

16. AN OVERVIEW OF THE INDUSTRIAL WASTE MINIMIZATION: CORPORATE SYNERGY SYSTEM IN THE REPUBLIC OF CHINA

*Chen Wen-Huei and
Tang Yi-Hua
Foundation of Taiwan Industry
Service, Taipei*

ABSTRACT

Of the approximately 90,000 firms in Taiwan, more than 96 percent are small and medium-sized enterprises (SMEs) with either a capital investment of less than US\$ 1.5 million or fewer than 200 employees. In total, SMEs generate about 50 percent of the gross production of all enterprises in Taiwan.

This paper will discuss the use of Corporate Synergy Systems (CSS) in promoting improved environmental management among SMEs. A CSS is a management mechanism, and through which a group of companies work together to achieve certain goals, such as the improvement of product quality, working environment, etc. A CSS consists of a headquarters/central firm, its upstream suppliers, and downstream OEMs.

For many years, the Industrial Development Bureau (IDB) of Taiwan has sought to develop effective methods to assist SMEs in implementing Industrial Waste Minimization (IWM) techniques to improve their environmental management efforts. In 1995, the IDB commissioned the Foundation of Taiwan Industry Service (FTIS), a technical consulting organization, to apply the CSS as a tool to implement IWM in SMEs. Today, the CSS has proved successful, and combined with IWM, has become IWM-CSS.

Due to the success of IWM-CSS since 1995, the IDB has annually chosen companies from different sectors to serve as central firms to promote IWM-CSS, including machinery manufacturing, paper mills, applied electronics, computer manufacturing, and semi-conductors. With cooperation and encouragement from the central firms combined with the efforts of the IDB and its consulting companies, hundreds of SMEs have implemented IWM. Today, the implementation of Environmental Management Systems (EMS) and Occupational Health and Safety Management Systems (OHSAS) has become a global trend. The IDB and the FTIS are now trying to use IWM-CSS to help SMEs face the challenges related to developing ISO 14001 EMS and OHSAS.

This paper presents the background and the concept of applying CSS to implement IWM, and is followed by a brief description of the achievements on the implementing experiences. Finally, it will discuss the possibility of applying the CSS mechanism to implement ISO 14001 or OHSAS 18001 in Taiwan.

INTRODUCTION

SMEs usually lack the financial resources, technical expertise, and manpower to apply environmental measures to improve their environmental performance. In addition, the public generally places less pressure on SMEs than on large enterprises regarding environmental, health, and safety issues. As a result, SMEs are comparatively less active in environmental programs in Taiwan. For example, the IDB has initiated voluntary IWM programs since 1989, and so far more than 500 firms have applied for and received assistance from the IDB in IWM implementation. However, less than 10 percent of the 500 firms who received assistance were SMEs.

In the face of the globalization of economic activities and strong international competition, companies must improve their product quality and public image, while simultaneously controlling the cost of production. To accomplish this, large companies must take great care in selecting their suppliers. Thus, under the leadership of large companies, supply chains have become more integrated for the sake of cost control and quality assurance. "Greening supply chains" has been viewed as a key approach to "multiply" the concept of cleaner production all over the world. The IDB has therefore been working to leverage the CSS mechanism to introduce the idea of greening supply chains as well as to induce SMEs to apply IWM.

Under the sponsorship of the IDB, the FTIS chose the first central firm in 1995, and then cooperated with the central firm to select suppliers to establish the first IWM-CSS. Through influence and encouragement of the central firm, many SMEs have joined the IWM-CSS team since then. SMEs joining the IWM-CSS begin by training staff. In the subsequent steps, SMEs conduct a plant audit, set objectives, and propose IWM options. Through implementation of the options, they produce economic benefits and improved environmental performance.

Thus far, the FTIS has promoted nine IWM-CSSs with central firms from different industry sectors, including machinery manufacturing, paper, applied electronics, computers, motor manufacturing, textiles, and specialty chemicals. These central firms worked with more than 130 suppliers to jointly implement the IWM programs.

CHOOSING AN APPROPRIATE CENTRAL FIRM

At the beginning of each fiscal year, the IDB publishes bulletins to solicit companies to serve as the central firms in new IWM-CSS programs. Strong candidates for serving as central firms should have: experience in implementing IWM; good cooperative relationships with its suppliers; and a demonstrated commitment from its top management to provide the necessary resources to run an IWM-CSS program. Through an open evaluation process, the IDB and the FTIS will select qualified companies to serve as the central firms in the new programs.

