600,000</td>
<td>720</td>
<td>26.6</td>
<td>1,560</td>
</tr>
<tr>
<td>Seaport-market</td>
<td>1,000,000</td>
<td>1</td>
<td>1,000,000</td>
<td>1,200</td>
<td>44.4</td>
<td>2,600</td>
</tr>
<tr>
<td>Beach</td>
<td>400,000</td>
<td>1.3</td>
<td>520,000</td>
<td>624</td>
<td>23.1</td>
<td>1,352</td>
</tr>
<tr>
<td>Seafood District</td>
<td>1,500,000</td>
<td>1</td>
<td>1,500,000</td>
<td>1,800</td>
<td>66.7</td>
<td>3,900</td>
</tr>
<tr>
<td>Birdwatching</td>
<td>800,000</td>
<td>1.3</td>
<td>1,040,000</td>
<td>1,248</td>
<td>46.2</td>
<td>2,704</td>
</tr>
<tr>
<td>Others</td>
<td>300,000</td>
<td>1.3</td>
<td>372,500</td>
<td>447</td>
<td>16.6</td>
<td>969</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9,600,000</strong></td>
<td>-</td>
<td><strong>12,182,500</strong></td>
<td><strong>14,619</strong></td>
<td><strong>524.9</strong></td>
<td><strong>31,675</strong></td>
</tr>
</tbody>
</table>

Table 4.2 Economic projection of proposed eco- and cultural tourism.

**Aquaculture and Fishery**

$^3$ See Appendix I.
$^4$ Number includes both direct and indirect jobs with ratio at 1:2. Multiplying factor based on job-visitor ratio = $0.026$ job/visitor-day

*Sustainable Economic Development:
Plan for Tainan County Coastal Area*
Despite the expected reduction in freshwater culture due to concerns of land subsidence and groundwater depletion, with benefit of tourism development, new types of cultivation and value-adding industry, the overall value of production and employment number are projected to stay at similar level even when taking into account increase in average income. The combination of factors including increase in direct sale to tourist, value-adding industry, and the lessening of competition from nearby county as result of the expected downsizing of aquacultural production, is projected to result in an increase in per-unit value and profit. Therefore, despite the reduction of freshwater cultivation, the overall economic capacity can be maintained at present level, resulting in similar and even higher employment figure (17,424 full-time jobs and 5,515 part-time jobs). When given a 10% increase in income, the number of jobs (15,855 full-time; 5,018 part-time) is still similar to the present level at 15,510 full-time jobs and 6,431 part-time jobs.

<table>
<thead>
<tr>
<th>Production</th>
<th>Current Area</th>
<th>Projected Area</th>
<th>Current Amount (M. Ton)</th>
<th>Projected Amount (M. Ton)</th>
<th>Current Value (NTS1 million)</th>
<th>Projected Value (NTS1 million)</th>
<th>Per-unit Value Increase</th>
<th>Current Full-time Jobs</th>
<th>Projected Full-time Jobs</th>
<th>Projected Part-time Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater culture</td>
<td>5,904.7</td>
<td>1,500</td>
<td>26,147</td>
<td>6,388</td>
<td>1,751.8</td>
<td>555.3</td>
<td>25%</td>
<td>2,951</td>
<td>1,875</td>
<td>2,605</td>
</tr>
<tr>
<td>Saltwater culture</td>
<td>7,321.6</td>
<td>8,000</td>
<td>7,637</td>
<td>8,345</td>
<td>783.5</td>
<td>1,042.8</td>
<td>25%</td>
<td>842</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>Coastal cage culture</td>
<td>-</td>
<td>3,000</td>
<td>-</td>
<td>243.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>842</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>Marine culture</td>
<td>3,904</td>
<td>3,900</td>
<td>402.9</td>
<td>503.2</td>
<td>25%</td>
<td>1,395</td>
<td>1,742</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal fishery</td>
<td>3,357</td>
<td>3,200</td>
<td>272.3</td>
<td>311.4</td>
<td>20%</td>
<td>9,719</td>
<td>11,117</td>
<td>1,795</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Off-shore fishery</td>
<td>1,226</td>
<td>1,200</td>
<td>94.9</td>
<td>111.5</td>
<td>20%</td>
<td>1,312</td>
<td>1,541</td>
<td>484</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seaweed farming</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>200.0</td>
<td>-</td>
<td>-</td>
<td>305</td>
<td>126</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>384</td>
<td>380</td>
<td>13.7</td>
<td>15.6</td>
<td>15%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>41,271</td>
<td>26,413</td>
<td>3,299.1</td>
<td>3,084.0</td>
<td>-</td>
<td>15,377</td>
<td>17,424</td>
<td>5,515</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.3 Economic projection for fishery production and employment under recommended plan.

5 Area includes ponds located outside the three townships.
6 Proposed new cultivation.
7 Proposed new cultivation.
Agriculture

With expected increase in profit as result of tourism development and value-adding industry, the production of agriculture is also projected to maintain the same capacity as the present level, providing similar number of jobs. A major change occurs in the shift from water-intensive rice farming to more sustainable dryland farming. The expected increase in market value and profit means an increase in income for the farming households.

