

## **9. THE USE OF CORPORATE SYNERGY SYSTEMS IN PROMOTING INDUSTRIAL WASTE MINIMIZATION IN SMALL AND MEDIUM ENTERPRISES IN TAIWAN**

---

*Shen-yann Chiu, Ph.D.*  
*Executive Secretary*  
*Taiwan Environmental Management*  
*Association, Taipei*  
*International Green Productivity*  
*Association, Taipei*

### **ABSTRACT**

A Corporate Synergy System (CSS) is a mechanism through which a group of manufacturing companies works together to achieve certain production or management goals. Established among firms linked by supply chains, a CSS usually consists of a central firm and its manufacturing suppliers or “satellites.” The system is being adopted in Taiwan as the key mechanism for promoting Industrial Waste Minimization (IWM) in small and medium enterprises. In this paper, the background and concept of CSS-IWM are presented, followed by a brief description of Taiwan’s CSS-IWM program. Finally, observations and suggestions are provided to conclude the paper.

### **BACKGROUND**

As with many developing Asian economies, a large proportion of Taiwan’s industrial production comes from small- and medium-sized enterprises (SMEs). Among approximately 95,000 firms in Taiwan, more than 96 percent are SMEs – firms with a capital investment of less than US\$ 1.5 million, total assets less than US\$ 4.5 million, or fewer than 200 employees. Together, these firms generate approximately 50 percent of the gross production of businesses in Taiwan. Not surprisingly, while small on a per-facility basis, the gross volume of wastes generated by SMEs is substantial. Moreover, as many of the SMEs are scattered in commercial and residential areas, the environmental and health impact of these firms on the public at large is particularly severe.

Small and medium-sized enterprises are limited in their capabilities to excel in environmental performance. In general, these firms have little financial, technical, and manpower capability to implement environmental measures. Furthermore, the public at large exerts substantially less pressure on SMEs than on large firms in the environmental, health and safety management. As a consequence, SMEs are comparatively less active in environmental programs. Corporate Synergy Systems have now been used in Taiwan for several years to motivate SMEs to implement IWM programs to improve their environmental performance.

### **What Is a Corporate Synergy System (CSS)?**

A Corporate Synergy System is a mechanism based on created by forming partnerships among business organizations to achieve common goals. Usually established within supply chains, Corporate Synergy Systems are initiated under the leadership of large companies. The upstream suppliers and downstream buyers in the chains are organized to work together to achieve common goals related to improving productivity or environmental performance. The CSS approach has been actively promoted by the government in Taiwan for many years to enhance cooperation among businesses to meet the needs of the country's economic development. In 1984, the Corporate Synergy Development (CSD) Center was established with funding from the Industrial Development Bureau (IDB) of the Ministry of Economic Affairs (MOEA) to coordinate CSS promotion efforts as a non-profit organization. Thus far, more than 100 CSSs have been organized, covering companies that account for one-third of Taiwan's total industrial output. The main objective of these CSSs has been to assist each participating firm to enhance productivity, technological capabilities, and management efficiency.

In any CSS, central firms play a key role in initiation, organization and maintenance of the system. Many large companies take up the role of central firms in a CSS due to a desire to improve their position in competitive markets. The globalization of economic activities and increasingly fierce international competition mean that companies must improve the quality of their products and public image while simultaneously containing their costs of production. To accomplish this, they must take great care in selecting their suppliers. Thus, under the leadership of large companies, supply chains are becoming more integrated in terms of decision making and planning with greater exchange of information among chain members. In addition to cost containment and quality assurance, many large firms have begun to work with upstream suppliers and downstream buyers to reduce their environmental liabilities.

