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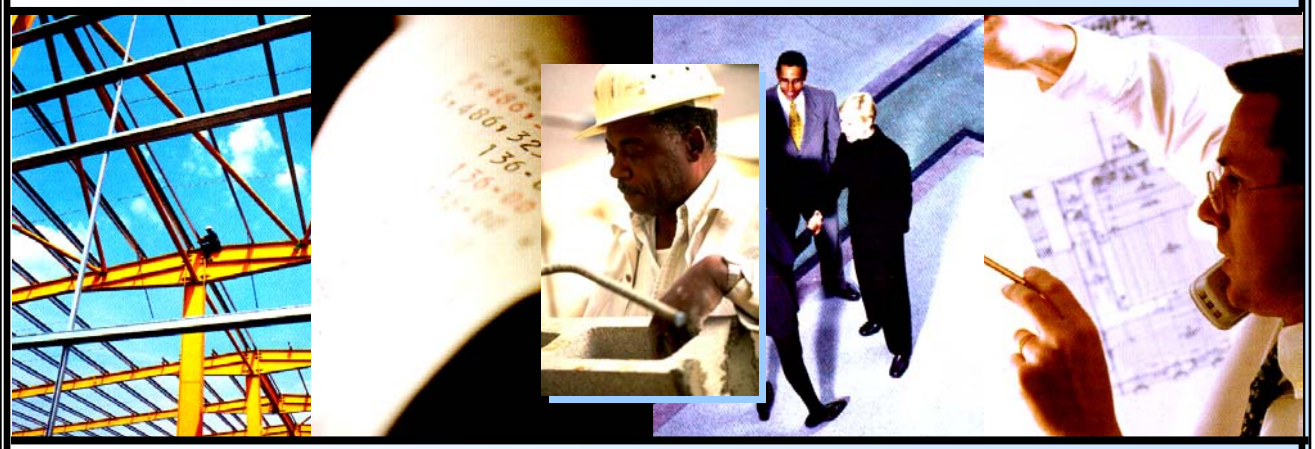
Guidance Manual

How to Establish and Operate Cleaner Production Centres



About the Guidance Manual

UNIDO/ UNEP Guidance Manual on How to Establish and Operate Cleaner Production Centres

Introduction to the Guidance Manual

Welcome to the UNIDO / UNEP Guidance Manual on **How to Establish and Operate Cleaner Production Centres**!

Cleaner Production Centres (CPCs) / National Cleaner Production Centers (NCPCs) have become a major source of expertise and advice on cleaner production in their respective countries. To date, 24 NCPCs have been created within the context of the NCPC Programme established jointly by UNIDO and UNEP. In parallel, more than 100 CPCs have been created through bilateral, governmental and other forms of assistance. There is now an extensive network of cleaner production-related institutions capable of delivering cleaner production at the local and national levels, and it is envisaged that this network will be enriched through the addition of more (new) Centres.

An upcoming or newly established Centre requires information and guidance about the various aspects of establishing and running the same. Previous experience suggests that it is both time-consuming and expensive to provide such guidance through an international expert. This realization, coupled with the need for specific guidance led to the preparation of this Training Manual.

This Guidance Manual is intended not only to provide you with a comprehensive account of all the planning that goes into setting up a new National Production Centre, but also the coarser and finer points that you would need to get into for successful operation of such an institution. In essence, the Manual intends to provide a crucial platform for capacity building for new as well as existing Cleaner Production Centres.

About this Guidance Manual

The Manual has been presented in six parts (Parts 1 to 6). The parts have been structured sequentially and logically so as to help you obtain an easy grasp of each topic. To illustrate, a brief synopsis of each part is provided below.

Part 1 – Understanding Cleaner Production

As the name implies, Part 1 covers such fundamentals as the concept of cleaner production, the evolution of this concept, its definition, other terminologies and their relationship to Cleaner Production, barriers to Cleaner Production and the need to mainstream cleaner production and how that may be achieved. The sub-section dealing with the concept of cleaner production contains carefully designed case studies so as to provide you with food for thought and help you gain a thorough insight to the subject in an interesting and novel way.

Part 2 – Evolution of Cleaner Production Centres and National Cleaner Production Centres

Part 2 presents a brief but thorough historical insight into the history and progression of Cleaner Production Centres in general and National Cleaner Production Centres in particular. It explains the evolution of Cleaner Production Centres and National Cleaner Production Centres in the context of understanding the strategies used and experiences gained along the way. Sub-sections in this part include the pollution prevention initiatives in North America since the late 1960s, conceptually parallel cleaner production initiatives in the European region, establishment of Cleaner Production Centres across the continents and some pertinent observations about them, an introduction to the National Cleaner Production Programme, its evolution and the important lessons learnt from the experiences of established National Cleaner Production Centres.

Part 3 – How to Establish a Cleaner Production Centre

Part 3 endeavors to provide a general blueprint which interested parties would have to consider while setting up a National Cleaner Production Centre. This part begins with an introductory text which explains the general scheme of things in this context, including the milestones of (i) formulation of a conceptual plan for the Centre, (ii) creating its basic design, (iii) planning to meet its financial requirements, and finally, (iv) the establishment of the Centre itself. An account of the nitty-gritty involved in achieving each of these milestones is provided in separate dedicated sub-sections. Given the complexity and importance of the process of establishing NCPCs, Part 3 is liberally interspersed with appropriate examples (some taken from real-life scenarios and the rest adapted from them), important guiding messages, relevant inputs in the form of messages from established National Cleaner Production Centres, and boxes highlighting essential "dos and don'ts".

Part 4 – How to Deliver Services of a Cleaner Production Centre (Guidance on Basic Services)

Part 4 begins with an introduction to the different categories of services (basic / core as well as strategic / extension services) that a Centre may offer its clients, and the inter-relationship between these two categories of services. It explores the aspects of the delivery of the basic services of a National Cleaner Production Centre, such as (i) awareness raising, (ii) training, (iii) cleaner production assessments, and (iv) demonstration projects. It then goes to explore the strategic approaches for the creation and sustenance of each service and explain their finer points. Part 4 also includes pertinent examples, checklists, important guiding messages, guiding messages from established National Cleaner Production Centres, and boxes highlighting essential "dos and don'ts".

Part 5 - How to Deliver Services of a Cleaner Production Centre (Guidance on Strategic Services)

Having provided a backdrop on the different categories of services a Centre may offer its clients, Part 5 expands the features of each of the five strategic services, namely (i) networking, (ii) matchmaking, (iii) knowledge management, (iv) interfacing with financial institutions, and (v) providing policy advice to national and local governments. Part 5 ends with a simple but crucial discussion elaborating on avenues of and suggested strategies for revenue generation from the delivery of services, so as to steer the Centre towards financial self-sustainability.

Part 6 – How to Monitor and Review the Progress of a Cleaner Production Centre

Part 6 begins with an explanation for the need for monitoring and reviewing the progress of a Centre and goes on to elaborate the different levels for such processes, namely from short-term monitoring and to longer-term reviews. Sub-sections within this part include an introduction to performance indicators, their fundamentals and hierarchy, suggested performance indicators for certain services, criteria for monitoring and reviewing the progress of a Centre, establishment of data collection and reporting systems, and obtaining information on changing scenarios and updating the business plan of the Centre. A concerted effort has been made to demystify all aspects of this important topic by providing a complete illustration of how to monitor and review the progress of a Centre with respect to training as a service. In this context, Part 6 also contains three annexes (a sample evaluation sheet, a sample data sheet and a sample summary sheet) tied in with the sub-sections

dealing with the hierarchy of performance indicators, and the establishment of data collection and reporting systems respectively.

How to use this Guidance Manual

Cover-to-cover reading of this Manual is not mandatory. Perusal of the Manual is left to your discretion. If you are concerned with the overall establishment of the Centre from scratch, it would be prudent to have a thorough read-through of each of the parts on the Manual in the provided sequence. Alternately, if you already have some exposure to cleaner production, and / or require understanding the intricacies of revamping an existing Centre, you may want to consider reading only pertinent parts of the Manual. Accordingly, each part of this Manual has been written as a standalone chapter. Adequate cross-references have been provided so that you may refresh your memory, and also have a glimpse of what to expect in subsequent sections / parts.

Apart from the usual Table of Contents provided at the beginning of the Manual, the opening page of each of the six parts of the Manual presents a handy truncated (up to the level of secondary titles) list as a ready reference. If it is a particular word or term that you are interested in, feel free to look up the convenient Keyword Index provided at the end of the Manual.

Conventions used in this Guidance Manual

The following icons have been placed in the left-hand side of the margin to draw special attention to certain characteristics of the accompanying text.

This icon denotes a case study.

This icon denotes an important point which you might want to keep in mind.

This icon denotes an example.

This icon denotes valuable guiding messages in the form of clear-cut “dos and don’ts”.

Happy reading!

UNIDO / UNEP

Guidance Manual

How to Establish and Operate Cleaner Production Centres

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Table of Contents

List of Boxes

List of Figures

List of Tables

PART 4

PART 5

PART 6

Part 1

Understanding Cleaner Production

What will we learn from Part 1?

1 Understanding Cleaner Production

1.1 The Concept of Cleaner Production

All businesses use resources of one kind or another to produce products and deliver services for meeting needs of other businesses and / or communities. In this process, some resources remain unspent, or unwanted products get produced as *waste* because 100% conversion or transfer of resources is seldom possible. This waste when discharged to the environment causes pollution.

Historically, businesses have responded to pollution in four ways.

1. Firstly, by ignoring the problem. This always leads to maximum damage to the environment. This damage is not limited only to the local-scale or neighborhood; it can occur at the regional and in some cases even the global scales.

2. Secondly, by prescribing to the doctrine "the solution to pollution is dilution"; i.e. by diluting or dispersing pollution so that its effects are less harmful or apparent.

3. Thirdly, by trying to treat pollution through the so-called end-of-pipe approach.

4. Fourthly (and most recently), through the prevention of pollution and waste generation at the source itself.

Figure 1.1 illustrates this trend.

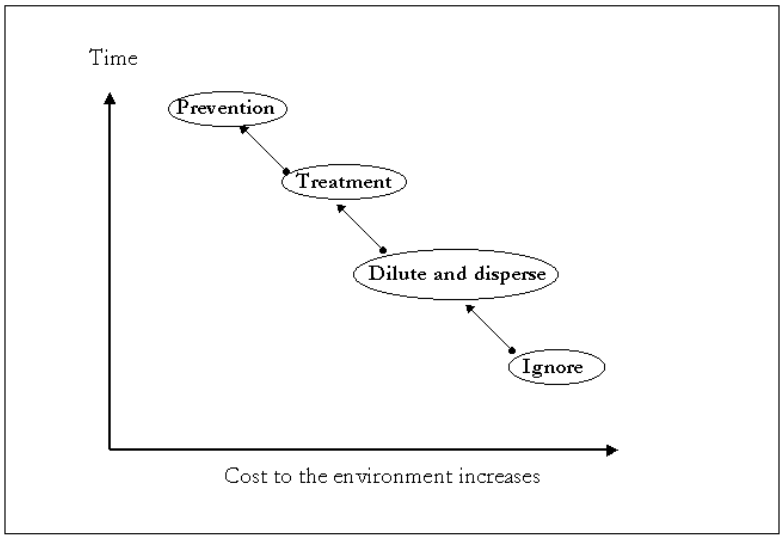

Figure 1.1: Response of Businesses to Environmental Pollution

We would like to recount here a case study to get an insight into the trend illustrated by **Figure 1.1**.

Case Study # 1[1]

Reactive Chemical Industries Corporation (RCIC) specializes in the production of additives for the processing of high polymer materials. Historically, RCIC had discharged around 500 m^3 of wastewater each day into a nearby river without any treatment. An incidence of fish kill downstream of the plant triggered monitoring and assessment of RCIC's wastewater stream. It was found that the wastewater had a Chemical Oxygen Demand[2] (COD) of 4,000 mg/L. Since the maximum stipulated COD discharge to the river at the time was 45 mg/L, RCIC built and commissioned a wastewater treatment plant (WWTP), at a capital investment of US$960,000 and an annual operating cost of US$72,000.