<table>
<thead>
<tr>
<th>Production</th>
<th>Current Area</th>
<th>Projected Area</th>
<th>Current Value (NTS1 million)</th>
<th>Projected Value (NTS1 million)</th>
<th>Unit Value Increase</th>
<th>Current Farming Household</th>
<th>Projected Farming Household (1)</th>
<th>Projected Farming Household (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>4,026</td>
<td>1,000</td>
<td>713.6</td>
<td>196.2</td>
<td>10%</td>
<td>3,563</td>
<td>973</td>
<td>886</td>
</tr>
<tr>
<td>Dryland farming</td>
<td>1,945</td>
<td>4,971</td>
<td>344.7</td>
<td>1,011.9</td>
<td>15%</td>
<td>1,721</td>
<td>5,059</td>
<td>4,604</td>
</tr>
<tr>
<td>Total</td>
<td>5,971</td>
<td>5,971</td>
<td>1,058.3</td>
<td>1,208.1</td>
<td></td>
<td>5,284</td>
<td>6,032</td>
<td>5,490</td>
</tr>
</tbody>
</table>

Table 4.4 Economic projection for agriculture production and employment under recommended plan.

Comparison with Heavy Industry

Together, development of eco- and cultural tourism and improvement in agriculture and fishery will produce an employment number comparable and competitive to that claimed by the heavy industry developers. When considering that the 8,350 jobs in plant operation will only be available to professionally trained workers and with the expected loss of fishery and agricultural jobs as result of the impact of the industrial zone, the difference will be even more significant in favor of the recommended eco- and cultural tourism plan. It is also important to keep in mind the number for the recommended plan does not include that from proposed Green industry.

In addition, in the long term with continuing technological innovations and industrial automation, the number of jobs at the two industrial plants and its related industries can be expected to decrease. In contrast, tourism as a service industry will continue to provide employment and business opportunities.

Number reflects a 10% increase in income.
Figure 4.3 Comparison of total employment opportunities

Figure 4.4 Comparison of accessible jobs to local population.

9 Number for heavy industry based on EIS, 1996.
Comparison of Employment Opportunities in the 20 Year Period

Figure 4.5 Comparison of employment opportunities in 20 years

Illustrative Case-studies on Property Value

The impact of different development can also be evaluated by comparing property prices around the development. Typically, areas around heavy industrial zone have a lower property value than those around scenic tourist areas. To illustrate the difference, three areas were chosen in the San Francisco Bay Area to provide a preliminary look. The three sets of examples are respectively located in an industrial area with petrochemical refineries, a suburban residential neighborhood, and a residential area near a popular tourist site.

<table>
<thead>
<tr>
<th>Locations</th>
<th>Neighborhood Character</th>
<th>2 Bedroom Homes</th>
<th>3 Bedroom Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richmond</td>
<td>Industrial -- Petrochemical refinery</td>
<td>US$ 171,000 (4 cases)</td>
<td>US$ 242,000 (6 cases)</td>
</tr>
<tr>
<td>Alameda</td>
<td>Suburban residential</td>
<td>US$ 214,450 (4 cases)</td>
<td>US$ 288,000 (6 cases)</td>
</tr>
<tr>
<td>Sausalito</td>
<td>Popular Tourist Area -- waterfront scenery</td>
<td>-</td>
<td>US$ 474,000 (2 cases)</td>
</tr>
</tbody>
</table>

Table 4.6 Case-studies of property values in San Francisco Bay Area.
The results show that two bedroom homes in Richmond experience a 30 percent drop in their property value, and three bedroom homes experience a 26 percent drop, compared to Alameda. When compared with Sausalito, the price for 3-bedroom home in Richmond is almost only one half that of Sausalito.

Conclusion

In addition to employment figure and value of production, in measuring of long term sustainability, it is important to keep in mind the tremendous external environmental and social costs the heavy industrial zone will bring, compared to the recommended eco-and cultural tourism plan. Despite the significant higher value of production at NT$ 303.6 billions a year, the development of the heavy industrial zone is based on the assumption that two additional dams will be publicly funded and constructed in Southern Taiwan, with a price tag of NT$ 100 billions each and a life expectancy of 30 to 50 years (EIS, 1996; WS, 1996). The huge water consumption is expected to create conflict with the Tainan Science Park and other existing industrial zones in the region, as well as agriculture production and domestic water use. The external costs also include spending on public health care, and threats to critical ecosystems and wildlife. It is also expected that much of the industrial plants’ revenue will go to the outside developers and investors, instead of being reinvested in the region. Moreover, with the world’s oil supply expected to run out within the next century, it is uncertain what will occur at the site after the developer withdraw the operation. However, it is certain that the environmental damage will be irreversible, and any restoration attempt will be extremely costly.

From the perspective of local and long-term economic development, the recommended eco- and cultural tourism plan has proven to be a favorable alternative to the heavy industrial zone in the analysis above.
5. Evaluation of Development Alternatives
5.1 Sustainability Indicators

'Sustainability indicators' have increasingly been used to inform people of their progress towards achieving sustainability in defined area such as environmental protection, economic growth, and community life, by indicating the general conditions and trends. The usefulness of sustainability indicators comes from its ability to indicate a measurable progress through time. In this chapter, we will use a system of sustainability indicators to illustrate and evaluate the impacts of the different development alternative, i.e., the recommended eco- and cultural tourism plan, Binnan Industrial Zone, and West coast highway.