To understand why satellite firms would join a CSS, one must first understand the basic characteristics of these firms. Generally speaking, satellite firms are SMEs with a relatively small staff and low capitalization. They are engaged in manufacturing activities involving relatively simple technologies. Their profit margins are generally small due to fierce market competition, reliance on easily acquired technologies, and relatively transparent cost accounting. SMEs rely heavily on their existing business networks and references from current buyers to generate new sales. In order to make a profit or even simply to survive, SMEs firms must be extremely flexible in meeting the demands of their buyers. Thus, when a large company wants its suppliers to participate in a CSS, suppliers will generally accommodate the request. In return, the central firm(s) of a CSS may reward the suppliers by providing special credit treatment, free staff training, and/or relaxed performance audit requirements. Eventually, through the operation of a CSS, large companies can use a variety of parameters such as product quality, financial strength, and environmental performance to rank their suppliers. The "good" suppliers can be given preference over others while pressure is applied to poorly operating and unranked suppliers to improve their performance. More detailed information on the characteristics of SMEs in Taiwan can be found in a recent paper by Syytu.<sup>1</sup>

---

<sup>1</sup> Syytu, D.S., 1995, "The Unique Business Characteristics of Taiwan's Small and Medium Enterprises: Their Business Environment, Sizes and Strategy," (in Chinese) a paper presented in *Journal of CSD Center*, Taipei, Taiwan, Vol. 115, March.

### **Benefits of and Obstacles to Implementation of Industrial Waste Minimization**

Industrial Waste Minimization (IWM) is defined as those technical and management activities that are capable of reducing or preventing generation of pollutants at the source. These activities include in-process recycling and conservation initiatives that reduce the use of materials and energy, substitution of environmentally benign materials for hazardous materials, improving process design and operation to prevent pollutants from leaving the process systems, and implementation of life cycle design to reduce wastage and improve material utilization. IWM is considered to be a win-win situation because it leads to improved production efficiency and better environmental performance. As IWM generally involves process and product changes, regulatory agencies rarely establish rules to require industry to implement IWM. Rather, regulators have hoped that firms would adopt IWM measures voluntarily once they realize the potential benefits of implementation.

Although IWM has many benefits, a number of factors can prevent SMEs from implementing a program. The two primary barriers are technical and financial. Technical barriers impede the ability of a company to develop, evaluate, and implement IWM programs. These barriers include: limited awareness of pollution management issues at a company's decision-making level; lack of in-house expertise on IWM; and the absence of readily available IWM technologies that can be easily adopted. In addition, attitudes toward changing established industrial processes or practices are often negative, which tends to impede implementation of new approaches to preventing pollution. Pollutant generators may be reluctant to take risks with new, unproved technologies or to compromise other business goals and practices; they may also distrust alternative processes or simply be uninterested in changing their habitual ways of doing business. The unavailability of capital for plant modernization often becomes a significant obstacle to implementing IWM even though the measures may lead to cost savings. Major companies may have capital to upgrade inefficient processes, but SMEs often do not. Other obstacles for SMEs in Taiwan to implementing IWM include:

- Lack of a cost-accounting system to identify costs of environmental control and potential benefits of source reduction;
- Lack of proper registration and licensing. A substantial portion of SMEs are currently operating without having registered with the appropriate government agencies resulting in a lack of authority on the part of the government to deal with the environmental issues associated with these firms;
- Lack of aggressive enforcement of pollution control regulations in the country; industries are thus less likely to invest in IWM if they are allowed to illegally dispose of wastes; and
- Lack of manpower, since SME's usually employ only a small staff, and can't easily acquire the new technical and management skills required for IWM implementation.

### **IWM Promotion in Taiwan**

Industrial waste minimization is hardly a new concept in Taiwan. In fact, information on technical aspects of IWM technologies is abundant and can be easily obtained. The most difficult problem, however, is to design promotion programs to

effectively encourage large numbers of industrial firms, especially SMEs, to start implementing, and to commit to continually improving their IWM programs.

As in many developed and developing economies, both government and industry in Taiwan are actively involved in promoting IWM. The role of government agencies in promoting IWM is to provide incentives that help overcome technical and financial barriers to IWM. These incentives can be divided into two categories: technical and financial assistance mechanisms, and regulatory enforcement mechanisms. Government agencies that provide technical and financial incentives for industrial development are contributing to the promotion of IWM by supporting the development of new technologies, providing technical assistance, and disseminating relevant information. Regulatory enforcement agencies are promoting IWM by imposing stringent but flexible technical and environmental regulations to encourage businesses to operate responsibly by developing products and manufacturing methods that reduce or eliminate pollutants at their source.