Subsequently, demands for better water quality by downstream users led to a tightening of COD discharge regulations to 20 mg/L. In keeping with the prevailing trend of "the solution to pollution is dilution", the Corporation decided to revamp the existing outfall by increasing its length and adding diffuser-port-riser mechanisms, at an investment of US$250,000. However, repeated negative impacts over time caused the river water quality to decline, thus resulting in a further tightening of discharge regulations. The Corporation found that additional investments in terms of upgrading the WWTP were extremely cost-prohibitive. Installation of a new WWTP was not feasible, given the substantial area requirement and escalating land prices.

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[1] Case Study #1 has been adapted from a real case study, although the names and figures have been changed here.

[2] Chemical Oxygen Demand (COD) is a commonly used measure of industrial pollution that is determined by drawing a sample and conducting laboratory analyses. The greater the COD, the greater the severity of pollution. Domestic sewage typically has a COD of 250 mg/l whereas a textile effluent has a COD in the range of 600 to 1,000 mg/l.

Given this scenario, the Corporation decided to look at the problem of wastewater generation from a new angle. One idea was reducing the wastewater discharge at the source in the production processes where it was generated in the first place. An in-plant cleaner production assessment was conducted at RCIC to find such opportunities. Certain cleaner production options were identified and evaluated for technical and economical feasibility. Some of the cleaner production ideas that were implemented included improvements and expansions, improved housekeeping, direct recycling in the washing plant and certain process modifications (e.g. installation of a microprocessor-based system to control the quantity and rate of addition of raw materials, installation of vacuum pumps to allow the recovery of product previously lost with wastewater, etc.).

Conventional approaches to pollution management are generally after-the-event and reactive. It makes sound business sense to be proactive; i.e. employ anticipatory and preventive strategies.

These options were implemented within a comparatively short time frame of 6 months, with an investment of US$60,000 and a payback period varying between 0.5 to 3 years. This helped the Corporation not only to meet the new stringent effluent discharge regulations easily, but also to increase its production by 15%, and save on raw materials and water. In fact, the effluent discharge to the WWTP was reduced to such an extent that approximately one-fourth of the existing WWTP was found to be redundant! RCIC therefore closed one of the batteries (125 m^3/day capacity) and decommissioned some of the equipment. The management at RCIC realized that *cleaner production* should have been the *first step* to manage the problem of pollution instead of dilution and end-of-pipe treatment. These simple but important discoveries made the Corporation scout out other such initiatives in coming years.

Recounting this case study gets us thinking … we start to wonder about the extent of time, land, money and other resources that might have been saved if RCIC had not used a reactive approach to pollution management in the first place. We start to make some important realizations - that pollution management may not be a *liability* if businesses simply become proactive. Indeed, as the story of RCIC demonstrates, the pitfalls of being reactive are many. An effective way to manage pollution, then, is to set out a proactive strategy that looks for minimization of resource consumption and a reduction of wastes, by increasing conversion of resources to products.

The strategy that integrates the concepts of environmental protection and improvement of resource productivity is called Cleaner Production.

Let us broaden our understanding of the concept of cleaner production now by reviewing another case study. Here we will look at a business involved in packaging and learn how *product redesign* helped in reducing wastes and making profits.

Case study # 2

PAC Foods supplies food-packaging solutions to restaurants. For years PAC Foods operated on a 'business-as-usual' basis set out by Mr. George Sr. who founded the company three decades ago.

When George's son Mathew took over operations, the situation was starting to change. Solid waste was becoming an important regulatory issue with environmental and economic dimensions. Disposal fees escalated and the neighborhood started expressing its concerns, with some articles appearing in the local newspapers against PAC Foods. Indeed, the company's packaging operations were responsible for significant generation of solid wastes.

Mathew decided to reevaluate PAC Foods' system of packaging. He proposed a *LessWaste Initiative*, to identify and implement waste reduction options. The thrust of the initiative concentrated on materials substitutions and design alterations. The entire programme was implemented by forming a team and by hiring a consultant. Within the first six months, PAC Foods was able to eliminate almost 7,500 tons of superfluous packaging.

Innovative solutions that led to the decrease of food packaging material volumes included:

The cleaner production concept is not limited to technology alone; it includes redesign of products and packaging.

(a) Reducing raised designs on napkins: This simple action enabled 23% more napkins to fit into a shipping container, saving 294,000 kg of corrugated packaging and 150 truckload shipments.

(b) Redesigning drink shipment boxes to achieve a 4% reduction in corrugated packaging (i.e. saving 450,000 kg).

(c) Converting light-weight and non-greasy classified food containers from paperboard cartons to paper bags, thus saving 3 million kg worth of packaging.

PAC Foods also contributed to toxics use reduction by printing its packaging material with soy-based inks, as well as by introducing unbleached carryout paper bags. These steps were applauded by the local community.

The *LessWaste Initiative* led to a net savings of US$250,000 from the second year onwards, with an initial investment of US$80,000. Mathew proposed a special bonus to all the members of the *LessWaste Initiative*.

We need to understand here that the *LessWaste Initiative* at PAC Foods was not a regulation-driven programme; rather, PAC Foods actively anticipated the avoidance of waste as a proactive measure. This involved teamwork, and profits were shared as an incentive. But perhaps what mattered most was Mathew's strategy of change management and commitment.

The benefits of waste reduction were not limited to a reduction in the company's operating costs or its increase in profits. Decrease in packing paper translated into less trees being cut down. Less truckload shipments translated into savings in fuel, decreased gaseous emissions and better air quality. Toxics use reduction translates to significantly less environmental risks, and improved worker health and safety. Thus, PAC Foods in many ways contributed to planet's sustainability – albeit to a limited extent. The company's image in the community also received a boost.

Cleaner production involves commitment of top management, teamwork and a vision to understand the strategic advantages to business by being environmentally friendly.

Over the years, Mathew made PAC Foods stand out in the market as an environmentally sensitive company and that helped him secure new clients.

The concept of cleaner production is not limited to the manufacturing sector alone. The concept is equally applicable to other sectors such as services, infrastructure, natural resource management etc. Let us now discuss a case study from the hospitality sector, which illustrates how a medium-sized hotel used cleaner production as a strategy to increase competitiveness and establish a niche in the market.

Case study # 3

The Smiths operated a 40-room hotel called Relax at a holiday spot over a number of years. A number of new hotels had sprung up in the neighborhood and Relax was losing its competitiveness. Something had to be done to turn the business around; i.e. reduce operating costs, re-establish a foothold and create a niche for itself in the market. The Smiths were looking for a systematic process that would help them realize these objectives.

The Smiths used a water and energy audit as the starting guideline, as these two resources mattered most to Relax from the point of view of operating costs. They got a consultant in place and formed a team. The audit programme was operated over a month and included a number of measurements, record-keeping, analyses and brainstorming within the team. The following energy and water-saving measures were identified and subsequently adopted.

(a) Existing lighting was replaced with lower wattage incandescent fluorescent lighting. The team anticipated savings of approximately 25% on electricity costs for lighting.

(b) Flow restrictors were installed on all taps and showers, and this was estimated to save approximately 16,000 L of water per day. This worked out to annual savings of US$4,470.

(c) The electric water heaters were replaced with gas operated units, which led to annual savings of approximately US$17,000.

(d) For an initial investment of only $250, the hotel could shut down its fountain pump system for five hours a night, thereby saving US$2,475 annually.

Cleaner production is implemented through a structured process. It involves identification of options and methods of a reasonable cost, the implementation of which can lead to economic and environmental gains.

The overall cost of investment worked out to be in the vicinity of US$55,000, with an annual monetary savings of US$26,000, greenhouse gas savings of 5.72 tons of CO_2 per year and electricity savings of 3.4 MWh.

The proprietors of the hotel were pleased that savings of such a magnitude could be had through such simple solutions. Publicizing their improved environmental performance helped the business earn the goodwill of existing clientele, attract new business (occupancy rates increased by 30% in the first quarter alone, directly as a consequence of effecting the changes) and increase profits. These measures also indirectly reduced previously high employee attrition rates. More importantly, the proprietors realized that there were further opportunities for improvement; other ideas in the pipeline include key-tag air-conditioning and lighting control in guest units and installation of dual-flush toilets during future refurbishment. Smiths decided to make water and energy audits an on-going process instead of a one-off initiative, and started developing data formats and work instructions to ensure that the process of tracking, evaluating and finding such options would be continuous.

Lessons from the Case Studies

Our three case studies show us that cleaner production entails eliminating environmental problems at the source, to the maximum extent possible. Cleaner production is one of the most cost-effective methods of environmental protection because it reduces the need for construction of expensive end-of-pipe treatment and disposal facilities, and reduces long-term risks and liabilities associated with releases of wastes to the environment. The RCIC case study was an illustration that stressed this point.

The critical issue in the case of Hotel Relax was the management's decision to install a continuous process of improvement and not treat audits as a one-off activity. Cleaner production is therefore a *continuous preventive strategy*. Cleaner production is practiced through a structured process (e.g. water and energy audits in the case of Hotel Relax) and is not an ad hoc approach.

It should also be stressed that cleaner production is very much about attitudinal change, and it requires commitment of the top management and teamwork. That is what probably worked in the example of PAC Foods.

Cleaner production is not limited to manufacturing processes alone; it includes products in the context of their entire life cycle. The cleaner production concept is therefore not limited to individual facilities, but extends itself to products (like in the case of PAC Foods) and services (as in the case of Hotel Relax), including customers and communities.

The factors driving the concept of cleaner production are, therefore, several: customer / community pressures, resource availability and pricing, competition in business and need of image-building, and increasingly stringent pollution control norms and their enforcement.

Adopting a cleaner production strategy is however not necessarily a complex procedure. Rather, we may look at such an exercise as a simple retrofit of previous business practices, or the ushering in of a new era of change management, with the added advantages of the ability to generate sizable cost savings, boost profit margins and earn enormous goodwill.

Cleaner production is not just an environmental tool. Just as importantly, it is a vehicle to enhance the productivity of a business enterprise. In essence, cleaner production is a strategy positioned at the interface of environmental protection and productivity. Each of the case studies cited in this section show how water and energy could be saved, or how raw material requirements could be reduced, or how the output or production could be increased. It may be useful therefore to examine the evolution of cleaner production from both these perspectives.

1.2 The Evolution of Cleaner Production

In the previous section, we noted that cleaner production is closely intertwined with productivity. Therefore, it is important for us to understand the evolution of the concept of productivity in the context of cleaner production.

1.2.1 Milestones in the Field of Productivity and Environmental Management

Traditionally, productivity has been defined as the amount of output per unit of input used. An increase in productivity entails an increase in the amount of output and / or a decrease in the

amount of input. Productivity is also impacted by the internal organization of a business; in other words, improving organizational effectiveness can be one way of improving productivity.

At first, productivity improvement focused on *quantity;* i.e. outputs. As the markets developed and competition increased, *cost effectiveness* became the key factor towards success. Therefore, a *cost reduction* approach was used to improve profitability or organizational effectiveness; viz. productivity.

Next, growing consumer preferences and competition ushered in the era of the *quality* drive. With its advent, productivity was measured not only in terms of the quantity produced, but also in terms of the percentage of production that met the required quality.

The *consistency* of delivering the utmost *quantity* of a product at the desired level of *quality* in a cost-effective manner became the third generation concept in the productivity movement. Consistency could be ensured only by influencing the internal organization of a business, and hence a number of management systems emerged - Total Quality Management (TQM), Total Preventive Maintenance (TPM) and subsequently, the international standard on Quality Systems viz. the ISO 9000 series.

While the productivity concept expanded, the field of environmental management also matured and broadened (see **Figure 1.2**).