A total of twenty indicators are identified here, echoing the development principles as stated in Chapter 4 and reflecting the needs of local communities.

I. Quality of Life:

1. Family reunification: percentage of 20-45 year olds emigrating from area.
2. Public Health: death rate in the area, break down by age group and cause of death.
3. Percentage of area residents living within 2 km of full range of basic needs: dependable transit, recreational outdoor space, shopping, school, library, health services, post office, restaurants, workplace.
4. Percent of Jr. High Graduates who continue on to Professional or High School in region.

II. Healthy Economic Development

5. Change in cost of living -- hours of paid work at the average wage required to support basic needs.
6. Percent of value added to region's products / raw materials before leaving the region.
7. Percentage of area residents who own their homes and/or land they work on.
8. Percent of tourist and industry revenue staying in the region.
9. Percentage of area people hired by new businesses without significant retraining.

III. Health of the Environment:

10. Percentage of ground and surface water sampling sites meeting clean water criteria (Break down by salinity, pH, dissolved solids, B.O.D., temperature, nitrogen, phosphorus)
11. Area of effective wetland / estuary / lagoon habitat.
13. Percentage of existing agricultural or aquacultural land converted to urban uses.
14. Number of good air quality days in the region.
15. Land subsidence rate in area.
16. Tons of toxic chemicals generated or imported into the region.

IV. Wise Use of Resources / Closed Loop Systems:

17. Per capita water consumption: (Break down by type of user: agriculture, aquaculture, residential, industrial, and other; and by sources: recycled, from which reservoir or well, showing if it's local or not)
18. Per capita energy consumption: (Breakdown by percentage of energy coming from each type of source and its location.)
19. Tons of solid waste generated per capita that is not recycled.
20. Number of vehicle trips compared to number of public transit trips in the area.

5.2 Evaluation of 3 Development Alternatives
Family Reunification
Percentage of 20-45 year olds emigrating from the area

Number of residents living within 2 km of basic services

Change in buying power

Public Health
Death Rate by age group in the area

Percentage of Jr. High graduates who continue on to Professional or High School

Percent of value added to region's products / raw materials before leaving the region

Current Trends
No Petro, No Highway
No Petro, Yes Highway
Yes Petro, Yes Highway
Percent of existing agricultural or aquacultural land converted to urban uses

Number of good air quality days

Land subsidence rate in the area

Tons of toxic chemicals generated in the region

Current Trends
No Petro, No Highway
No Petro, Yes Highway
Yes Petro, Yes Highway
Tons of solid waste generated per capita that is not recycled

Number of vehicle trips compared to number of public transit trips in the area

Current Trends  No Petro, No Highway  No Petro, Yes Highway  Yes Petro, Yes Highway
## 5.3 Summarized Comparison of Development Alternatives

The following summarizes the major impacts of the development alternatives.

<table>
<thead>
<tr>
<th></th>
<th>Recommended Plan -- Eco- &amp; Cultural Tourism, Improved Agriculture &amp; Fisher, Green Industry</th>
<th>Binnan Industrial Zone -- Steel Mill, Petrochemical Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economy</strong></td>
<td>Keeps existing agricultural and fishery and related employment.</td>
<td>Conflicts with existing agriculture and fishery. Loss of related employment.</td>
</tr>
<tr>
<td></td>
<td>Higher number of employment opportunities for local population.</td>
<td>Jobs required technical and professional training.</td>
</tr>
<tr>
<td></td>
<td>Protect important environmental and scenic resources for future economic development.</td>
<td>High external costs, such as construction of additional dams, loss of natural habitats.</td>
</tr>
<tr>
<td></td>
<td>Generate higher gross revenue than present; most of revenue stays in the regions especially if development is taken up by local residents and townships.</td>
<td>Generate higher value of production, but little stays in the region.</td>
</tr>
<tr>
<td></td>
<td>Compatible and supportive of regional high-tech development.</td>
<td>Conflict with regional high-tech development because of competition of water resource.</td>
</tr>
<tr>
<td></td>
<td>Economy grows over a long period of time.</td>
<td>Production reaches its peak in shorter period, but is expected to decline in long term.</td>
</tr>
<tr>
<td></td>
<td>More benefit to the local region.</td>
<td>Important for national economy, but at a high cost.</td>
</tr>
<tr>
<td><strong>Quality of Life</strong></td>
<td>Cleaner environment and scenery attract people to stay.</td>
<td>Less attractive for people to stay due to potential accidents and pollution.</td>
</tr>
<tr>
<td></td>
<td>Increase public services, e.g., public transportation, commerce, etc.</td>
<td>Development of highway for transportation of industrial products; large volume of truck traffic increases noise pollution and risk of accidents.</td>
</tr>
<tr>
<td></td>
<td>Employment opportunities encourage family reunification.</td>
<td>Employment opportunities encourage family reunification.</td>
</tr>
<tr>
<td></td>
<td>Increased revenue can improve local social services including health care and education.</td>
<td>Potential accidents and pollution present a threat to public health.</td>
</tr>
</tbody>
</table>
### Table 5.1 Summarized comparison of development alternatives.