To understand why satellite firms would like to join an IWM-CSS, one needs to consider the problems and characteristics special to these firms. Generally, SMEs have relatively few staff and little extra capital, so they are constantly engaged in manufacturing activities. In order to make a profit or even just to survive, SMEs must be extremely flexible in meeting the demands of its buyers/central firms. Thus, when a central firm strongly requests its suppliers to participate in IWM-CSS, companies will

generally comply. Through implementation of a IWM-CSS, it becomes possible for central firms to use a variety of parameters to rank their suppliers, including product quality, financial ability, and environmental performance.

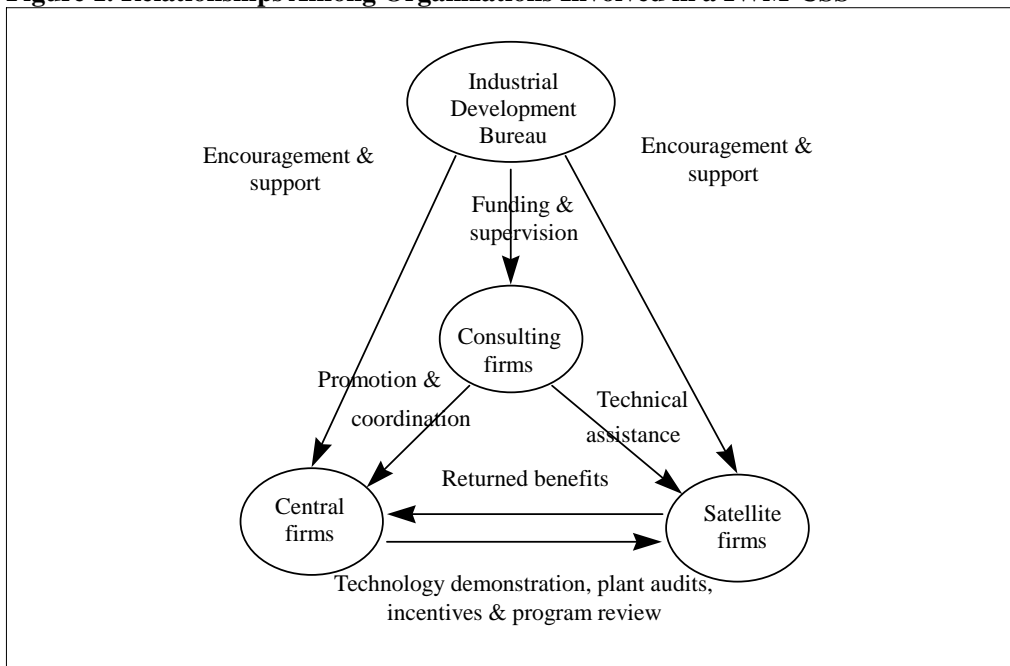
In any IWM-CSS program, the central firms play a key role in initiating, organizing, and maintaining the system. They have to help, encourage, and coordinate all of their satellite firms in implementing various IWM activities. Given their desire to improve their image and position in competitive markets, many large companies are willing to take on the responsibility of asking and helping their satellite firms to implement IWM. In this way, the central firms can also reward those firms dedicated to good environmental management by providing special credit treatment, placing additional orders, supplying free staff training, and other measures.

ENGAGING SUPPLIERS IN AN IWM-CSS PROGRAM

Once selected to be the central firms for the new IWM-CSS programs, the chosen companies need to obtain commitments from a sufficient number of suppliers to join the IWM-CSS. Typically, the central firms hold a seminar with the IDB and the FTIS to explain the basics of IWM-CSS to their suppliers. The seminars cover topics such as the concept of IWM, steps in implementing IWM programs, the roles and responsibilities of the participating firms in a CSS, and the program schedule. Following the seminar, the central firms ask the suppliers' (also referred to as satellite firms) top management to make a commitment to join the program.

A successful IWM-CSS program relies on securing the commitment of decision-makers in each satellite firm. Companies must then closely follow the methodology and implementation schedule. A successful IWM-CSS also depends on close collaboration among the four major parties: the IDB, the consultant (FTIS), the central firms, and the participating satellite firms. The specific roles performed by these organizations are shown in Figure 1. The role of the IDB is to provide funding and encouragement. Central firms are responsible for proposing requirements and supervising their satellite firms. Under a contract with the IDB, the FTIS serves as a consultant to help keep the IWM-CSS program running, and is responsible for bringing all parties together. FTIS also is responsible for other logistics such as providing technical assistance, review of programs, assisting with process audits, and overall management of the program. With regard to the satellite firms, each of them must organize an internal team to take charge of the IWM program.