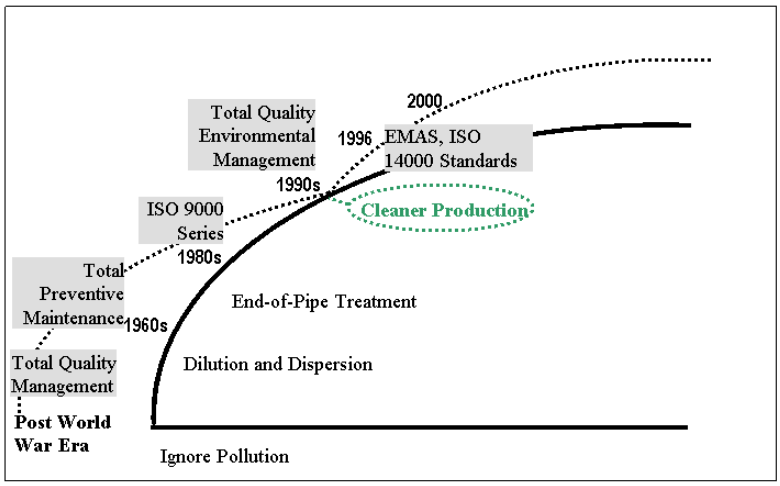

Figure 1.2: Tracking the Influence of Quality Programmes on Productivity

The earlier concepts of "ignore", "dilute" and "treat" pollution changed to "prevent pollution", "re-utilize wastes or generated by-products" and finally "treat" and "dispose of" residues in a secured manner. This change took place because of a variety of reasons listed below:

- Pressures from the neighborhood and environmental non-governmental organizations (NGOs) increased dramatically. By ignoring or practicing dilution, businesses attracted legal suits, lost their reputation in the market and subsequently faced closure.

- The standards on pollution control became stringent across multiple media; viz. air, water and solids. Enforcement became stricter, requiring significant investments in treatment and disposal facilities. This required substantial funds and the acquisition of extensive tracts of land. A radical turnaround was needed in thought processes for preventing pollution at the source itself, if the business was to survive and operate cost-effectively.

The emphasis on pollution prevention needed to have support from the internal organization of the business, with the commitment of its top management. This was promulgated by Environmental Management Systems (EMS) such as the ISO 14000. This led to ensuring consistency in environmental

performance and establishing the strategic importance of environmental thinking in business.

Around this time, the environmental factor got integrated into productivity improvement programmes (e.g. TQM to TQEM). Here, the concepts of resource vulnerability, life cycle assessment, and waste as an economic burden, were brought to the fore through environmental management, thus reinforcing the need to internalize environmental issues in business.

The need to fundamentally change the approach to business by using natural resources efficiently, and taking a holistic life-cycle view of product generation was recognized in the 1990s. Efficient use of natural resources translates into environmental protection, and also results in the improvement of productivity.

Consequently, as **Figure 1.3** shows, the conventionally held view of productivity grew steadily from the earliest 'quantity based' and 'cost reduction' approaches, to incorporate 'quality of the product' and finally, to respond to 'environmental' concerns.

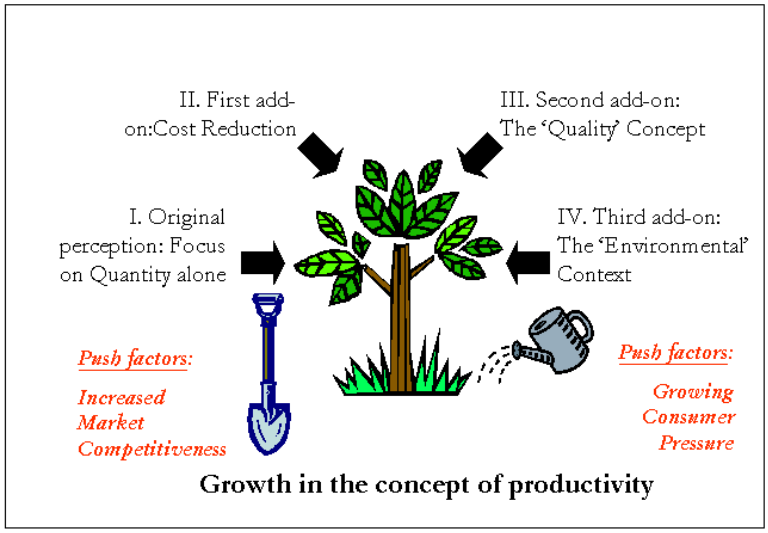

Figure 1.3: Major Milestones in the Field of Productivity

At this juncture, trends in productivity and environmental management intersected and influenced each other in developing a *common* strategy such as cleaner production.

1.3 The Definition of Cleaner Production

A formal definition of the term "cleaner production" will help us to organize our ideas at this point. We will review the definition of cleaner production proposed by the United Nations Environment Programme (UNEP) in the next section.

1.3.1 UNEP's Definition of the Term "Cleaner Production"

Cleaner production is defined[3] as the **continuous** application of an **integrated preventive** environmental strategy applied to **processes**, **products** and **services** to increase overall **efficiency**, and reduce risks to humans and the environment. Cleaner production can be applied to the processes used in any industry, to products themselves and to various services provided in society.

For **production processes**, cleaner production results from one or a combination of the following - **conserving** raw materials and energy, **substituting** toxic/hazardous materials by more benign ones and **reducing** the **quantity** and/or **toxicity** of all emissions and wastes before they leave a production process.

For **products**, cleaner production focuses on the reduction of environmental impacts over the entire **life cycle** of a product, from raw material extraction to the ultimate disposal of the product, by appropriate design.

For **services**, cleaner production entails incorporating environmental concerns into the design and delivery of services.

Figure 1.4 shows a representation of this definition.

[3] United Nations Environment Programme (UNEP) - Cleaner Production. Available at: http://www.uneptie.org/pc/cp/understanding_cp/home.htm

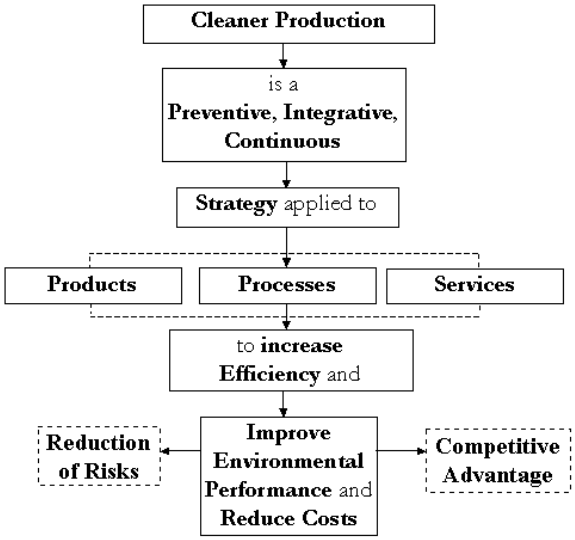

Figure 1.4: The Definition of Cleaner Production[4]

1.3.2 Extracting the Key Elements from UNEP's Definition of Cleaner Production

Let us now extract the key elements from UNEP's definition of cleaner production. The following points come to mind.

- Cleaner production entails a **continuous** process; it is not a one-time activity.

- Cleaner production is **not limited** to industries or businesses of a certain type and/or size.

- Cleaner production moves towards striking a **balance** between the availability and consumption of materials (including water) and energy. It does not deny growth, but does insist that it be **ecologically sustainable**.

- Cleaner production refers to the approach of producing goods and providing services with **a minimum of environmental impacts**, given the technological and economic limits at the current time. It is not merely limited to

[4] Modified from Joseph Strahl, 1996. Available at: http://www.lu.se/IIIEE/general/cp.html

minimization of wastes; rather it employs a broader context, and uses the term "**impacts**" in the **life cycle**.

- In addition to life cycle impacts, cleaner production also addresses **health and safety** concerns and emphasizes **risk reduction**. In this perspective, cleaner production is a **holistic** environmental management strategy.

- Cleaner production is both **efficient** (in terms of increased *outputs* on an immediate basis) and **effective** (in terms of positive *outcomes* over the long-term).

- Cleaner production is a **'win-win-win'** strategy that protects the environment, communities (i.e. the health and safety of workers, consumers and the neighborhood) and business (i.e. its profitability and image). Therefore, cleaner production addresses economic, environmental as well as social concerns and should **not** be considered only as an environmental strategy.

Box 1.1 illustrates the types of options that may be considered for implementing cleaner production.

Box 1.1 Cleaner Production Options

Housekeeping Improvements to work practices and methods and proper maintenance of equipment can produce significant benefits in terms of saving resources. Housekeeping options are typically low cost and provide low to moderate benefits.

Process optimization Process optimization involves rationalization of the process sequence (e.g., the elimination of a redundant washing sequence), combining or modifying process operations to save on resources and time, and improving process efficiency. In some cases, changes may best be introduced by piloting or demonstrating on a smaller scale. These options are typically low to medium cost and provide moderate to high benefits.

Raw material substitution Raw materials can be substituted if better options exist in terms of costs, process efficiency, and reduced health and safety related hazards. Such an approach may be necessary if the

materials already in use are difficult to source, or become expensive, or come under the purview of new consumer, health and safety, or environmental regulations. It is important to assess the options through laboratory / bench scale studies and pilots, to ensure that the product quality is not changed and / or is acceptable to the market.

New technology Adopting and transferring new technologies can often reduce resource consumption and minimize wastes, as well as increase the throughput or the productivity. These options are often capital intensive, but can lead to potentially high benefits.

New product design Changing the product design can cause impacts on both the "upstream" as well as "downstream" side of the product life cycle. Product re-design can, for instance, reduce the quantity or toxicity of materials in a product, or reduce the use of energy, water and other materials during use, or reduce packaging requirements, or increase the "recyclability" of used components. This can lead to benefits such as reduced consumption of natural resources, increased productivity, and reduced environmental risks. Often, this helps in both establishing as well as widening the market. Product re-design is however a major business strategy and may require feasibility studies and market surveys, especially if the supply-chain around the product is already established and is complex.

1.4 Other Terminologies and Their Relationship to Cleaner Production

1.4.1 Cleaner Production and its Relation to Other Similar-Sounding Concepts

At the time UNEP embarked on the overarching concept of cleaner production in 1990, a number of quite similar concepts existed and many others subsequently emerged. In the real world, some of these concepts are better applied in some places rather than others. It is important therefore to clarify what

cleaner production is in relation to some of these concepts. **Equally importantly, if we want to communicate cleaner production to different stakeholders, we have to use the words they are willing to hear.**

Concepts similar to cleaner production may be grouped into six parts - parallel approaches, allied approaches, developmental approaches, product-related approaches, service-related approaches, and associated tools. Each of these approaches is discussed below.

Parallel approaches

Green Productivity It is a term used by the Asian Productivity Organization (APO) to address the challenge of achieving sustainable production. APO started its Green Productivity Programme in 1994. Just like cleaner production, green productivity is a strategy for enhancing productivity and environmental performance for overall socio-economic development. The concept of green productivity and cleaner production are almost synonymous.

Eco-efficiency The term was coined by the World Business Council for Sustainable Development (WBCSD) in 1992. It is defined as the delivery of competitively priced goods and services that satisfy human needs and ensure quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the earth's estimated carrying capacity. This concept is favoured by many in the industrial sector. The concepts of eco-efficiency and cleaner production are almost synonymous.

Waste Minimization The concept of waste minimization was introduced by the U.S. Environmental Protection Agency (USEPA). In this concept, waste and pollution reduction occurs on-site, at the source through changes of input raw materials, and / or technology changes, good operating practices and product changes. Compared to cleaner production, waste minimization is in one sense broader, in that it also includes off-site recycling of waste, but in another sense, it is narrower, since it does not cover product (re)design to minimize all life cycle impacts.

Pollution Prevention The terms cleaner production and pollution prevention are often used interchangeably. The distinction between the two tends to be geographic - pollution prevention is mostly used in North America, while cleaner

production is used in other parts of the world. Both concepts focus on a strategy of continuously reducing pollution and environmental impact through source reduction - i.e. eliminating waste within the process rather than at the end-of-pipe. However, cleaner production includes the aspect of reduction of impacts and risks across the life cycle of a product, and in this sense is a more comprehensive concept than pollution prevention[5].

Source Reduction This is a term that is rather synonymous with cleaner production - reducing generation of wastes or contaminants at the source, and thereby reducing releases that could pose hazards to the environment and public health.

Toxics Use Reduction Toxics use reduction is the elimination or avoidance of toxic substances in products or processes so as to reduce risks to the health of workers, consumers, and the public, and to minimize adverse effects on the environment. Toxics use reduction is a special case of cleaner production since it focuses specifically on the aspect of reducing toxicity / hazards.

The future of cleaner production will likely see many attempts at weaving together its threads with other, environmental management and productivity related concepts. Such developments should be embraced and encouraged; one constructive approach is to see all these concepts as different facets of approaches to sustainable development.

Allied approaches

Energy Efficiency This is essentially a sub-set of cleaner production. The concepts of energy conservation and renewable energy often have strong elements of cleaner production.