<table>
<thead>
<tr>
<th>Environmental Health</th>
<th>Sustainable Economic Development: Plan for Tainan County Coastal Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect important and endangered wildlife.</td>
<td>Loss of lagoon area, potential accidents, pollution threatens survival of wildlife</td>
</tr>
<tr>
<td>Enhance shoreline protection by reducing groundwater use and restoring shoreline forests.</td>
<td>Disrupt coastal hydrology and threatening shoreline security.</td>
</tr>
<tr>
<td>Increase water recharge, reducing land subsidence.</td>
<td>High water consumption. Construction of dams upstream reduces freshwater reaching the coastal area, worsening land subsidence.</td>
</tr>
<tr>
<td>Enhancing qualities of fishery and wildlife habitats along the coast</td>
<td>Wastewater and disruption of habitats threaten fishery production.</td>
</tr>
<tr>
<td>Increase fishery productivity.</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.1 Summarized comparison of development alternatives.
6. Policy Recommendations and Conclusion
6.1 Policy Recommendations

To facilitate the implementation of the proposed economic development plan, this study makes the following policy recommendations. It is especially critical that items 1 through 3 under Eco- and Cultural Tourism are implemented as soon as possible, before the region irreversibly loses its important development resources. It is the responsibilities of national and local government agencies, as well as the citizen groups in the region to carry the following tasks.

**Eco- and Cultural Tourism**

1. Designate the coastal area as a National Nature Reserve to protect the important ecology and the scenic tourism resources. The area should include the entire coast of the county, West of Route 17. Separate designations of Wildlife Protection Areas also need to be established to protect the habitats of endangered wildlife including the Black-faced Spoonbill. The Designation should be accompanied by an effective management plan to implement the protection mechanism and enhance quality of existing habitats, including restoring the Tseng-Wen Estuary to a natural estuary ecosystem.

2. Reject the proposal for Binnan Industrial Zone and other development proposal which will threaten the integrity of the coastal ecology and environment and the region's eco-and cultural tourism development resources.

3. Terminate constructions of West Coast Highway to prevent loss of natural habitats and scenic resources, and make Route 17 a scenic corridor.


5. Designate development zones to accommodate and limit development in appropriate and strategic locations and to avoid adverse sprawls and excessive impact on existing communities and important environmental and tourism resources.

6. Clean up and eliminate pollution in local rivers and creeks. Restore the river and creek to serve as natural habitats and scenic tourism resources.

7. Provide start-up loans and technical assistance for tourism-related small business.

**Improved Agriculture and Fishery**

1. Gradually eliminate freshwater inland aquaculture; encourage saltwater and off-shore cage aquaculture.

2. Increase funding for research in sustainable aquaculture and agriculture production and assistance for the fishers and farmers to adopt improved practice.

3. Coordinate marketing effort for fishery and agricultural products.
4. Bioremediation for aquaculture and agriculture wastewater; clean up local creeks and eliminate pollution upstream.
5. Create a regional water resource management to conserve, manage, and reclaim freshwater supply.

**Green Industry**

1. Designate Green Industrial Zones to encourage and accommodate Green industries.
2. Provide regulatory and financial incentive for starting tourism and green industry related small business.
3. Provide start-up loans for small Green business.
4. Coordinate production and marketing process.
5. Provide technical assistance in source reduction, reuse, and recycling.
6. Set up proper waste management plan and infrastructure.
Map 6.1 Recommended designation of protection areas
Sustainable Economic Development Plan for the Tainan County Coastal Area
6.2 Conclusion

In the decades since 1960's, Taiwan has achieved a remarkable industrial and economic growth. However, this single-minded growth comes with tremendous social and environmental costs. The problem of pollution, resource depletion, deterioration of urban environment are not only threatening the quality of life in the urban and rural communities, but are also becoming major obstacles to continuing economic development. With increasing incidents of 'natural' disasters, industrial accidents, and shortage of important resource such as water, it has become painfully clear that the current mode of development is not capable of producing a sustainable economy and environment in the long term.

A new and integrated approach of economic and community development needs to be developed to address the multiple needs in creating long term economic prosperity, a healthy environment and community well-being.

Like the rest of the country, residents of Tainan county, especially those who live in the coastal townships, are now faced with a decision of whether to accept the existing mode of industrial development or to pursue an alternative economic development that address the long-term needs of the community including a sustainable economy and the protection of environmental and community integrity.

This report outlines a proposal for a sustainable economic development plan that consists of eco- and cultural tourism, improved agriculture and fishery, and Green industry. The proposal is based on an understanding and recognition of important existing economic development opportunities within the framework of regional development, as well as the natural and cultural heritage of the coastal area. The plan is backed by an economic analysis and an evaluation using a system of Sustainability Indicators. The result shows a clear advantage for the recommended plan over the heavy industrial zone.

The decision is now in the hands of the residents and responsible agencies and officials to determine the future of the region and the lives of its people in generation to come.
Appendix
Appendix 1. Domestic Tourism in Taiwan

Total Number of Person-Trip (for 78 locations nation-wide):

<table>
<thead>
<tr>
<th>Year</th>
<th>1996 (Jan-April)</th>
<th>1995</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (Person-Trip)</td>
<td>4,440,000</td>
<td>45,690,000</td>
<td>42,142,447</td>
</tr>
<tr>
<td>Growth from same period last yr. (%)</td>
<td>4</td>
<td>8.42</td>
<td>2.94</td>
</tr>
</tbody>
</table>

Number based on 78 tourist destination, excluding temples and other religious sites. 79 destinations are counted in 1995 (with addition of the observation deck at Hsin-Kwan Tower).