Figure 1. Relationships Among Organizations Involved in a IWM-CSS



IWM-CSS IMPLEMENTATION WORK AT SUPPLIER FACILITIES

Once central and satellite firms have been chosen, the focus of the IWM-CSS moves to the facilities of the satellite firms. The program consists of a facility audit, training courses, team member meetings, and technology demonstrations, and further steps to ensure that a suitable plan is developed and implemented. The combination of activities leads to achieving environmental improvements usually with economic benefits. The FTIS uses the seven steps listed below to assist each satellite firm to develop an IWM program.

Step 1

The on-site work begins with training sessions for the staff of each participating firm. Two kinds of training courses are designed. The awareness classes, which introduce the concept of IWM, benefits and barriers, general approaches, and OHSAS issues, are basically for the management level employees. The technical classes, including plant audit procedures, IWM opportunity assessment methodology, and available IWM measures and practices, are designed for the process and operation staff.

Step 2

Each participating firm has to establish an IWM team to take charge of the program and to coordinate the efforts of the plant. Management must lead the team while the employees are required to participate by proposing and implementing IWM measures.

Step 3

Plant audits are conducted for each participating firm to examine the plant operations in detail to determine the sources of waste and to prioritize the pollution problems. This step can also integrate with the OHSAS issues, and the IWM teams can also consider the environmental issues and risks related to occupational health and industrial safety. Based on the auditing data, each firm needs to set clear goals for improving their performance in the first year.

Step 4

Firms are encouraged to solicit proposals from employees on new methods to reduce working risks or improve the working environment. Employees can often provide many excellent IWM or risk-reducing options if given a chance. Firms can use a variety of methods such as training courses, personal meetings, employee brainstorming sessions, or incentives.

Step 5

Each firm establishes a suitable process to rank the proposals or options, through which the high priority pollution or risk problems are identified. The professional staff evaluate the technical and economic factors and provide sufficient data for the decision-makers to select the best option to either resolve the problems or to keep them under control. There are many options that can easily reduce the environmental impacts, such as changing the workers' attitudes, good machinery maintenance, or separating waste streams.

Step 6

Following the start of IWM program implementation in each firm, the FTIS holds periodic meetings for the IWM-CSS members. Through the meetings, the members can share experiences and information, and discuss any problems that they have encountered. Moreover, with the participation of the IDB and the central firm in the meetings, the group meetings become a very good communicating mechanism for encouraging these firms to improve continuously.

Step 7

Actions are taken to maintain and sustain the IWM programs for continued growth and expanded benefits within each firm as well as in entire IWM-CSS. In this step, the IDB and the central firms provide recognition or other rewards and incentives to the outstanding satellite firms of the IWM-CSS.

THE ACHIEVEMENTS OF IWM-CSS PROGRAMS IN TAIWAN

IWM-CSS programs are conducted on an annual cycle. Currently, there are over 10 active IWM-CSSs in Taiwan, which clearly demonstrates that the CSS mechanism is a very useful tool for implementing IWM. As the concepts of environmental management systems (particularly the ISO 14001 model) are very similar to IWM, CSS can also be a useful tool for promoting implementation of ISO 14001 and OHSAS. Therefore, in 1998, the IDB began incorporating aspects of ISO 14001 and OHSAS into the IWM-CSS

implementation. The following section provides some examples of successful IWM-CSS programs from recent years.

TECO's IWM-CSS

Teco Electric and Machinery Co., Ltd. established the first IWM-CSS in 1995. Teco is one of the largest electrical equipment manufacturers in Taiwan. Teco highly values environmental protection and its corporate image, and each of its manufacturing factories has won National IWM Outstanding Awards every year. At the request of Teco's general manager, 18 suppliers joined Teco's IWM-CSS and more than half of them were SMEs. Teco's IWM-CSS members and performance are shown in Table 1. During 1995, Teco's IWM-CSS implemented a total of 2,119 IWM options. These options required a capital investment of US\$ 453,000 and yielded a profit of approximately US\$ 5 million. Teco's IWM-CSS has now been expanded to 32 firms, many of which have reported production cost reductions of more than 20 percent as a result of practicing IWM.