Occupational Health and Safety It is often the case that efforts to protect the health and safety of workers will require reducing emissions at the source, by changing raw materials or modifying the process. To all intents and purposes, this is cleaner production. In a more indirect way, efforts to make the working environment safer for workers will result in better productivity.

Materials Management Since the purpose of materials management is to manage materials more efficiently and reduce losses and waste, it comes very close to cleaner production.

Product-related approaches

Design for the Environment (DFE) DFE is the systematic consideration, during product design, of issues associated with the environment over the entire life cycle of a product. This approach

[5] Note that the acronym P2 is often used for pollution prevention.

attempts to create financial and environmental savings by redesigning products to reduce environmental impact. The object is to minimize or eliminate anticipated waste generation and resource consumption in all the phases of the life cycle; viz. raw material sourcing, production, product distribution, use, and disposal. DFE is also called *eco-design*.

Product-Service Systems This concept focuses on creating a community-wide system for ensuring the best use and reuse of products. As with DFE, this concept focuses on the product element of cleaner production.

Service-related approaches

Sustainable Tourism This term has strong links with cleaner production. Sustainable tourism requires tourist services to reduce their use of material and energy intensity and to reduce their generation of pollution.

Developmental approaches

Sustainable Development This term is defined as development that meets the needs of present generations without compromising the ability of future generations to meet their own needs. The strategy of cleaner production is driven by the vision of sustainable development.

Industrial Rationalization This is a term that deals with large-scale shifts in patterns of industrial production. Since it is often used in circumstances where inefficient industrial sectors are being phased out, it often has a strong, but generally unrecognized, component of cleaner production.

Mise à Niveau A French term that corresponds to industrial upgrading, this term is used in circumstances where entire industrial sectors are being upgraded and modernized. Such modernization (again) often contains a generally unrecognized component of cleaner production, since modern technologies are often more efficient in their consumption of material inputs.

Associated concepts

Triple Bottom Line A methodology for measuring and reporting on financial, environmental and social performance, this tool can have incorporated into it strong elements of cleaner production. Indeed, several cleaner production centres today have

been experimenting with this tool as a way of pushing forward the cleaner production agenda.

Figure 1.5 illustrates the position of cleaner production with respect to some of the concepts outlined above, as well as the reactive approach of end-of-pipe treatment discussed earlier.

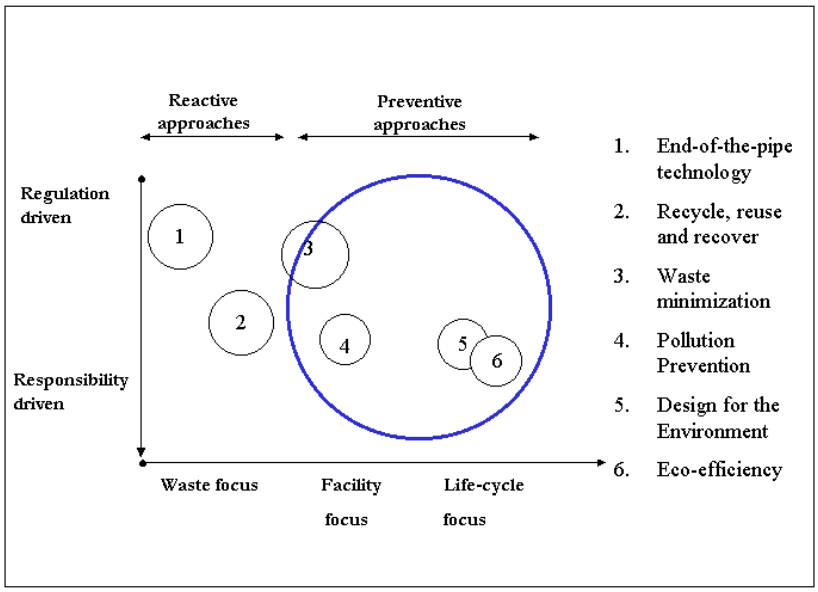

Figure 1.5: Cleaner Production and its Relation to Other Similar-Sounding Concepts[6]

1.4.2 Cleaner Production and Environmental Management Systems

By now, we have acquired a fair idea of the strategy of cleaner production, its definition and important associated concepts. Let us now look at the concept of Environmental Management Systems (EMS) and explore what it can offer.

An EMS[7] serves as a tool to manage and improve in a systematic manner the environmental performance of an organization. An EMS is that aspect of the organization's overall management

[6] Modified from: Berkel, R. Van & J.V.D. Meer (1997), Training Course for Future Trainers on Environmentally Sound Technology Transfer. IVAM Environmental Research, University of Amsterdam.

[7] "Environmental Management Systems". Available at: http://www.p2pays.org/iso/faqs.htm#faq1

structure that addresses immediate and long-term impacts of its products, services and processes on the environment.

An EMS gives order and consistency for organizations to address environmental concerns through the allocation of resources, assignment of responsibility and ongoing evaluation of practices, procedures and processes. Importantly, an EMS focuses on continual improvement of the system.

The EMS follows a Plan-Do-Check-Act Cycle, or PDCA. **Figure 1.6** shows the process of first developing an environmental policy, planning the system, and then implementing it. The process also includes checking the system and putting into action the improvements thereby identified. The model is continuous, because an EMS is a process through which an organization is constantly reviewing and revising the system.

An EMS can offer increased efficiency and potential cost savings while managing environmental obligations. It can effectively target and bring about savings of scarce environmental resources. It can provide a competitive business advantage, and lead to an increase in employee morale. Finally, an EMS is a model that can be used by a wide range of organizations - from manufacturing facilities to service industries and government agencies.

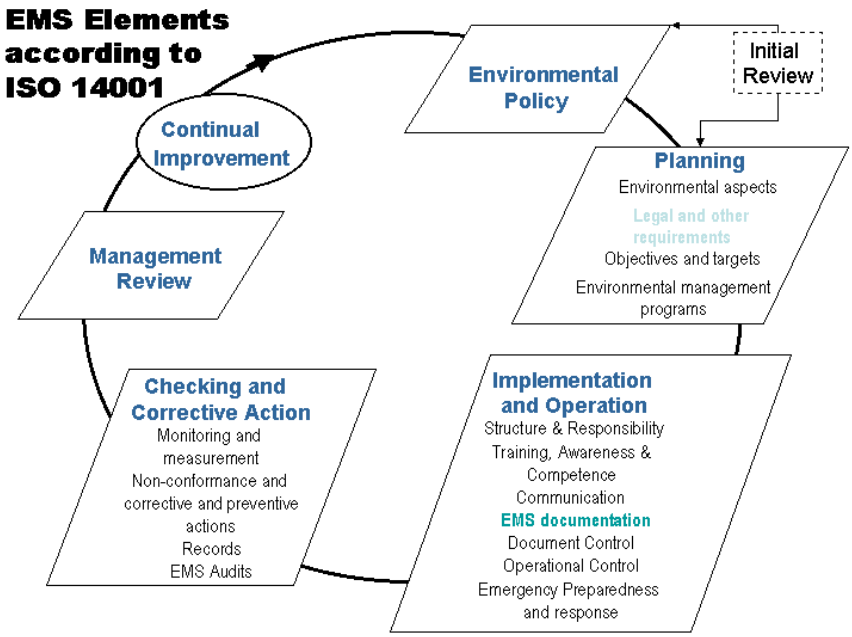

Figure 1.6: The Environmental Management System Model[8]

Box 1.2 gives us a brief review of the two commonly practiced Environmental Management Systems.

Box 1.2 ISO 14001 Environmental Management System and Eco-Management and Audit Scheme[9]

The International Organization for Standardization (ISO) is a worldwide federation of National Standards Bodies, at present comprising of 127 members, one from each country.

ISO 14001 was first published in 1996 and specifies the requirements for an environmental management

[8] Based on the ISO 14001 Series.

[9] More information the two systems can be accessed at
"ISO 14001 Environmental Management". Available at: http://www.iso14000-iso14001-environmental-management.com/iso14001.htm
"Eco-Management and Audit Scheme (EMAS)". Available at: www.emas.org.uk/

system. It applies to those environmental aspects which the organization has control over and those on which it can be expected to have an influence.

ISO 14001 is often seen as the corner stone and most well known standard of the ISO 14000 series[10]. It is the only ISO 14000 standard against which it is currently possible to be certified by an external certification authority. It is important to note that the EMS as per ISO 14001 does not itself state specific environmental performance criteria.

This standard is applicable to any organization that wishes to implement, maintain and improve an environmental management system, assure itself of its conformance with its own stated environmental policy (those policy commitments of course must be made), demonstrate conformance, ensure compliance with environmental laws and regulations, seek certification of its environmental management system by an external third party organization and make a self-determination of conformance.

The Eco-Management and Audit Scheme (EMAS), is a regulation developed to meet the needs and expectations of governments, citizens and consumers in the European Union (EU) member states. Because EMAS has a legal status within Member states, it can take a more prescriptive approach to environmental management issues. It currently applies only to manufacturing industries.

The overall objective of EMAS is to promote continuous improvement in environmental performance of industrial activities in the EU and European Economic Area, by committing them to evaluate and improve their environmental performance, and provide relevant information to the public. The scheme is voluntary and based on common principles throughout the EU.

[10] Other standards in the ISO 14000 series are ISO 14004, ISO 14010, ISO 14011 and ISO 14012.

> Practicing EMAS does not replace existing European Community and/or national environmental legislations, or absolve a company from its responsibility to fulfill all its legal obligations under environmental legislations.

The ISO 14001 EMS follows a structured approach to establish, operate and review environmental management in an enterprise. It involves identifying significant *environmental aspects*[11], assessing negative environmental impacts associated with those aspects under normal, abnormal and emergency situations, and developing options to control and reduce those impacts. In this process, ISO 14001 integrates the ideas of impact assessment, scenario-building, and control and reduction of impacts.

The ISO 14001 EMS offers a **common standard approach**, with its associated **documentation**, well defined **certification** and **surveillance** criteria. It is important to remember that it does not in and of itself require or lead automatically to cleaner production and more broadly the preventive approach; it is perfectly possible to obtain an ISO 14001 certificate for a programme based entirely on the use of end-of-pipe approaches. Cleaner production can be a **strategic input** into an ISO 14001 EMS, making the goal of the EMS prevention of inefficient consumption and waste generation. From the point of view of cleaner production, this has the advantage of giving businesses a tool through which to apply the principles of preventive environmental management and productivity in a systematic manner, on a continuous basis, and over the **entire life cycle**, rather than just within the factory boundary. In addition, since there is no basis for a standardized and internationally agreed upon certification system for cleaner production, injecting cleaner production into an ISO 14001 EMS is a way to have a business's preventive approach formally recognized. In this perspective, an ISO 14001 EMS can add significant value to cleaner production.

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[11] According to ISO 14001, an environmental aspect is "the element of an organization's activities, products or services that can interact with the environment"

On the other hand, cleaner production can add significant value to the ISO 14001 EMS. Many organizations perceive the adoption of an ISO 14001 EMS as cost prohibitive due to its associated surveillance and documentation requirements. In such cases, cleaner production can provide an avenue for offsetting the costs of establishing and maintaining an EMS through the economic benefits that it brings about.

1.5 Barriers to Cleaner Production

In the last ten years, cleaner production has led to a paradigm shift in environmental management at the level of industries, businesses and financial institutions, as well as local governments and communities.

However, there have been a number of barriers to the promotion and adoption of cleaner production. Let us review these barriers so as to develop strategies to overcome them.

Resistance to change

Many stakeholders have an attitude to follow business as usual and not adapt to change. Any change is considered as unwarranted, risky and not necessarily profitable.

Lack of information, expertise and adequate training

Many a time, the stakeholders are interested in the concept of cleaner production but are unable to put it in practice, due to information gaps and lack of technical assistance.

Lack of communication within enterprises

At times, a stakeholder gets interested in cleaner production and has the necessary skills or expertise. However, the stakeholder is unable to communicate the concept and its benefits to the top management. This creates a barrier to implement cleaner production.

Competing business priorities - in particular, the pressure for short-term profits

A significant impediment to the adoption of cleaner production is the emphasis of enterprises on short-term profitability. Since

enterprises are judged by markets and investors principally on short-term performance, they have difficulties in justifying some of the investment in cleaner production processes and technologies, even when there are demonstrably attractive long-term financial returns.