- According to one survey, 94.7% of respondents have travelled at least once a year; 60% have travelled at least once per season. (Summary of Survey Report on Domestic Tourism, 1995)

Purpose of Trip (1995)

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Recreation</th>
<th>Visit to Family &amp; Friends</th>
<th>Business</th>
<th>Religious</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Response</td>
<td>73.3</td>
<td>10.7</td>
<td>7.3</td>
<td>7.0</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Travel Spending (1995)

<table>
<thead>
<tr>
<th>Items</th>
<th>Meal/ Food</th>
<th>Transportation</th>
<th>Lodging</th>
<th>Entertainment</th>
<th>Shopping</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT$</td>
<td>4986</td>
<td>4560</td>
<td>3694</td>
<td>2936</td>
<td>1970</td>
<td>433</td>
<td>18579</td>
</tr>
<tr>
<td>US$</td>
<td>184.7</td>
<td>168.9</td>
<td>136.8</td>
<td>108.7</td>
<td>73.0</td>
<td>16.0</td>
<td>688.1</td>
</tr>
<tr>
<td>% of Total Spending</td>
<td>27</td>
<td>25</td>
<td>20</td>
<td>16</td>
<td>11</td>
<td>2</td>
<td>100</td>
</tr>
</tbody>
</table>

- Average spending per person on travel: NT$ 18,579 (US$ 688.1)
- Average spending per trip: NT$ 4,816 (US$ 178.4)
- Average spending per person-trip: NT$ 876 (US$ 32.4) (based on 5.5 persons/trip)
Travel Duration (1995)  
Average number of travel days per trip (1995) = 2.12

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>≥5</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Response</td>
<td>41</td>
<td>27</td>
<td>17</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

Popularity of Destinations based on Types (1995)

<table>
<thead>
<tr>
<th>Types</th>
<th>% of Response</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural &amp; Historical</td>
<td>22</td>
<td>Museum, folk parks, historical sites</td>
</tr>
<tr>
<td>Adventure &amp; Theme Parks</td>
<td>35</td>
<td>Theme parks, zoos, gardens</td>
</tr>
<tr>
<td>Coastal Sites</td>
<td>12</td>
<td>Beach, coastal parks, scenic areas</td>
</tr>
<tr>
<td>Lakes &amp; Reservoir</td>
<td>11</td>
<td>Natural &amp; artificial lakes, dams</td>
</tr>
<tr>
<td>Mountain &amp; Forest Sites</td>
<td>20</td>
<td>Scenic Areas, nurseries</td>
</tr>
</tbody>
</table>

Comparable Tourist Destinations

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Nearest Major City</th>
<th>Driving time from major city</th>
<th>No. of Visitor per year</th>
<th>Seasonal Variation</th>
<th>Main Attraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dong-San River</td>
<td>I-Lan County</td>
<td>Taipei</td>
<td>3+ hours</td>
<td>1,200,000 (1994)</td>
<td></td>
<td>Scenery, lodging in Chiao-Si (hot spring)</td>
</tr>
<tr>
<td>Northeast Point Scenic Area</td>
<td>Taipei County</td>
<td>Taipei</td>
<td>2+ hours</td>
<td>764,040 (1994)</td>
<td>high in spring, summer</td>
<td>Scenery, seafood, beach</td>
</tr>
<tr>
<td>Stone Gate Reservoir</td>
<td>Tao-Yuan County</td>
<td>Taipei</td>
<td>2+ hours</td>
<td>1,382,450 (1994)</td>
<td></td>
<td>Scenery, food (fish), nearby temple parks, resort, camping</td>
</tr>
<tr>
<td>Tseng-Wen Reservoir</td>
<td>Tainan County</td>
<td>Tainan</td>
<td>1.5 hours</td>
<td>298,974</td>
<td>highest in Feb. &amp; Dec.</td>
<td>Scenery, camping, temples</td>
</tr>
<tr>
<td>Chi-Gu area</td>
<td>Tainan County</td>
<td>Tainan</td>
<td>1.5 hours</td>
<td>-</td>
<td>-</td>
<td>Scenery, seafood, etc.</td>
</tr>
</tbody>
</table>

Types of Travel (1995)
### Type of Travel

<table>
<thead>
<tr>
<th>Type</th>
<th>Family Travel</th>
<th>Joined Travel</th>
<th>Company Trip</th>
<th>School Trip</th>
<th>Individual Trip</th>
<th>Religious</th>
<th>Other Group</th>
<th>Guided Tour</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Response</td>
<td>55</td>
<td>28</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

### Top 10 Tourist Destination (1995)

<table>
<thead>
<tr>
<th>Destination</th>
<th>No. of Toursits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palace Museum</td>
<td>3,671,628</td>
</tr>
<tr>
<td>National Natural Science Museum</td>
<td>3,158,726</td>
</tr>
<tr>
<td>Taipei Zoo</td>
<td>3,103,112</td>
</tr>
<tr>
<td>Six Flags Village Theme Park</td>
<td>1,784,131</td>
</tr>
<tr>
<td>Taipei Youth Recreational Center</td>
<td>1,520,641</td>
</tr>
<tr>
<td>Ba Gua Mountain</td>
<td>1,510,485</td>
</tr>
<tr>
<td>Taiwan Folk Park</td>
<td>1,427,782</td>
</tr>
<tr>
<td>Sword Lake Mountain</td>
<td>1,340,389</td>
</tr>
<tr>
<td>Lake Tseng-Ching</td>
<td>1,261,092</td>
</tr>
<tr>
<td>Stone Gate Reservoir</td>
<td>1,225,205</td>
</tr>
</tbody>
</table>