Table 1. Results of TECO's IWM-CSS Program, 1995

Firm code	Business/Product	Number of employees	CP options proposed	CP options implemented	Investment US\$ (1,000)	Benefit** US\$ (1,000)
1	Appliances	102	40	28	3.6	54.6
2	Appliances	350	1,805	1,612	1,392.9	1,788.2
3	Electric motors	380	565	306	13.6	322.5
4	Electric motors	340	62	53	255.0	2,239.6
5	Electric equipment	850	14	1	*	
6	Printed circuit boards	280	12	8	3.6	26.9
7	Electronics	50	6	6	*	20.0
8	Electronics	54	4	4	*	4.1
9	Packaging	44	13	13	5.4	19.8
10	Packaging	260	71	18	3.9	100.2
11	Plastic	95	8	8	*	26.1
12	Plastic	37	2	1	*	*
13	Metal processing	280	34	28	168.9	336.8
14	Metal processing	47	6	3	*	
15	Parts fabrication	22	4	4	*	2.1
16	Brass tube processing	33	3	3	*	5.4
17	Brass tube processing	36	17	17	2.57	42.5
18	Molding	50	7	6	*	7.1
Sum		3,310	2,673	2,119	1,849.5	4,993.6

Note: * Indicate investment data not available.

Cheng-Loong's IWM-CSS

The Cheng-Loong Paper Manufacturing Company organized the second IWM-CSS program in 1996. Cheng-Loong's IWM-CSS consisted of 10 upstream suppliers that provided waste paper, machinery, chemicals, energy, and transportation services, and 3 downstream buyers who were paper container manufacturers. With more than 90 percent of the participating firms being SMEs, Cheng-Loong's IWM-CSS implemented 868 IWM options in one year. Participating firms invested a total of US\$ 991,000 in IWM which yielded a profit of US\$ 3.5 million in 1996. The members and performance of Cheng-Loong's IWM-CSS are shown in Table 2.

Table 2. Results of Cheng-Loong's IWM-CSS Program, 1996

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

Sanyang's IWM-CSS Achievements

Sanyang Industry is a motor and auto-bicycle assembly and manufacturing company. Sanyang had a strong interest in improving the competitiveness of its suppliers, to reduce production costs for each part and improve the overall efficiency of the supply chain. Sanyang applied to become one of the central firms in 1998.

The year 1998 also marked a change in the IWM-CSS program. Due to the strong successes during the period from 1995-1997, the IDB decided to launch three new IWM-CSS in 1998, and also decided to expand the program to include occupational health and safety practices. During the first three years of the program, the government found that it was extremely difficult to separate environmental and safety issues when

providing assistance to SMEs. As a result, the FTIS integrated numerous OHSAS techniques into the IWM-CSS program in 1998.

Sanyang's IWM-CSS consisted of 15 firms all of which were Sanyang's suppliers. As part of the integration of industrial safety elements into the IWM-CSS programs, the FTIS used the Voluntary Protection Program (VPP) checklist as a tool to evaluate the risks to workers in each firm. The schedule of overall IWM-CSS was essentially the same as in previous years, except that FTIS also addressed industrial safety issues at each group meeting or on-site visit. After one year of work, Sanyang's IWM-CSS resulted in substantial economic benefits, improved environmental performance, and significant reduction of risk. Achievements are summarized in Table 3.

Table 3. Results of Sanyang's IWM-CSS Program, 1998

Benefits		
Economic	Total investment:	US\$ 4 million/yr
	Total benefits:	US\$ 1 million/yr
Environmental	Water saving:	17,000 ton/yr
	Reduction in electricity use:	4.4million kwh/yr
	Waste recycled	1,600 ton/yr
	CO ₂ reduction:	1,700 ton/yr
	CO reduction:	1,500 ton/yr
	HC reduction:	7,400 ton/yr
Safety	On average, each firm gained 27 points in the VPP evaluation.	