Perception of risk

Cleaner production involves possibilities of process modification, equipment replacement or product/packaging redesign. Some stakeholders view this as risky, especially if the technology is not proven, or the product is not tested in the market.

Difficulty in accessing cleaner technology

Investment in new, cleaner technology is a major decision for enterprises to undertake. In addition to the substantial costs of new technology, there are several potential external barriers, which may discourage or prevent enterprises from updating their existing plant and equipment. These can include the complexity of new technology, the level of technological specificity (cleaner technologies may be hard to transfer from one user to the other), etc.

Accounting systems which fail to capture environmental costs and benefits

Accounting systems and project appraisal procedures very often fail to take adequate account of environmental impacts, risks, liabilities and associated costs (which are not easily quantifiable to start with). Because of these limitations, the stakeholder is often unable to place environmental performance in the business perspective and therefore fails to fully appreciate the economic benefits of practicing cleaner production.

Difficulty in accessing external finance

The implementation of cleaner production technologies has been hindered by a lack of access to finance. Banks, government investment agencies, corporate financial departments, venture capitalists, and other sources of risk capital for industry either discriminate against or do not have the competence to evaluate applications that concern cleaner production programmes, thus severely limiting their access to capital.

The failure of existing regulatory approaches

A lack of orientation in the existing national policy and regulatory framework towards cleaner production is one of the major impediments to the adoption of the cleaner production strategy. Conventional regulatory approaches have in many cases proved to be counterproductive to the uptake of cleaner production. By assuming that the regulators are in the best position to determine appropriate action, regulations may engender an attitude of complacency on the part of the management.

Perverse economic incentives

Economic subsidies for business resource inputs may be a significant disincentive to cleaner production. For example, to the extent that governments subsidize the price of energy and water or the prices of relatively polluting fuels, through subsidies, they will diminish the financial benefits of cleaner production.

Many of these barriers can be addressed through strategies such as awareness raising, training, provision of technical assistance, implementation of demonstration projects, opening up financing programmes, and by aligning national policies and regulations to promote cleaner production. In order to support these strategies, adequate institutional building is also necessary, as is the creation of partnerships between stakeholders. These efforts will then ensure that the cleaner production is mainstreamed.

In the next section, we will review of some of the efforts undertaken by various international agencies as well as national governments, to set a common agenda for cleaner production and take it forward.

1.6 Mainstreaming Cleaner Production

1.6.1 Sustainability - The Driving Force and Cleaner Production - The Vehicle

In **Section 1.2.1**, we learnt that the intersections in the fields of productivity and environmental management led to a common strategy of cleaner production.

There are many other definitions of "sustainability", but exact definition does not matter – the general direction towards sustainability is now clear. It is best to start now – if a business waits for the route to be fully signposted, its competitors will gain an advantage over it.

Two important milestones were crucial to facilitate such a process. One was the Brundtland Report of 1987, and the second was Agenda 21 of 1992, which was outlined and agreed upon at the United Nations Conference on Environment and Development (UNCED) (itself an outcome of the Brundtland Report). Agenda 21 is a comprehensive action plan for global, national and local organizations of the United Nations System, governments, and major groups in every area with human impacts on the environment.

The Brundtland Report, also known as "Our Common Future", alerted the world to the urgency of making progress toward economic development that could be sustained without depleting natural resources or harming the environment. Published by an international group of politicians, civil servants and experts on the environment and development, this report provided a key statement on the term "sustainable development", defining it as

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'

The Brundtland Report highlighted three fundamental components to sustainable development: environmental protection, economic growth and social equity.

The Report recommended that the environment should be conserved and our resource base enhanced, by gradually changing the ways in which we develop and use technologies. Developing nations must be allowed to meet their basic needs of employment, food, energy, water and sanitation. If this is to be done in a sustainable manner, then there is a definite need for a sustainable level of population. Economic growth should be revived and developing nations should be allowed a growth of equal quality to that of the developed nations.

Agenda 21 made significant references to cleaner production (see **Box 1.3**). It provided a direction and focus for the adoption of cleaner production on a multi-stakeholder and multi-partnership basis.

Box 1.3 Reference to Cleaner Production in Agenda 21

Agenda 21 is a large document comprising of 40 chapters. There are several major themes and ideas that run through it. One of these is that of cleaner production and Environmentally Sound Technologies (EST)[12].

Chapters 20[13], 30[14] and 34[15] in particular, identify several interventions to this effect. While Chapter 20 makes several recommendations related to cleaner production and EST in the context of hazardous waste management, Chapter 30 has a programme area called "Promoting cleaner production".

The full implementation of Agenda 21 and the Programme for Further Implementation of Agenda 21, were strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, in 2002, as the means to reconcile economic growth and environmental protection.

Ensuring economic and ecological efficiency as the basis for future strategies in business is essential if development is to be sustainable. It is recognized that such a requirement can be addressed competently through the strategy of cleaner production. Thus, while "internalization" of environmental protection into productivity improvement is driven by the vision of sustainability,

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[12] Cleaner production is often misunderstood as being equivalent to Clean(er) or Environmentally Sound Technology (EST). However, technology is just one element of cleaner production. Cleaner production additionally addresses human factors such as attitudinal change, methods, monitoring and management, that ensure that technology is actually used in a manner that is environmentally sound. In addition, many definitions of EST include end-of-pipe technology, which has no part in the meaning of cleaner production.

[13] Chapter 20 is entitled "Environmentally Sound Management of Hazardous Wastes, including Prevention of Illegal International Traffic in Hazardous Wastes".

[14] Chapter 30 is entitled "Strengthening the Role of Business and Industry".

[15] Chapter 34 is entitled "Transfer of Environmentally Sound Technology, Cooperation and Capacity-building".

cleaner production acts as the vehicle to translate this vision into practice.

Both Agenda 21 and the WSSD Summit have provided cleaner production the needed national and global focus.

1.6.2 The International Declaration on Cleaner Production

In order to obtain a commitment to cleaner production across a wide cross-section of stakeholders, an International Declaration on Cleaner Production was launched by the UNEP in 1998. The Declaration is not limited to national governments but may also be signed by companies, associations and individuals. As of March 2002, the Declaration had over 300 major signatories and had been translated into 15 languages.

1.6.3 Establishment of Cleaner Production Centres as a Milestone in the Mainstreaming Process

Figure 1.7 illustrates the typical progression of cleaner production activities in a country. There are adaptations and deviations to this model, as countries have evolved their own approaches to promote cleaner production that are most appropriate to the local framework. Most countries have thus adopted a combination of top-to-bottom and bottom-to-top approaches to help facilitate the implementation of cleaner production.

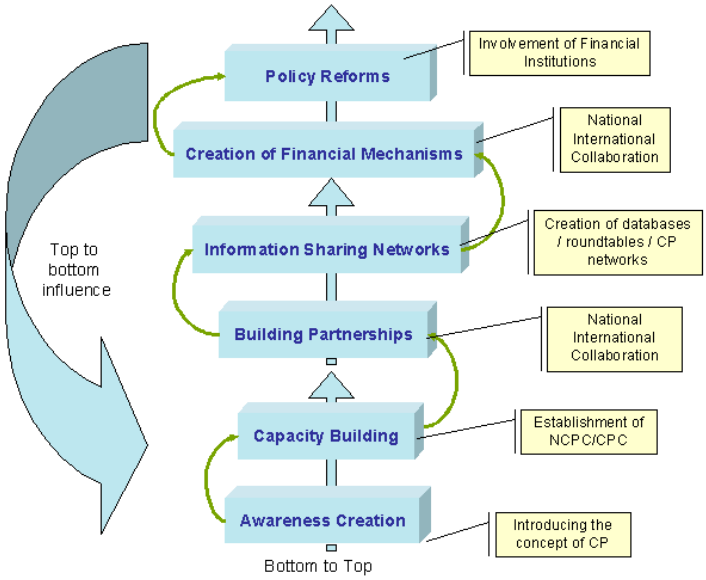

Figure 1.7: Typical Progression of Mainstreaming Cleaner Production

Typically, the progression of cleaner production mainstreaming in a country follows a strategy of moving from awareness creation to capacity building of institutions, to implementation of cleaner production projects within the industry and service organizations throughout the country. As the next logical step - with the help of the key institutions, recognized as the Cleaner Production Centres (CPCs) and by working in partnerships - cleaner production is implemented across focal sectors[16] to increase its acceptance. The Cleaner Production Assessments (CPAs) and demonstration projects are considered as important tools by the CPCs to promote and establish cleaner production.

Most countries institute information-sharing mechanisms by holding seminars, publishing manuals, conducting training and operating websites, for a *multiplier* effect. Here, the CPCs have played a crucial role in both steering and conducting of the programmes and activities.

Some countries have devised suitable financing mechanisms and policy instruments to develop an enabling framework for

[16] For more information on the term "focal sectors", refer to **Part 3** of this Manual.

promotion of cleaner production. Technical support in this regard has often been provided by the CPCs, especially to the financial institutions.

Policies and regulations have been found to play a critical role in mainstreaming cleaner production. To this end, some countries have undertaken suitable policy reforms and have even established National Cleaner Production Policies. Some national governments have proposed new forms of regulations (e.g. product-based regulations) and have influenced directives related to trade and taxation. The CPCs have played a catalytic role in this reform process. Thus, the establishment of CPCs has been one of the crucial strategies in mainstreaming cleaner production.

To date, 25 National Cleaner Production Centres (NCPCs) have been established within the context of the NCPC Programme established jointly by the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP). In parallel, more than 100 CPCs have been established through bilateral, governmental and other forms of assistance. There is now an extensive network of cleaner production-related institutions capable of delivering cleaner production at the local and national levels.

In this light, it is important that we understand the evolution and experiences of the CPCs. This can indeed assist us in taking cues on how to establish and operate a cleaner production centre. The next Part of this Manual deals with this topic.

Part 2

Evolution of Cleaner Production Centres and National Cleaner Production Centres

What will we learn from Part 2?

2 Evolution of Cleaner Production Centres and National Cleaner Production Centres

2.1 Cleaner Production Centres - Their Origin and Evolution

Part 1 concluded on the note of mainstreaming cleaner production and the role of Cleaner Production Centres (CPCs) as critical capacity building institutions at the local and / or national levels. It is therefore interesting and worthwhile to track the history of CPCs and in particular understand the origin and evolution of the NCPC Programme that was established by UNIDO and UNEP.

For the purposes of this Part, the term "Cleaner Production Centres" or CPCs will **include** Pollution Prevention (P2) Centres, Regional CPCs, Green Technology Centres, National Centres for Cleaner Production[1], Centres of Investment Projects and Environmental Certification, Technical Assistance Centres for Pollution Prevention and Waste Minimization, Technical Assistance Programmes for P2, Cleaner Production Laboratories, Centres for Pollution Prevention and Clean Technology Offices[2], etc. We shall use the term "National Cleaner Production Centres" or NCPCs exclusively in the context of the UNIDO/UNEP-backed Programme.

Figure 2.1 shows the NCPCs and CPCs around the world. To date, 25 NCPCs have been established by UNIDO with support from UNEP. In parallel, more than 100 CPCs have been established through bilateral, government and other forms of assistance. Thus, there is now an extensive network of cleaner production-related institutions capable of delivering cleaner production at the local and national levels.

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[1] Although they sound alike, the term "National Centres for Cleaner Production" (NCCP) differs from the term "National Cleaner Production Centre" (NCPC). The latter is always employed in the context of the UNIDO/UNEP-backed NCPC Programme (see **Section 2.2**).

[2] The underlying theme amongst all the terms is **cleaner production**. However, the terminologies are varied depending on the institutions / agencies financing the centres.

Figure 2.1: NCPCs and CPCs around the world[3]

It is important to note that the idea of reviewing the evolution of CPCs/NCPCs is mainly to understand the strategies used and experiences gained, and not to report an inventory on CPCs/NCPCs as such. We will however make an attempt to provide a representative status on the CPCs across the world.

2.1.1 Pollution Prevention Initiatives in North America

The concept of pollution prevention[4] already figured prominently in the National Environmental Policy Act (NEPA) of the United States of America (USA) in the late 1960s. Pollution prevention gained additional momentum with the passage of a national law, the Pollution Prevention Act, in 1990. This led to the development and implementation of a series of specific prevention programmes, most notably the establishment and operation of CPCs (termed Pollution Prevention Centres) in the region.