### Means of Transportation (1995)

<table>
<thead>
<tr>
<th>Transportation</th>
<th>% of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Car</td>
<td>54</td>
</tr>
<tr>
<td>Tour Bus</td>
<td>18</td>
</tr>
<tr>
<td>Public Bus</td>
<td>15</td>
</tr>
<tr>
<td>Airplane</td>
<td>4</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>9</td>
</tr>
<tr>
<td>Train</td>
<td>9</td>
</tr>
<tr>
<td>Taxi</td>
<td>5</td>
</tr>
<tr>
<td>Walking</td>
<td>5</td>
</tr>
<tr>
<td>Car Rental</td>
<td>4</td>
</tr>
<tr>
<td>Bicycle</td>
<td>2</td>
</tr>
<tr>
<td>Boat</td>
<td>1</td>
</tr>
</tbody>
</table>
Motivations of Travel (1995)

<table>
<thead>
<tr>
<th>Motivation</th>
<th>% of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sight-seeing</td>
<td>34</td>
</tr>
<tr>
<td>Visit historic sites</td>
<td>7</td>
</tr>
<tr>
<td>Visit ceremonies &amp; rituals</td>
<td>3</td>
</tr>
<tr>
<td>Relax from work</td>
<td>22</td>
</tr>
<tr>
<td>Have not visit</td>
<td>10</td>
</tr>
<tr>
<td>Influence of media</td>
<td>3</td>
</tr>
<tr>
<td>Recommendation from friends &amp; relatives</td>
<td>7</td>
</tr>
<tr>
<td>Advertising of tourist agency</td>
<td>2</td>
</tr>
<tr>
<td>Company trip</td>
<td>6</td>
</tr>
<tr>
<td>Nice weather</td>
<td>5</td>
</tr>
</tbody>
</table>

Other Facts:

- The industry expects NT$360,000,000 of domestic tourist spending a year after 1996. The major theme parks are currently investing heavily in expansion of existing facilities. (Six Flags: NT$130 millions; Taiwan Folk Park: NT$600 millions.)
- In-region travel is highest in Northern Taiwan with 41.7% of responses.
- The most important factors affecting choices of destinations are ‘travel safety’ and ‘convenience of transportation’.
- The top five favorite recreational activities are ‘visiting natural landscape’, ‘barbecuing and picnicing’, ‘hiking’, ‘visiting cultural and historic sites’, and ‘camping’.
- 94.7% of respondents had traveled at least once in 1995.
- The top five reasons for not traveling are ‘no time’, ‘don’t know where to go’, ‘no one to go with’, ‘no interests’ and ‘tourist areas are often too crowded’.
- Monthly number of travel varies little, typically with February as the highest (11%).
- An average of 2 trips per person in 1994.
- Travel within 2 hrs of driving is most preferred.
- Travel time between Tainan and Kaohsiung by freeway is about an hour.
Appendix 2. Foreign Visitors in Taiwan

- Average spending per person per day (1995): US$190.93 (Hotel Cost=36.5%; shopping=31%)
- 25.3% of visitors stayed for 3 nights; 21.6 stayed for 5 to 7 nights (1995).
- 76.4% are individual travelers; 17.2% came on packaged tours.

Top 5 Tourist Destinations (1995)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Palace Museum</th>
<th>CKS Memorial</th>
<th>Long-San Temple</th>
<th>Martyr’s Temple</th>
<th>Taroko, Tien-Hsian</th>
</tr>
</thead>
<tbody>
<tr>
<td>% (1995)</td>
<td>38.3</td>
<td>35.4</td>
<td>21</td>
<td>15.5</td>
<td>14.2</td>
</tr>
</tbody>
</table>

Other popular destinations include Yang-Ming Mountain, North Coast, and Ken-Tin National Park.

Top Tourist Destinations (1994)

<table>
<thead>
<tr>
<th>North</th>
<th>Palace Museum</th>
<th>CKS Memorial</th>
<th>Lung-San Temple</th>
<th>Martyr’s Temple</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>40.6%</td>
<td>39.4%</td>
<td>27.8%</td>
<td>20.5%</td>
</tr>
<tr>
<td>Central</td>
<td>Sun Moon Lake</td>
<td>Aboriginal Park</td>
<td>Mount Ali</td>
<td>-</td>
</tr>
<tr>
<td>South</td>
<td>Tseng-Ching Lake</td>
<td>Tsuo-Ying</td>
<td>Ken-Tin National Park</td>
<td>Fu Kung Mountain</td>
</tr>
<tr>
<td>East</td>
<td>Tarogo Gorg</td>
<td>Chi-Ben Hot Spring</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Daily Spending (1995)

<table>
<thead>
<tr>
<th>Nationality</th>
<th>Japan</th>
<th>Korea</th>
<th>H.K.</th>
<th>Singapore</th>
<th>USA</th>
<th>Germany</th>
<th>Australia, N.Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>US$</td>
<td>271.6</td>
<td>158.46</td>
<td>146.53</td>
<td>163.54</td>
<td>137.46</td>
<td>145.5</td>
<td>155.47</td>
</tr>
</tbody>
</table>
Sight-seeing visitors spent US$ 254.15 in average per day compared to business visitors with US$231.68 per day. (1994) Visitors on packaged tours spent US$306.88 in average per day.