In Taiwan, the official program to provide technical assistance and financial incentives to promote industrial waste minimization started in 1989 with an executive order by the Premier of the Executive Yuan to adopt IWM as a the cornerstone of Taiwan's strategy for solving environmental problems. Following this executive order, the MOEA and the Environmental Protection Administration (EPA) together established the Joint Waste Reduction Task Force (JWRTF) which was delegated with overall responsibility for promoting IWM in the country. The first task accomplished by the JWRTF was to formulate and implement a 5-year plan from 1991 to 1995 to promote IWM in Taiwan. A second 5-year plan to promote IWM is now being implemented in Taiwan. Specific elements in IWM program include the following:

- *Public awareness promotion:* JWRTF produced booklets, posters, newsletters, technical manuals and videos to educate industry and the general public about IWM. The most positively received form of awareness promotion was the presentation of awards to organizations with outstanding achievements in IWM. As of 1995, a total of 50 firms, 47 individuals, and 17 organizations had received such awards.<sup>2</sup>
- *Training and education:* To help industry implement IWM, sector-specific training courses were provided for technical staff and decision-makers in industry. Between 1990 and 1995, 256 IWM training courses were offered in the country, benefiting more than 22,000 participants.<sup>3</sup>
- *Information exchange:* General information on the nature and benefits of IWM technologies, and case studies that illustrate technical feasibility are necessary for user communities. Two computer data systems have been established. One of these systems contains technical information and case studies on IWM techniques. The other data system is designed for use by companies to locate individuals capable of providing specific expertise; it collects human resource information pertinent to individuals' expertise, capabilities, and experience. In addition to these two data systems, an industrial waste exchange information has

---

<sup>2</sup> China Technical Consultants, Inc. (CTCI), *Waste Minimization White Paper*, ROC, (in Chinese) prepared for Industrial Development Bureau, Ministry of Economic Affairs, ROC, July 1996.

<sup>3</sup> Ibid.

been in operation since 1987. This system has facilitated nearly 200 exchanges between the waste generators and users.

- *Technical assistance*: Contracted by JWRTF, China Technical Consultants, Inc. (CTCI) and Foundation of Taiwan Industrial Services (FTIS) provide technical assistance at no cost to industry. Each year, a number of firms are selected by these nonprofit organizations for in-depth technical assistance. Over the last four years, 89 firms in 30 industrial sectors received assistance; hundreds of additional firms received general consultation.<sup>4</sup>
- *Technology research, development, and demonstration*: Under this program element, special attention has been given to developing technologies and detailed case studies of IWM technologies suitable to domestic conditions. From 1989 to 1995, Ministry of Economic Affairs sponsored nearly 80 research and development projects related to IWM technologies.<sup>5</sup> Industrial Technology Research Institute (ITRI) performs a majority of these projects. The annual budget allocated by MOEA for R&D of IWM technologies is approximately US\$10 million.
- *Financial incentives*: Under the sponsorship of IDB, several commercial banks are helping firms implement IWM projects by providing low-interest loans. Additional financial incentives that are being provided by government include investment tax credit, import tariff exemption, and accelerated depreciation for IWM equipment. In 1994 and 1995, more than 1,200 applications were approved of tariff exemption for imported IWM and pollution control equipment.<sup>6</sup>

It has been more than eight years since the initiation of the IWM program in the country. During this period, the program's focus has switched from public awareness promotion, training and technology demonstration to providing assistance to industries in the implementation of IWM options. Furthermore, since 1995, new program elements have been added to promote ISO 14000 and life cycle design. Although no quantitative information is available on the extent of IWM application in the country, it is clear, that the IWM program has succeeded in raising awareness of cleaner production concepts in the country. Instead of solely depending on end-of-pipe (EOP) treatment, thousands of firms in the country now consider source reduction a viable option for solving their environmental problems.