The initial role of the CPCs in the USA was to act primarily as information-clearing houses, concerned with the collection of pollution prevention-related information in the form of case studies, bibliographies, etc.; and its dissemination to interested parties through hard copy publications, electronic media, and finally the World Wide Web. Service-oriented activities were provided by the private sector - a

[3] From: http://www.uneptie.org/pc/cp/ncpc/ncpcmap.htm

[4] We noted in **Part 1** that the term "pollution prevention" (or P2) is synonymous with cleaner production - the former tends to be used widely in North America, while the latter is used in other parts of the world.

logical outcome, given that the legal and regulatory framework for pollution prevention was established at the outset. These CPCs confined their area of activity to one or more (but never all) of the following services viz. publications, training, applied research, technical assistance, permit and regulatory assistance, financial assistance and so on[5]. Interestingly, in every State, CPCs were set up as project units, outreach offices or technical assistance cells across environmental regulatory offices, small business assistance and promotion offices, environmental NGOs, research units and universities. This provided a wider institutional base to mainstream pollution prevention in the USA.

The Pollution Prevention Act also mandated the allocation of revolving funds for local pollution prevention programmes. This greatly assisted in the promotion of pollution prevention investments amongst businesses in the region. Some of the CPCs operated as project development and appraisal offices to service pollution prevention funds. Thus, the setting up of CPCs in the United States was rather well-strategized - it was broad-based and created an enabling framework through pollution prevention legislation and financing schemes.

A CPC was established by Environment Canada in Ontario in 1992. Formerly called the "Great Lakes P2 Centre", it is now known as the "Canadian Centre for P2" or C2P2. Today, C2P2 functions as an information clearinghouse for promoting pollution prevention. It is a non-profit, non-governmental organization supported by businesses and the Canadian government. The Board of Directors of the C2P2 includes persons from businesses, the government, trade institutions and academia. In 1997, the centre decided not to limit itself to information-sharing alone and broadened its scope to include various other services.

2.1.2 Cleaner Production Initiatives in the European Region

Developments concerning CPCs were taking place in the European region in parallel. Adopting cleaner production throughout the European industry was a recommendation put forth at the Industry and Development Seminar in Warsaw, held prior to the 1990 Bergen Conference in preparation for the 1992 Earth Summit. As a result, in 1991, the Norwegian government supported a Polish CPC as part of the NIF-NOT Cleaner Production Programme. This programme was run between the Norwegian Chartered Engineers' (Norske Sivilenginores Forening, NIF) and the Polish Engineers' (Naczelna Organizacja

[5] USEPA: Pollution Prevention State P2 Programmes Website. Available at: http://www.epa.gov/p2/resources/statep2.htm

Techniczna, NOT) Societies. The CPC formulated in this programme coordinated the work of eight other regional centres. Interestingly enough, these societies were non-governmental organizations, with the Polish counterpart providing the existing infrastructure and network of its various branch societies, and the Norwegian counterpart providing the technical experts and the funding. The main objective of the CPC was to raise awareness, conduct training, develop trainers and build a framework between cleaner production and EMS.

Around 1992, the concept of NCPC was promulgated, taking its directions from Agenda 21. In 1993, taking a cue from the forthcoming NCPC Programme, Australia launched a CPC ("Australia Centre for Cleaner Production") based on strong State and Federal Government interest in and commitment to cleaner production. This CPC was a non-profit organization and any excess revenue was distributed to appropriate beneficiaries at the end of each financial year (e.g. for cleaner production scholarships, public good funding, etc.). The seed funding for the centre was provided by sponsoring and associate member institutions. The centre was to be self-funding within three years; consequently it chose to build up a constant revenue base from its services as a broker in technology transfer, a consultant for cleaner production, and a developer of education and business packages in cleaner production. Unfortunately, this CPC failed in 1996 and was finally wound up in 1997.

2.1.3 Establishment of CPCs across the Continents

Given the enthusiastic response to CPCs, some of the developed countries decided to introduce CPCs in other countries, (especially the developing countries), thereby establishing a gateway for marketing cleaner technologies. This led to the establishment of CPCs across the continents. These CPCs focused on the traditional information-dissemination, training and technology transfer activities, and gradually expanded their services to include technical assistance and catalyzing investments for cleaner technology projects.

While generally quite similar to NCPCs, these centres can and did differ in some significant aspects, notably the importance given to technology transfer rather than to the development of national capacities.

In the initial years, such CPCs were primarily funded by the bilateral developmental agencies under various international projects. Between 1994 and 1995, eleven CPCs were established in the Central and Eastern European region, specifically in Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland (three centres), Romania and Slovakia through seed funding by USAID, and the assistance of the

World Environment Centre (WEC). The USAID grants were available to most centres until September 1997.

In 1994, the Government of Norway through the World Cleaner Production Society (WCPS) established Russian and Russian-Norwegian CPCs, drawing funds partly from the Government of Norway and partly through domestic funding.

In the Asia-Pacific region, USAID funded a CPC in the Taiwan Province of China in 1995 through the US Asia Environment Partnership (USAEP). USAEP along with the Singapore Confederation of Industries (SCI) established a CPC in Singapore in 1996 under a programme called Clean Technology and Environmental Management (CTEM). Initially, this Center was designed to be a clearinghouse for information on cleaner production practices, but today the centre provides outreach activities such as briefings, seminars, and workshops for CEOs and industry associations.

There have also been instances of CPCs merging. For instance, the USAID-funded CPCs in the Czech Republic and Slovakia merged with the respective NCPCs of the countries after several years of establishment as CPCs.

2.1.4 Some Observations about the CPCs

From the last section, it is clear that CPCs in developing countries and countries in economic transition, evolved primarily as regional offshoots. These CPCs were influenced to a great extent by donor / funding institutions.

While the concept of CPCs trickled down well with important stakeholders, there were some inherent drawbacks. To a large extent, these CPCs tended to be more supply-driven than demand driven. Being rather devoid of "national character", they could not influence national policies, and were generally confined to providing services such as information sharing, technology transfer and match making.

CPCs in the developed countries, on the other hand (US, Canada and Australia), played an important role in catalyzing and mainstreaming cleaner production. These CPCs performed reasonably well because of the enabling framework already in place, such as a pollution prevention-oriented policy and pollution prevention regulations, as well as supportive financing and budgetary allocations.

2.2 The National Cleaner Production Centre Programme

We have tracked the evolution of CPCs in the previous section. There are many similarities between CPCs and NCPCs. In fact, many a time it becomes difficult to assess which takes a cue from which. We also noted certain drawbacks inherent to CPCs, notably their inability to influence national policies, as they were devoid of national character.

NCPCs are backed by two multilateral UN institutions, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP). The NCPC Programme mandates a commitment by the National Governments to their respective NCPCs and hence (unlike the CPCs) NCPCs get uniquely positioned in the national perspective. The NCPC Programme builds the capacity of NCPCs to enable them to provide a wide range of services[6] such as awareness-raising, training, cleaner production assessments, demonstration projects, etc. Finally, the NCPC is part of a worldwide network that provides an opportunity to share both content and experiences in cleaner production – a great advantage in being a member of the same "family".

Thus, the UNIDO/UNEP NCPC Programme design provides a unique set-up in terms of offering an opportunity for international co-operation, national capacity building and networking amongst the actors in cleaner production throughout the world. In the following section, we shall examine the NCPC Programme in further detail.

2.2.1 An Introduction to the National Cleaner Production Programme

The NCPC Programme is a joint initiative by UNIDO and the Division of Technology, Industry and Economics (DTIE) of UNEP, to help developing countries and countries with economies in transition promote the application of cleaner production in enterprises, and importantly, to incorporate cleaner production in the national environmental policy and regulatory framework.

[6] Covered in detail in **Part 4** and **Part 5** of this Manual.

UNIDO has the lead role in establishing NCPCs. It is the executing agency for the NCPCs, being responsible to the funding or donor organizations and the NCPC counterparts; viz. the national governments. It is responsible for providing initial training to centre personnel, providing technical oversight for all activities undertaken by the centres, formulating the annual work plans with the Directors of the centres, assisting them in the management of their centres and monitoring their progress.

"The UNIDO/UNEP Programme design provides a unique set-up in terms of offering a profound infrastructure for international co-operation and networking between cleaner production actors throughout the world, which bilateral programmes cannot provide".

- Evaluation Report of the NCPC Programme, 1996, Lund University, Sweden.

For its part, UNEP plays a lead role in the dissemination of cleaner production information, the organization of in-country training activities, and the mobilization of key policy-makers, particularly the Ministries of Environment.

The UNIDO/UNEP NCPC Programme typically provides funding for the first three to five years of a centre's life. These funds cover the NCPC director's salary, short-term national and international consultancies, initial international training and study tours, and procurement of some equipment. The host country or institution typically provides the salaries of a deputy director, administrative staff, office space and logistical support (communications, supplies, etc).

NCPCs have relatively lean organizational structures, the idea being that each centre creates a network of institutions and individuals in the country that it can work with. Each centre is directed by an experienced country national. In nearly all cases, the NCPC is hosted within a local organization[7] - for example, in Costa Rica by the Chamber of Industry, in India by the National Productivity Council, in Kenya by the Kenya Industrial Research Development Institute, and in Hungary by the Department of Environmental Economics and Technology, Budapest University.

Host organizations and other local stakeholders make contributions (both financial and in-kind) to the centre, such as secondment of personnel, office facilities and equipment. This arrangement has been effective in building ownership of activities in each country, and has also minimized operational costs. Furthermore, co-operation with a strong national host institution increases possibilities for the sustainability of the centre, once the project funding period has elapsed.

[7] For successful capacity building, it is crucial to form partnerships with local organizations that are willing to invest resources for promoting cleaner production. A key requirement for the host is that it has to have good contacts with the industry.

2.2.2 The Gradual Evolution of the NCPC Programme

At the launching of the NCPC Programme in 1994, eight NCPCs were set up - Zimbabwe (1994), Brazil (1995), China (1995), India (1995), the Czech Republic (1994), Mexico (1995), the Slovak Republic (1995), and the United Republic of Tanzania (1995). These centres were selected from solicitations received from 39 institutions in 25 countries. The NCPCs in the Czech Republic and Slovakia were extensions of CPCs established earlier with USAID support. In 1996, the Tunisian CPC established a few years before with USAID funding was included in the Programme. In 1997, a centre was established in Hungary.

The Government of the Netherlands funded the centres in China, India, Mexico, the United Republic of Tanzania and Zimbabwe, whereas the Government of Austria funded the centres in the Czech Republic, Hungary and Slovakia. The centre in Tunisia, when it entered the UNIDO / UNEP Programme, received funding from Norway. The centre in Brazil was funded nationally and continues to remain so.

At this stage, the NCPCs' activity profile was designed to cover the following areas - awareness-raising, training, information dissemination, demonstration projects, and to some extent, policy advocacy.

Based on the encouraging progress of the Programme and requests from developing countries and countries with economies in transition, the years 1998 and 1999 saw a continuation of the Programme and addition of new NCPCs. In 1998, a regional grouping of centres was established in Central America: Costa Rica, El Salvador, Guatemala and Nicaragua. The first three of these centres were funded by Switzerland (the Swiss State Secretariat for Economic Affairs, SECO), while Austria funded the NCPC in Nicaragua. The year 1998 also saw the establishment of an NCPC in Vietnam, through initial funding from the Swiss Development Corporation (SDC), and later funding from SECO. Another centre, also funded by SECO, was set up in Morocco in 1999.

At this point, NCPC services were expanded to include assistance in obtaining cleaner production investments. Additional emphasis was also put on integrating cleaner production with Environmental Management Systems like ISO 14001. Performance indicators were also introduced for monitoring and assessment of all NCPCs.

The period 2000-2001 saw the creation of a group of new centres in Eastern and Southern Africa: Ethiopia, Mozambique (both funded by Italy), Kenya (funded by UNDP) and Uganda (funded by Austria). The same period saw the establishment of two more centres in Asia, one in

Sri Lanka (funded by Norway) and one in the Republic of Korea (self-funded). The latter NCPC has a design specifically suited to the country's specialty; i.e. technological expertise. There was an added emphasis on providing services concerning cleaner technology know-how. The Croatian centre was also established in this period, as the outcome of a cleaner production demonstration project which was funded by the Czech Government.