Main Attractions to Sight-seeing Foreign Tourists (1995)

<table>
<thead>
<tr>
<th>Attraction</th>
<th>Taiwan's Scenery</th>
<th>Chinese Culture</th>
<th>Chinese Cuisine</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>61.8</td>
<td>47.4</td>
<td>37.7</td>
</tr>
</tbody>
</table>

Interests of tourists mainly included tasting Chinese cuisine, shopping, visiting museums, sight-seeing, touring temples and historic sites. (1994)

Purpose of Visit (1994)

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Business</th>
<th>Sight-seeing</th>
<th>Visiting friends &amp; relatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>50.4</td>
<td>31.6</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Nationalities (Place of Residence) of Visitors (1994)

<table>
<thead>
<tr>
<th>Countries</th>
<th>Japan</th>
<th>USA</th>
<th>H. K.</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>42.4</td>
<td>14.4</td>
<td>9.4</td>
<td>33.8</td>
</tr>
</tbody>
</table>

Average Travel Duration (1994)

<table>
<thead>
<tr>
<th>Duration</th>
<th>3 Nights</th>
<th>4 Nights</th>
<th>5-7 Nights</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>29.7</td>
<td>18.4</td>
<td>21.2</td>
</tr>
</tbody>
</table>
## Appendix 3. Case-studies in Eco-tourism (I)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractions</td>
<td>Natural unspoilt environment</td>
<td>Rural scenery</td>
<td>Sheep farms, crops, steam trains</td>
<td>Sea and sand</td>
</tr>
<tr>
<td>Visitors/Year</td>
<td>3,100,000</td>
<td>3,500,000</td>
<td>300,000</td>
<td>1,032,202</td>
</tr>
<tr>
<td>Visitor Nights</td>
<td>5,800,000</td>
<td>75,000</td>
<td>(6,654 beds)</td>
<td></td>
</tr>
<tr>
<td>Average Stay</td>
<td>1.6 nights</td>
<td>2 to 3 nights</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue</td>
<td>1,500,000,000</td>
<td>760,000,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jobs - Direct</td>
<td>96</td>
<td>2,661</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect</td>
<td>97</td>
<td>49,275</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7,412 FTE</td>
<td>7,500</td>
<td>193</td>
<td>51,936</td>
</tr>
<tr>
<td>Percent Jobs Seasonal</td>
<td>33% - 60%</td>
<td></td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>Revenue/Visitor - USS</td>
<td>484</td>
<td>217</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NTS</td>
<td>13,068</td>
<td>5,859</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Jobs Per Visitor</td>
<td>0.0032</td>
<td>0.0021</td>
<td>0.0064</td>
<td>0.0501</td>
</tr>
<tr>
<td>Total Jobs/Visitor</td>
<td>0.0023</td>
<td>0.0021</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average Jobs/Visitor ratio: 0.004; average Job/Visitor-day ratio: 0.0026

**Tunisia:** Visitor nights estimated assuming 85% occupancy; visitors estimated assuming 2 nights per visit; indirect employment includes all retail.


## Appendix 3. Case-studies in Eco-tourism (II)

<table>
<thead>
<tr>
<th>Location</th>
<th>Site profiles</th>
<th>Visitors /yr</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acada, CA</td>
<td>100 acres constructed wetland and wildlife refuge</td>
<td>150,000</td>
<td></td>
</tr>
<tr>
<td>Blackwater National Wildlife Refuge, MD</td>
<td>20,000 acres, forest, wetlands, river system</td>
<td>126,000</td>
<td></td>
</tr>
<tr>
<td>Corkscrew Swamp Sanctuary, FL</td>
<td>11,000 acres bald cypress swamp, pine flatwoods, wet prairie, marsh, lake</td>
<td>80,000</td>
<td></td>
</tr>
<tr>
<td>Des Plaines River Wetlands, IL</td>
<td>550 acres wetlands adjacent to 3-mile section of the Des Plaines River</td>
<td>1,000-5,000</td>
<td>depending upon forest preserve visitors and organized tours</td>
</tr>
<tr>
<td>Everglades, FL</td>
<td>1.5 million acres, primary wetlands. Sawgrass prairie, freshwater marsh, swamp</td>
<td>1.3 millions (in1991)</td>
<td></td>
</tr>
<tr>
<td>Hackensack Meadowland, NJ</td>
<td>8,000 acres marsh in 20,000 acres meadowland</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>J. N. “Ding” Darling National Wildlife Refuge, FL</td>
<td>5,153-acre refuge including 2,825 acres of wilderness. Tidal marsh, mangrove swamp, freshwater marsh</td>
<td>720,000</td>
<td>even larger areas of wildlife habitat were lost to human development as the tourist industry bloomed in the 1930s.</td>
</tr>
<tr>
<td>John d. Macarthur Beach, FL</td>
<td>225 acres upland &amp; 535 acres submerged lands, subtropical coastal mangrove estuary.</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Jug Bay Wetlands Sanctuary, MD</td>
<td>500 acres wetland and upland</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td>Sackville Waterfowl Park, Canada</td>
<td>55-acre Town-Park, 48 acres wetlands with a 1.5-mile shoreline</td>
<td>25,000</td>
<td>tours are organized by the Tourist Bureau during the waterfowl season</td>
</tr>
<tr>
<td>South Platte Park, CO</td>
<td>625 acres, 2.5 miles along the South Platte River</td>
<td>90,000</td>
<td></td>
</tr>
<tr>
<td>Tiffit Nature Park, NY</td>
<td>264 acres wetland</td>
<td>31,000</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5. Green Businesses and Industries