In spite of these impressive results, the impact of IWM program on SMEs has been far from satisfactory. Thus far, for example, though more than 200 firms have received in-depth technical assistance to implement IWM measures, less than 20 percent of these firms are SMEs. In an attempt to rectify the situation, the Industrial Development Bureau took the initiative in 1995 to adopt the CSS mechanism to promote IWM in SMEs. The results, as described in the balance of this paper, have been quite impressive.

### **Steps to Implementing CSS-IWM programs**

The first step in establishing a CSS-IWM program involves a commitment from a large company to become a central firm. At the beginning of each fiscal year, the IDB

---

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

<sup>6</sup> Ibid.

publishes bulletins soliciting companies to serve as central firms in new CSSs in the country. Large companies who have had experience in implementing IWM programs are naturally good candidates to become central firms of CSSs. To qualify as a central firm, a company must demonstrate commitment from its top management to provide necessary resources to run the CSS-IWM program, and a sufficient number of suppliers who could potentially join the program. Once selected, the central firm(s) would go through the list of its suppliers and make a preliminary selection of firms who could benefit from IWM measures. A seminar then would be organized to explain the basics of a CSS such as: the concept of IWM; the process of implementing a CSS-IWM; the roles and responsibilities of participating firms; and the program schedule. Following the seminar, satellite firms would be asked to register to provide pertinent firm information and indications of top management commitment. These firms would then go through a final qualification procedure before formally being accepted into the system.

A successful CSS-IWM program relies on securing the commitment and general consensus of top decision makers of each satellite firm to follow the methodology and schedule set by the group. During the course of program implementation, specific roles properly are assigned to the central firms, satellite firms, consultants, and government agency. The entire framework requires government agencies to provide: encouragement and support to the program; funding and supervision to consultants who assist central firms in promoting IWM concepts and coordinating CSS implementation; and technical assistance in planning and implementing the IWM program. The central firms must promise adequate incentives to participating satellite firms. Assisted by consultants, they would also organize a team to take overall responsibility for: conducting plant inspections; process audits, program reviews; and perform technology demonstrations for participating firms when necessary.

CSS-IWM programs are generally carried out in the seven steps briefly described below. More detailed descriptions of the IWM implementation approach can be found elsewhere.<sup>7</sup>

- Step 1:* Start by providing training to the staff of each participating firm. Two training courses are designed for different groups. Awareness classes are basically for management personnel and include an introduction to the concept of IWM, benefits and barriers, general approaches, and industrial environmental, health and safety. The technical classes, designed for process and operation staff, include plant audit procedures, IWM opportunity assessment methodology, and available IWM measures and practices;
- Step 2:* Establish an IWM team in each participating firm to take charge of the program and to coordinate the efforts of the plant. Management leads the team and the employees are expected to participate by proposing and implementing IWM measures;
- Step 3:* Conduct plant audits for each participating firm to examine plant operations in detail to determine the sources of waste generation and to prioritize waste streams;

---

<sup>7</sup> Chiu, S, and B. Peters, "Industrial Pollution Prevention," a *Technical Memorandum* published by Asian Development Bank, Metro Manila, The Philippines, November 1994.

- Step 4:* Identify potential IWM options for the facilities, through numerous sources, such as secondary literature, personal contacts, and, most importantly, brainstorming employees;
- Step 5:* Identify high priority waste streams and select the best IWM options for the company; then and implement these options;
- Step 6:* Evaluate the progress of the IWM program on a company- and CSS-wide basis following the implementation of selected IWM options; and
- Step 7:* Take actions to sustain the IWM program of each firm and the entire CSS for continued growth and increased benefits.