Finally, in 2002, centres were established in Lebanon (the first in the Middle-East) and South Africa.

Presently, there are 25 NCPCs operating in the UNIDO / UNEP NCPC Programme. However, UNIDO has been flexible in its design of projects, establishing other types of CPCs or cleaner production programmes. For instance, while all NCPCs have a multi-sectoral focus, UNIDO is experimenting with sector-specific centres. A self-funded CPC was set up in Russia in 2001, which focuses on the oil and gas industry. Preliminary work is underway to launch a centre focusing on cleaner fuels in Pakistan. UNIDO is also experimenting with centres that look at cleaner production as well as waste management. A centre with this scope was established in St. Petersburg in 2001, with funding from Austria and the United Kingdom. In 2001, a National Network (as opposed to a centre) was created in Cuba (with Austrian funding). This was tailored to Cuba's economy, wherein most enterprises are owned by line ministries (for example, sugar factories are owned by the Ministry of Sugar).

2.3 Lessons Learnt[8]

Many countries have requested assistance from the NCPC Programme in developing their own cleaner production capacities. A frequent request from countries is for advice and know-how on how to establish a self-sufficient cleaner production centre. It therefore becomes important for us to learn from the experiences of established NCPCs. This is what we shall aim to do in this particular section of the Manual.

At the outset, it is important to note that there is no set recipe for establishing a CPC. Countries are at different stages of socio-economic development, with different industry structures, socio-economic profiles,

[8] Users of the Manual are encouraged to read the report "Learning from the Experience of National Cleaner Production Centres." Available from the Cleaner Production Publications Catalogue: Changing Production Patterns at: www.uneptie.org/pc/cp/library/ catalogue/catalog_general.htm. Note that the report applies equally to CPCs.

cultures and challenges. Thus, what may work in one country will not necessarily work in another.

Initially, it was thought that establishing and operating an NCPC was going to be an easy task. However, in many cases the experience was different. Today, the UNIDO/UNEP Programme requires centres to develop business plans that plan activities around basic business principles, and adapt them according to local conditions.

Becoming self-sustainable has become rather critical for all the NCPCs today. Generally, on average, five years of sustained funding is needed to enable a centre to become financially sustainable. Few donors accept to continue funding a centre for more than three years and hardly any will fund it for more than five. Therefore, centres have a "window of opportunity" of three (possibly five) years in which to create a sufficient market for themselves in cleaner production and become financially sustainable after the initial funding ends. All of the first generation NCPCs have made this transition to financial sustainability, some much more successfully than others. They are now financing their activities from various sources such as domestic funding (national or local government grants or contracts), operational income (Cleaner Production Assessments or CPAs, training programmes, consultancy fees, membership fees, publication sales, etc.), and international funding (other multilateral / bilateral agencies – World Bank projects, bilateral assistance, etc.).

The transition from being donor-financed to becoming self-sustainable can be best summarized as 'desperate'! We will be covering between 20 and 25% of our costs this year, and maybe next year will be able to reach up to 50%. Many things are not paid for, for example, policy work and dialogue."

- NCPC, Mexico

Not all activities of an NCPC have the potential to become self-financing, raising difficult questions for each centre about balancing income-earning activities with the less profitable goals of a cleaner production centre (e.g., helping small- and medium-sized enterprises, policy dialogue, etc.). However, as a centre matures, the need for external technical assistance declines, reducing the proportion of external funding needed, and centres become more adept at obtaining domestic or bilateral donor funding for non-income generating activities.

Therefore, from the point of view of financial sustainability, CPCs need to explore providing services to an ever wider range of stakeholders, and deploying new strategies for "market development".

Historically, NCPCs have expanded their services from Level 1 to Level 2 as shown in **Figure 2.2**. The general trend is that recently established NCPCs focus on Level 1, with plans to move to Level 2, while mature NCPCs graduate from Level 2 to the more strategic Level 3.

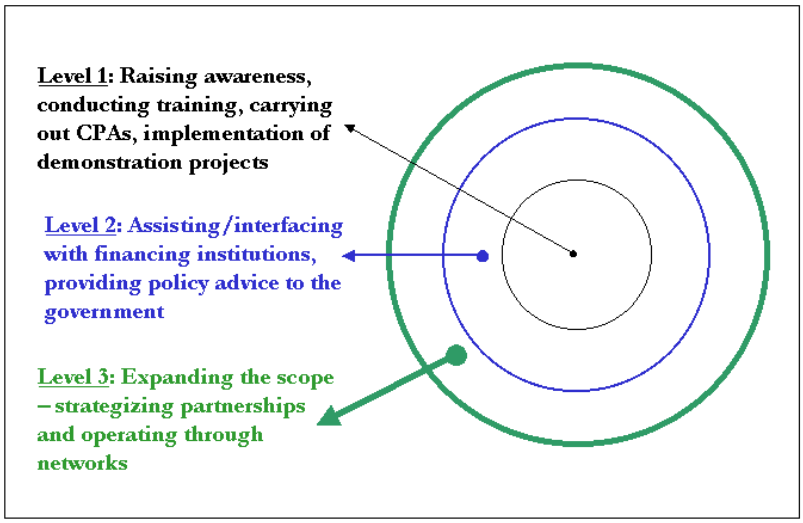


Figure 2.2: Expansion of NCPC Services from Levels 1 to 3

"Our country is currently experiencing a lot of political and economic insecurities which has evidently had an impact on the centre's activities. Broadening our activities beyond cleaner production (to), for example, energy audits, has helped us to keep running."

- NCPC, Zimbabwe

At the strategic level (or Level 3), it is important to realize that cleaner production is much more than just reducing waste and emissions. Cleaner production today is also about EMS, increasing energy efficiency, improving health and safety conditions of the work force and the neighborhood, redesigning products by carrying out life cycle analysis; most importantly, it is about sustainable consumption patterns. These wider aspects of cleaner production need to be integrated into both the communication of the concept as well as the delivery of services. This can be effectively done by creating strategic partnerships and operating through networks.

Companies having or aspiring towards ISO 14001 certification, for instance, may be more receptive to cleaner production if it is integrated into the development of environmental management systems. In another example, company employees may be more enticed by a health and safety approach to cleaner production. Energy efficiency savings may open the door more easily to cleaner production in small and medium-sized enterprises, which often face high energy costs. Recognizing how cleaner production can be **allied with other more familiar concepts and tools**, will help to **mainstream** cleaner production within the **decision-making process** and to **widen the client base** of a centre.

Part 3

How to Establish a Cleaner Production Centre

What will we learn from Part 3?

3 How to Establish a Cleaner Production Centre

3.1 Introduction

No Cleaner Production Centre can be successfully established unless the lead is taken by an institution or a consortium of institutions that has / have a clear stake in establishing it as a part of their mission and business objectives. We will call such an institution or consortium the "*Champion*".

Part 3 provides a general guidance to the Champion for establishing a CPC.

Although not a pre-requisite, it would be ideal if the Champion were a signatory to IDCP[1]. This would help the champion to induce other stakeholders of the CPC to become signatories to IDCP, and thus disseminate the message of cleaner production.

The process of establishing a CPC can be described in terms of four milestones. In essence, these four milestones form the *Business Plan* for the centre.

1. *Formulating the conceptual plan*: The Champion will need to formulate the concept that will be responsible for the genesis and operation of the centre. The concept should clarify for instance what the CPC should do and how. The plan will also identify other stakeholders that the Champion should induce to join together to establish the centre.

2. *Developing the basic design*: The stakeholders of the centre together will need to formulate its mission, objectives and strategy, along with its organizational set-up. In addition, the stakeholders will also need to identify the basic resource requirements that will be needed to render the centre operational.

3. *Meeting the financial needs of the centre*: Once the basic resource requirements of the centre have been finalized, the next step will be securing funding to meet those requirements. Funding

[1] Refer to **Section 1.6.2** of **Part 1** of this Manual for an elaboration on IDCP (International Declaration on Cleaner Production).

sources could include seed funds in cash and / or in kind from the stakeholders themselves, as well as any identified funding from national and / or international donor agencies.

4. *Establishing the Centre*: This would entail formally registering the centre, establishing its oversight bodies, recruiting the staff, and preparing its physical facilities.

Figure 3.1 depicts this process with various milestones. Each milestone in turn will have some steps.

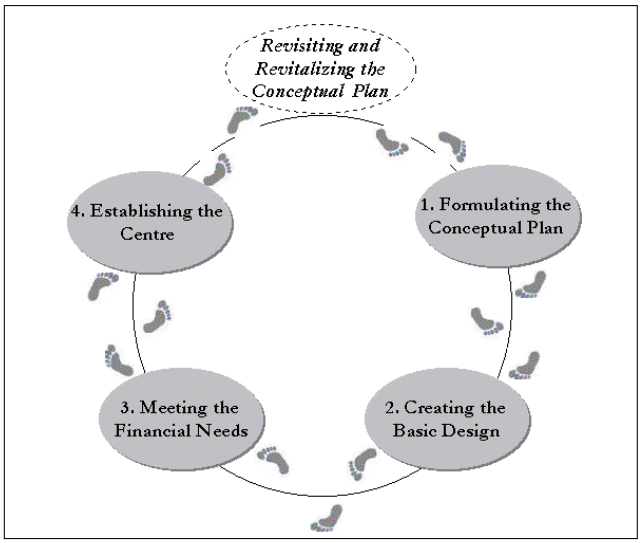
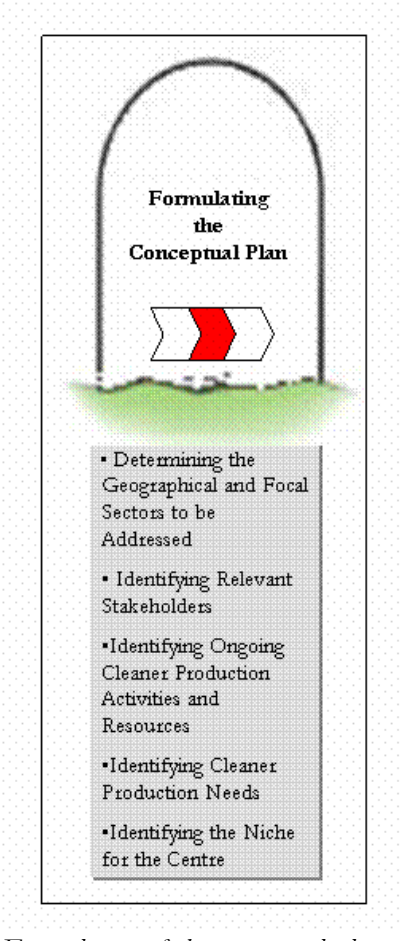


Figure 3.1: The Four Milestones of Establishing a Cleaner Production Centre

While the process on paper is laid out in four tidy milestones, with a series of steps, it is more than likely that in reality it will be a good deal less tidy. Often, the stakeholders will find that some steps need to be triggered earlier or undertaken simultaneously, and there could also be situations where the outcomes of one step could influence earlier steps in the form of a "feed-back loop".

In this part of the Manual, we will be describing each of the milestones and the steps involved.

Once the pertinent decisions have been taken, at the end of each milestone, they should be documented and preserved carefully. This documentation will come in handy towards later stages; i.e. revisiting and revitalizing the conceptual plan for the centre as and when the need arises, making formal presentations / proposals to interested parties (e.g. donor institutions, etc.), getting into legalities, and so on.



3.2 Formulating the Conceptual Plan for the Centre

- What should be the geographic coverage of the centre?
- What are the focal sectors that need to be addressed through the centre?
- Which stakeholders should be involved in the establishment and operation of the centre? What could be their roles and relationships?

At this point, the Champion and the stakeholders together will work on the rest of the fundamental conceptual issues:

- What other cleaner production activities or resources exist in the country? What are the cleaner production-related needs that are still unmet?
- What type of services should the centre focus on in its initial stage, the first three to five years? What could be the services that could be planned for a later date (once the centre is well established)?

By answering these key questions, the Champion and the other stakeholders can then:

- Identify the niche that the centre can suitably fill;
- Develop a preliminary design for the centre, i.e. the draft mission, objectives and strategies; and
- Elaborate the basic organizational structure of the centre, including the centre's physical location, and the use of a host institution or not.