Defining a green business / industry:

A green business or industry is sustainable in all or some of the following:
- Products or services, manufacturing processes, treatment of employees, effect on local/regional economy, effect on local/regional ecosystem.

Shades of Green:

In industrial and business processes there are many ways to act sustainably and many degrees or depths of sustainability.

Some examples include:

- Converting waste into new products: Create-A-Sarus, Berkeley
- Recycling waste into reusable raw materials: Evergreen Oil, Newport Beach, CA
- Making use of recycled waste:
- Producing "green" products or services: Whole Foods, Inc. / The Body Shop / Working Assets.
- Retrofitting to be more "green": West Coast Samples, Chino, CA.
- A business that audits other businesses / industries for opportunities for "green" improvements:
  McLaren Hart, Rancho Cordova, CA
  Industrial ecology - A grouping of industries making use of each other's waste: The Kalundborg Industrial Ecosystem, Denmark.

Some Sustainable Industry Criteria (from Blueprint for a Sustainable Bay Area):

+ Keeps local dollars flowing in the local economy.
+ Participates in improving the community.
+ Creates little or no pollution.
+ Efficiently uses renewable, reused or recycled materials and produces little waste.
+ Is diverse and adaptable to withstand recession.
+ Focusses on fair and equitable opportunity for employees.
+ Creates jobs for a range of education, experience and income.
+ Provides opportunities for local ownership.
+ Provides and invests in a safe work environment.
+ Commits to the region and its long-term health.
+ Is not sprawl-inducing in location, proximity to employees, or density of employment.
Specific Examples Relative to the Chi-Gu Area:

1. **Eco-Tourism** (to be discussed in a separate report)
   Provides local jobs and income while helping to preserve valuable local environments and culture and educate people about their value.

2. **Agricultural - Aquacultural closed loop systems:**
   Fish production wastes can become fertilizer for agricultural fields, grasses produced in and agricultural fields can be used as fish and livestock feed.

4. **Organic Farming**
   Pesticide free farming greatly reduces the environmental impact of agriculture and provides healthier foods. There is an increasing demand for organic products and a willingness to pay slightly more for them.

3. **Seaweed and other Aquatic Plant Farming**
   Making use of wetland, estuary, or lagoon areas to raise plants, such as seaweed, which have market value or can be used as fish and livestock feed, while maintaining the or improving the ecological values of these areas.

5. **Value Added Agriculture and Aquaculture**
   Locally processing the products of agriculture and aquaculture into things with more market value. Must be based on exact products that can be produced in the area, unknown at this time. Some ideas:
   + Turning sweet potatoes into potato chips.
   + Canning or otherwise packaging fish products.
   + Processing fruits and vegetables by canning, making jellies, …?
   + Salt processing and packaging, other products?

**Case Study 1: Lake Go Reed Wetland and Fish Farm, Yixang County, China**

Wetland combined with fish farm yields fish, reed grass and ecologically valuable wetland. Constructed wetland and pond system created, manipulation of water levels timed to maximized fish and reed production. Wetland plants feed herbivorous fish and are harvested for fuel and other purposes. Results:

+ Fish yields of 9 metric tons/hectare (60% grass carp and Wuchang fish, 30% silver carp and big head carp, 10% crucian and common carp).
+ Reed (*Phragmites sp.*) yields of 75 metric tons/hectare.
+ System employs 104 people, mostly part time.

**Case Study 2: Salt Marsh Restoration, China’s East Coast**
Construction of salt marshes for environmental protection and agricultural production. Marsh construction and planting dominated by the grass species *Spartina anglica*. Results:
+ Stabilize coastline by dissipating wave energy and slowing currents.
+ Provide habitat for migratory birds, waterfowl, domestic fowl, nereids (worms) and crabs.
+ Increase aeration and organic content of water, lowering pollution.
+ Decreased the salt content of the soil.  
+ Increased sedimentation.
+ Grass harvested as a source of animal fodder, as an effective ‘green manure’ for rice fields, as a source of fuel and methane for cooking and illumination.

Case Study 3: Experimental Water Hyacinth River Pollution Control
Fumen River, Suzhou, Jiangsu Province, China

Annual planting and harvesting of water hyacinth in river for pollution absorption and as an agricultural crop. 2.7 hectares of riverine water hyacinth (*Eichhorina crassipes*) planted in the river from May through December. Results:
+ Hyacinth absorbs numerous river pollutants.
+ 2,500 metric tons of hyacinth harvested and used as fodder for fish in culture ponds and for ducks swine and snails, generally safe levels of pollutants found in these animals.
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