CSS-IWM programs in Taiwan follow a yearly cycle. Meetings are held periodically in each participating firm to provide staff training, to assess plant operations, to solicit participation and ideas from employees, to review the progress, and to identify and overcome obstacles to IWM implementation. In addition to separate meetings at individual firms, group meetings are organized where consultants and representatives from participating firms gather to exchange ideas and assess the progress of the CSS-IWM program. At the end of fiscal year, actions are taken to assess the results of the program, and to identify additional IWM measures for implementation in next fiscal year.

The success of any CSS-IWM program depends on close collaboration among four major parties: government, consultants, central firms, and participating satellite firms. The specific roles performed by these organizations are listed in Table 1. The roles of government agencies and central and satellite firms have been described earlier; the consulting firms are responsible for bringing all parties together and for providing the expertise needed to make the program operate smoothly. Under a contract with the Industrial Development Bureau, the Foundation of Taiwan Industry Service (FTIS) presently serves as the primary consultant for CSS-IWM program implementation. FTIS's expertise on IWM has been developed through years of serving as one of the government contractors providing technical assistance to industry to practice IWM and implement environmental management systems under ISO 14000.

### **Results of CSS-IWM Programs in Taiwan**

Since 1995, two corporate synergy systems have been established in Taiwan to promote IWM in supply chains. TECO Electric and Machinery Co., Ltd., one of the largest electrical equipment manufacturers in the country, initiated the first system. Prior to initiation of CSS-IWM, several of TECO's plants had implemented IWM programs and therefore had a good understanding of the financial and environmental benefits of the concept. TECO's top management was convinced that further substantial gains could only be realized if its suppliers also adopted IWM measures through CSS-IWM effort. During the first stage of CSS-IWM organization, however, many of TECO's suppliers were either not interested or only passively participating in the program. It was only after TECO's general manager openly threatened to discontinue purchasing relationships that the suppliers began to seriously participate in the CSS-IWM program.

The TECO CSS-IWM system consisted of four of TECO's electric equipment assembly plants serving as the central firms, and 12 suppliers serving as satellite firms.<sup>8</sup>

---

<sup>8</sup> TECO Electric and Machinery Co., LTD, and Foundation of Taiwan Industrial Service, *TECO's Corporate Synergy System for Promotion of Industrial Waste Minimization- A Special Report*, (in

**Table 1. Roles of Organizations Involved in CSS-IWM Program**

Organization	Roles
Government agencies	<ul style="list-style-type: none"> <li>• Provide encouragement and support</li> </ul>
Consulting firms	<ul style="list-style-type: none"> <li>• Provide staff training programs</li> <li>• Assist in establishing IWM teams</li> <li>• Assist in plant audits</li> <li>• Assist in identification and feasibility analysis of IWM options</li> <li>• Assist firms to compile pertinent data</li> <li>• Call regular meeting to track progress</li> <li>• Supply pertinent information</li> </ul>
Central firms	<ul style="list-style-type: none"> <li>• Get top management commitment and support</li> <li>• Serve as a role model</li> <li>• CSS system audit and reviews</li> <li>• Provide assistance and incentives to participating satellite firms</li> </ul>
Satellite firms	<ul style="list-style-type: none"> <li>• Get top management commitment</li> <li>• Establish IWM teams</li> <li>• Carry out IWM implementation</li> </ul>

An Environmental Safety Promotion Team (ESPT) was organized among all these firms to run the CSS-IWM program with technical assistance provided by FTIS. Table 2 lists the participating firms in TECO's CSS-IWM, including four central firms (A through D) and 12 satellite firms (E through R). The satellite firms represent suppliers of data processing equipment, printed circuit boards, parts molding, etc. More than 60 percent of the participating firms were SMEs. During FY 1995, the participating firms in the system implemented a total of 2,119 IWM options. Based on available data, these options required a capital investment of US\$ 453,000, and resulted in a savings of US\$ 5 million in FY 1995. The TECO CSS-IWM system has since been expanded to include 32 firms, and many of them have reported reductions in production costs of greater than 20 percent as a result of practicing IWM measures.