Ford's IWM-CSS Program

The Ford Motor Company was one of the central firms chosen for the 1999 IWM-CSS program. Ford consulted with FTIS on how to assist its satellite firms in establishing ISO 14001 EMS as part of the IWM-CSS. There are an increasing number of international companies in the market that are asking their suppliers to obtain ISO 14001 certification in a short time frame. As the concept and methodology underlying ISO 14001 are very similar to IWM, experience with IWM facilitates establishing an ISO 14001 EMS easier. Therefore, an IWM-CSS program is also a useful mechanism for helping SMEs to establish ISO 14001 EMS. As a result of the new corporate policy requiring that all Ford suppliers obtain ISO 14001 certification before 2003, Ford Taiwan wanted to help its suppliers meet the challenge.

Both ISO 14001 and IWM share the common themes of pollution prevention and continuous improvement, and have similar approaches for implementation. The major difference between IWM and ISO 14001 is that ISO 14001 is a certifiable standard, while IWM is simply a voluntary effort. The requirements for documentation and procedures in an IWM are not nearly as stringent as ISO 14001. A comparison of ISO 14001 and IWM requirements is provided in Table 4. The Table demonstrates that if a company can meet the requirements of ISO 14001 at each step of implementing an IWM-CSS program, it will have a strong start towards obtaining ISO 14001 certification. However, incorporating ISO 14001 into an IWM-CSS means that program implementation will be slower than if the companies practiced IWM only.

Table 4. A Comparison of ISO 14001 to IWM

ISO 14001 requirements	Consistent with IWM	Inconsistent with IWM
4.2 Environmental Policy	Commit from top management	IWM only requires internal commitment. ISO requires clear policies and public announcements.
4.3.1 Environmental Aspects	Survey and evaluation process are similar.	ISO requires not only survey and evaluation, but also review of product quality, environmental impacts, and specific evaluation procedures and methods.
4.3.2 Legal and Other Requirements	Comply with environmental and other regulations.	ISO stresses the compliance with integrated regulations and requires the documentation of compliance.
4.3.3 Objectives and Targets	Targets for waste minimization.	IWM is a proactive program. ISO requires an enforceable program
4.3.4 Environmental Management Programs	Plan for waste minimization.	Both are similar. However, ISO stresses auditing obligations and responsibilities.
4.4.1 Structure and Responsibility	Waste minimization structure	Both require participation from all employees. However, IWM is a temporary arrangement while ISO is a permanent structure with clear responsibility.
4.4.2 Training, Awareness and Competence	Educational training and rewards for good performance.	ISO requires planning all employees' training and keeping records of training.
4.4.3 Communication	Attend IWM meetings and present IWM results.	ISO stresses keeping records of internal and external communication, policy announcements, and publication of special achievements.
4.4.4 Environmental Management System Documentation	Set up IWM models.	ISO requires enforceable management structure.

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ISO 14001 requirements	Consistent with IWM	Inconsistent with IWM
4.4.5 Document Control	Requires maintenance, record, protection, and operation.	ISO requires a stronger documentation management mechanism
4.4.6 Operational Control	SOP	IWM SOP is incomplete and limited to the SOP of process, machine and facility.
4.4.7 Emergency Preparedness and Response	Pollution prevention and industrial safety.	IWM is less complete than ISO.
4.5.1 Monitoring and Measurement	Review and improvement.	Both require scheduled supervision and quantification. IWM needs to strengthen its process and record keeping.
4.5.2 Non-conformance and Corrective and Preventive action	Project execution, modification, and audit.	ISO has the expectation of continuous improvement.
4.5.3 Records	Must keep records of results.	ISO's records trace back to past activities, products, and services.
4.5.4 Environmental Management System Audit	Quantify results and audit program effectiveness.	ISO specifies clear audit procedures.
4.6 Management Review	Specify the next round of activities after review meeting.	Both have the mechanism for starting new activities. However, ISO requires a standard procedure and documentation.

SUMMARY AND CONCLUSION

The IDB, the FTIS, and the IWM-CSS members have been dedicated to the implementation and continuous improvement of IWM-CSS programs in Taiwan. After five-years of effort and research, the IWM-CSS mechanism is now well developed in Taiwan, and is even well prepared to fully incorporate ISO 14001 or OHSAS issues. Given the success of the program, it is hoped that in the near future, large enterprises will voluntarily initiate their own IWM-CSS programs, rather than depend on financial support from the IDB.

IWM-CSS can help build the capability of Taiwan's industries to face the global economic competition. Through cooperation between the central firm and the satellite firms towards the goal of greening supply chains, companies can not only improve their product quality, but also their public image. Taiwan as a whole can benefit from a safer working environment and a cleaner environment.