A second CSS-IWM program was organized by the Cheng-Loong Paper Manufacturing Company in July of 1996.<sup>9</sup> Established with Cheng-Loong's Tayuan Paper Mill and Hsinchu Paper Mill as central firms, the CSS consists of 10 up-stream suppliers that provide waste paper, machinery, chemicals, energy, and transportation services, and 3 downstream buyers who are paper container manufacturers (see Table 3). With over 90 percent of participating firms being SMEs, the Cheng-Loong system implemented 868 IWM options in a one-year period from July 1996 to June 1997. These participating firms invested a sum of US\$ 991,000 in IWM measures, resulting in a total benefit of US\$ 3.5 million in FY 1996.

During FY 1997, two additional CSS-IWM systems were organized by SAMPO Corporation and Macronix International with technical assistance of FTIS and CTCI,

---

Chinese) Taipei, Taiwan, December 1996.

<sup>9</sup> Industrial Development Bureau (IDB), and Foundation of Taiwan Industrial Service, *Cheng-Loong Tayuan Plant's Corporate Synergy System to Promote Industrial Waste Minimization (Final Report Draft)*, (in Chinese), Taipei, Taiwan, June 1997.

**Table 2. Results of TECO's CSS-IWM Program in FY 1995**

<b>Firm code</b>	<b>Business /Product</b>	<b>Number of employees</b>	<b>IWM options proposed</b>	<b>IWM options implemented</b>	<b>Investment US\$ (1,000)</b>	<b>Benefit** US\$ (1,000)</b>
A	Appliances	102	40	28	3.6	54.6
B	Appliances	350	1,805	1,612	1,392.9	1,788.2
C	Electric motors	380	565	306	13.6	322.5
D	Electric motors	340	62	53	255.0	2,239.6
E	Electric equipment	850	14	1	*	
F	Printed circuit boards	280	12	8	3.6	26.9
G	Electronics	50	6	6	*	20.0
H	Electronics	54	4	4	*	4.1
I	Packaging	44	13	13	5.4	19.8
J	Packaging	260	71	18	3.9	100.2
K	Plastic	95	8	8	*	26.1
L	Plastic	37	2	1	*	*
M	Metal processing	280	34	28	168.9	336.8
N	Metal processing	47	6	3	*	
O	Parts fabrication	22	4	4	*	2.1
P	Brass tube processing	33	3	3	*	5.4
Q	Brass tube processing	36	17	17	2.57	42.5
R	Molding	50	7	6	*	7.1
<b>Sum</b>		<b>3,310</b>	<b>2,673</b>	<b>2,119</b>	<b>1,849.5</b>	<b>4,993.6</b>

Notes: \* Indicate investment data not available.

\*\* Benefits realized in FY1995.

Source: Adapted from Reference no. 4.

respectively. SAMPO is one of the largest electrical appliance and equipment manufacturers in the country. The SAMPO CSS-IWM system consists of 14 firms, 97 percent of which are SMEs that supply metal parts, plastic parts, PB boards, printing products, and packaging materials. The system implemented a total of 789 IWM options that cost US\$ 825,530, and resulted in an annual benefit of US\$ 4,680,425.<sup>10</sup>

Macronix is a manufacturer that primarily produces non-volatile memory and logic memory integrated circuits. The CSS-IWM system organized by the company attract 18 firms that produced a host of goods and services including IC fabrication, chemicals, waste treatment, construction, and IC packaging. These firms implemented a sum of 156

<sup>10</sup> Industrial Development Bureau (IDB), and Foundation of Taiwan Industrial Service, 1998, *SAMPO's Corporate Synergy System to Promote Industrial Waste Minimization (Final Report Draft)*, (in Chinese), Taipei, Taiwan, June 1998.

**Table 3. Results of Cheng-Loong CSS-IWM Program in FY 1996**

<b>Firm code</b>	<b>Business /Product</b>	<b>Number of employees</b>	<b>IWM options proposed</b>	<b>IWM options implemented</b>	<b>Investment US\$ (1,000)</b>	<b>Benefit* US\$ (1,000)</b>
PM-1	Paper	288	210	173	397.8	1,194.5
PM-2	Paper	100	98	92	22.3	521.5
CE-1	Chemicals	15	21	9	24.3	89.3
CE-2	Chemicals	50	66	51	130.7	414.3
CE-3	Chemicals	19	22	21	30.6	85.8
PC-1	Paper containers	155	45	42	10.8	151.0
PC-2	Paper containers	141	455	335	60.0	291.8
PC-3	Paper containers	140	44	28	32.1	134.2
CG-1	Energy	37	56	37	4.3	45.6
TR-1	Transportation	13	10	10	62.9	27.2
WP-1	Waste paper collection	6	13	13	14.6	60.7
WP-2	Waste paper collection	5	8	8	2.2	30.9
WP-3	Waste paper collection	58	26	22	169.3	357.1
WP-4	Waste paper collection	5	14	14	14.6	65.5
ME-1	Machinery	6	13	13	14.6	98.0
<b>Sum</b>		<b>1,040</b>	<b>1,101</b>	<b>868</b>	<b>991.1</b>	<b>3,567.4</b>

Note: \*Benefits realized in FY 1996.

Source: Adapted from reference no. 5.

IWM options in FY 1997 at a cost of US\$537,000, and garnering US\$4.5 million in benefits in FY 1997.<sup>11</sup>

The positive results in previous years provide a strong incentive for expansion of CSS-IWM program in Taiwan. In FY 1998, three new CSS-IWM systems were organized with the assistance from FTIS; these systems were created by central firms including Acer Peripherals, Inc (an electronic manufacturer), Sanyang Industry (a motor cycle and automobile assembler), and Super Textile Corporation. Assisted by CTCI, two additional CSS-IWM system have been organized under United Microelectronics Corporation (an IC fabricator), and Acer Incorp. (a computer manufacturer). A total of 74 satellite firms join these five CSS-IWM systems, of which more than 70 percent are SMEs.

<sup>11</sup> Industrial Development Bureau (IDB), and China Technical Consultants, Inc., *MACRONIX's Corporate Synergy System to Promote Industrial Waste Minimization (Final Report Draft)*, (in Chinese), Taipei, Taiwan, June 1998.

## SUMMARY AND CONCLUSION

As in many other countries, small and medium enterprises in Taiwan are slow in implementing Industrial Waste Management. These firms are in general less capable financially and technically to acquire more advanced technologies to improve their environmental performance. In an attempt to induce a change, the Corporate Synergy System approach was adopted by the Government in Taiwan in 1995 to attract more SMEs to practice IWM. The results thus far clearly indicate that the CSS approach is effective in promoting IWM in SMEs. Facing the fierce competition in global markets and newly developed international environmental requirements, many large companies are willing to take the initiatives to form CSSs to promote IWM in their supply chains. Driven by the incentives from its buyers (or, in some cases, suppliers), many SMEs would join CSSs and learn how to practice, and realize the benefits of, IWM.

CSS-IWM is still in its first stage of application, however. Since program inception in 1995, four systems have been established under firms that represent manufacturers of electrical equipment, paper products, electrical appliances, and integrated circuits. At the beginning stage, relatively simple IWM-measures (the “low-hanging fruits”) are implemented. The results of a cost and benefits analysis of implemented options are quite positive, with average investment pay off in less than four months. The evidence that CSSs could effectively attract SMEs who would be otherwise left out of the IWM promotion program is most encouraging. Under the influence of IDB, five more CSS-IWM programs are currently being implemented involving many large companies in electronics, computer, textile, IC fabrication and motor vehicle assembly. Furthermore, IDB has recently decided that priority of technical assistance under the IWM promotion program should be given to CSSs. In other words, those firms forming CSSs would receive preference treatment, and those applying technical assistance individually would most likely face rejection. This decision would substantially expand the application of CSS-IWM in the country. Additionally, the government is planning to promote EMS under ISO 14001 and health and safety under BS 8800 through CSSs. This initiative would undoubtedly improve the depth of IWM implementation in the industry.