Each of these points is discussed in more detail below.

3.2.1 Determining the Geographical Coverage and Focal Sectors to be Addressed by the Centre

The Champion must decide what the coverage of the centre will be in terms of:

- The geographical area of the country the centre will cover; and
- The focal sectors the centre will address.

With regards to geographical coverage, the Champion may like to consider whether the centre will:

- Play a national role; i.e. address the entire country; or
- Play a regional / local role; i.e. a centre could be established at the state, provincial, or even the municipal level. As outlined in **Part 2** of this Manual, examples of centres at all these levels currently exist.

The decision here will be situation-specific. In some cases, the latter option is chosen if the Champion is a local player. In other cases, it is possible that the Champion may be in a position to source limited funds or gather support mainly from regional institutions. Sometimes, the plan of setting up a regional centre may be chosen to serve as a pilot or as a confidence-building strategy, with a possible launch in the future as a national centre.

With regards to the sectoral coverage, it should be remembered that the *industrial manufacturing sector has received the most attention to date*. This is because this sector has been considered one that causes the greatest environmental impacts (in terms of resources consumed and wastes produced), is economically critical (in terms of contributions to the Gross Domestic Product or GDP) and is socially important (in terms of employment).

The Champion should, however, examine *relevance of other sectors* as well - the service sector, the government and agriculture - in deciding the focus of the centre. The characteristics of each of these sectors are briefly described below.

- *The service sector*: Cleaner production has been successfully promoted in service sectors such as tourism, hospitality and health services. The emphasis for the service sector may well be on issues such as minimization of consumption (especially that of natural resources), redesign of products, rethinking delivery of services, as well as minimization of wastes, and more importantly, promoting

sustainable consumption within communities. This sector also includes consultants, technology providers and operators involved in waste management services.

- *The government sector*: Cleaner production concerns in this sector have mostly focused on public or government-owned business enterprises, infrastructure providers and operators of water, power, transportation services, etc. They are characterized by high consumption of natural resources, and high inefficiencies of resource conversion and reutilization. Municipalities, armed forces, ministries, roads and telecom departments, etc. are also examples in this sector where cleaner production can be usefully adopted.

- *The agricultural sector*: This sector involves intensive use of natural resources (e.g. water). As in other sectors, this sector too generates a significant amount of wastes (for instance, post-harvest losses). Furthermore, agricultural activities use a variety of agro-chemicals, such as fertilizers and pesticides, which pose risks to the environment in their life cycle.

When deciding what sectors a new centre should focus on, it is often useful to study each of the sectors in the context of the national economy, social indicators and environmental sensitivity. Some of the useful statistics that the Champion may consult would fall under the following sub-groups:

- Economic (percent contribution to the GDP, percent contribution to the exports, percent investments)

- Social (percent employment of the total)

- Environmental (percent consumption of natural resources, namely, materials, water and fuels)

Sectors making a large contribution to the GDP, having a high order of employment and, at the same time, demonstrating significant consumption of natural resources, could well be the focal sectors for a new centre. However, more detailed analyses may be required by examining the geographical and size distribution of the sectors, supply-chain linkages across the sectors and most critically, the relevant national priorities proclaimed by the government. For instance, priority might be given to a sector that is a major user of natural resources (certain types of materials, water and / or fuels), and where the reduction in consumption is prioritized by national policy. Or perhaps the Champion may prefer an export-oriented sector, with wide cross-sectoral influences due to its

supply chain, which may be under environmental pressures at the same time.

The Champion could also decide that the industrial sector may not be the most relevant sector of the economy for a centre, especially where there are possibilities of setting up a local centre. For instance, in a coastal region with significant tourism activities, the tourism sector may serve as one of the focal sectors. In another example, the Champion will probably want to focus a municipality-based centre on those particular industries that are present in the municipality. It might also want to focus on the commercial sector and / or even on the services that the municipality itself operates.

Note that one centre cannot *effectively* cover *all* sectors of the economy *at the same time*. Therefore, in establishing a centre, one needs to adopt a phased approach, supported by strategic partnerships.

The Champion may therefore consider the options of covering only a few relevant sectors, or work across all the critical sectors while limiting to select sub-sectors.

One must remember that at this stage the Champion is **not** making **definitive** decisions, and is working primarily at a conceptual level. It could well be that during later discussions with other stakeholders; there could be modifications to both the geographical coverage and the sectoral focus that it proposed initially. There could be even further modifications when the stakeholders assess what cleaner production activities are already ongoing and/or what cleaner production expertise already exists in the region / sector(s).

3.2.2 Identifying Relevant Stakeholders for the Centre

The Champion should not attempt to establish a centre alone. It is important to bring together all relevant, equally interested or committed stakeholders. A centre will function sustainably only if the stakeholders representing all the different facets of cleaner production are involved and take ownership for the centre. If these institutions are not involved upfront, there are risks such as duplication, poor coordination, lack of support, especially in messaging and implementing cleaner production, and perhaps, even the threat of competition!

In many cases, the initial decisions made about the geographical coverage and sectoral focus of the centre will determine the stakeholders that may

have to be approached. For instance, if a Champion is trying to form a national centre focusing on certain industrial sectors, "natural" stakeholders are the relevant national associations of industries.

In order to identify institutions of relevance, the Champion (helped by other stakeholders as they get identified) should do a "matchmaking" exercise by comparing the centre's coverage and focus to the profiles of cleaner production-related stakeholders in the country. The profiles should include details on cleaner production-related activities (past as well as existing projects / initiatives), national and international collaborations, pool of expertise (key staff), infrastructure (laboratory and computer facilities) and so on.

Some general guidance can be given about what types of institutions could be stakeholders in a centre. These can be listed as follows:

- Representatives of the focal sectors;
- Representatives of the government authorities that are involved in the management of production and consumption patterns of the focal sectors;
- Representatives of the financial institutions who are intimately connected with the focal sectors, to influence the decisions regarding investment in cleaner technologies;
- Representatives of institutions of higher learning and research that can work with the focal sectors to develop cleaner technologies;
- Representatives of those parts of civil society that are impacted by the activities of the focal sectors (e.g., resource depletion and degradation, health and safety related issues, etc.).

Each of these stakeholders is discussed further below.

Representatives of the focal sectors

This is probably the most important class of stakeholders for a centre.

- They will help the centre to get to know and reach its "clients".
- They will be a source of sector-specific technical and economic knowledge that will allow the centre to evolve more appropriate sector-specific cleaner production promotion strategies.

- After adequate training, they can also be a source of sector-specific cleaner production experts, who in alliance with the centre can offer cleaner production services to their members.

- Often, they are respected partners of governments - another important class of stakeholders in a centre - who use them not only to understand the needs of the sector, but also to transmit the government's policy decisions.

Industry or trade associations are a very common stakeholder, either as general industrial associations that cover numerous industry sectors (e.g., the General Confederation of the Enterprises of Morocco, in the case of the NCPC in Morocco), or that cover specific industrial sectors (e.g., the Sugar Industry Association for the NCPC in Guatemala). Chambers of Commerce have also been stakeholders in centres (e.g., the National Chamber of Commerce for the NCPC in Costa Rica), as have Business Federations (e.g., the Confederation of Indian Industries for the NCPC in India).

Representatives of government

Because cleaner production involves many public policy issues, government authorities should always be one of the important stakeholders in a centre.

Government policies and actions (or inactions) can influence the production and consumption patterns of a multitude of institutions and programmes across sectors. For instance, subsidized prices for water or energy will discourage the users of these resources from using them efficiently. By being involved with a centre, government authorities can be made aware of where their policies are unfavourably distorting production and consumption patterns, and how they can take steps to eliminate such distortions. Conversely, by actively pursuing policies to promote cleaner production with the help of a centre, government authorities can implement cleaner production oriented policies.

Note that, depending on the geographical coverage desired for the new centre, the governmental authorities to involve can be at the national, regional or local level.

Since historically there have always been links between cleaner production and environmental protection (see **Section 1.2** of **Part 1** of this Manual), Ministries of Environment, Environmental Protection Agencies, Environmental Departments and so on, have generally been one of the stakeholders in CPCs.

Cleaner production has important links to industrial efficiency, innovation, productivity and competitiveness. Therefore, the Ministries of Industry (or equivalents) are also often stakeholders in centres. If energy efficiency (one element of cleaner production) is considered an important part of a centre's mandate, then Ministries of Energy - where they exist - could be stakeholders. The need to create an enabling framework for cleaner production-related investments suggests that the Ministries of Finance or Economy could be important stakeholders. A focus on tourism could mean that the Ministry of Tourism should be a stakeholder.

Representatives of financial institutions

It is being increasingly recognized that financial institutions have an important role to play in promoting cleaner production. Involving financial institutions as stakeholders in a centre can help in establishing a "virtuous circle" between project financiers and project seekers. The enterprises or institutions with a need to make investments in cleaner production-related projects could get connected to bankers who are looking for low-risk high-return projects.

Representatives of institutions of higher learning and research

These institutions can have a stake in cleaner production at two levels:

- Cleaner production can often require basic or applied research to adapt existing technologies or develop new process technologies, or redesign products from the point of view of the environment (i.e. eco-design). Institutions that are involved in such research and development activity can be stakeholders in the activities undertaken by a centre.

- Institutions of higher learning in engineering, business, finance (universities, vocational training schools, and so on) have a role to play in mainstreaming cleaner production, as they are involved in educating the younger generations. If the education programmes at these institutions provide an exposure to students on cleaner production concepts, tools and techniques, then it will be easier to develop the required pool of cleaner production professionals across multiple sectors.

Representatives of the civil society

Depending on the focus of the centre, NGOs can have a large stake in cleaner production. Environmental NGOs are of particular importance as they represent sections of civil society that are impacted by pollution

or environmental degradation, and / or consequent health and / or economic damage. Their role in awareness creation and information dissemination is particularly important. There are examples where environmental NGOs have worked proactively with industry to catalyze cleaner production, rather than taking a confrontationist approach.

By this point, the Champion should have identified the most relevant group of stakeholders for the new centre. The Champion will then have to conduct one-on-one meetings with the identified stakeholders, so that each party can understand each others' concerns, obtain answers to any doubts and clarify their respective roles in the venture. These activities will be followed by a brainstorming session, which could require revisiting the Champion's proposed conceptual plan for the centre, and which subsequently will translate the understanding of establishing the centre into a concrete commitment.

After this step, the Champion and the stakeholders will have to continue the process of developing the design and implementation plan of the new centre and obtain the necessary funding towards its establishment. It could well be that the Champion will have to continue to play a lead role; however the decisions from now on should follow a participatory or consultative mode as a group.

3.2.3 Identifying Ongoing Cleaner Production Activities and Cleaner Production Resources in the Country / Region

During the process of establishing a centre, it is important for the stakeholders to take stock of what cleaner production activities have already been undertaken in the country / region, or are underway.

It could be that no cleaner production work has ever been undertaken in the country / region. However, the experience of the CPCs indicates that this is rarely the case; often something (however modest) is already being done with regards to cleaner production, and persons may already have received some training on cleaner production concepts and methods. It would be prudent for the stakeholders in a new centre to explore the efforts already undertaken and the resources already available.

The best time to take stock of cleaner production activities is during the phase of stakeholder identification, profiling and subsequent consultative process. During this phase, the Champion should be spreading its net wide and holding discussions with as large a group as possible of

potential stakeholders of the centre. Such discussions will often be the best way of discovering what has already been done or is being done on cleaner production, and who might be the cleaner production resource persons that are already available.

It is important that the Champion and other stakeholders not use too narrow a definition of cleaner production in this review or stock-taking exercise. There are many activities that may not have the title of "cleaner production", but may actually have a very strong element of cleaner production (e.g., green productivity, eco-design and so on[2]). Similarly there may be persons who do not list cleaner production as one of their areas of expertise, but who do actually have considerable expertise that is relevant to cleaner production.

3.2.4 Identifying Cleaner Production Needs

Once the group of stakeholders in the new centre has been consolidated, and once all are in agreement about the geographical coverage and sectoral focus of the proposed centre, the stakeholders will need to take part in a process that will help in moving ahead from the conceptual plan to the design and implementation plan for the centre. It could be more effective that the Champion leads this process, assuming it is acceptable to the other stakeholders.

There are a number of possible different needs in cleaner production, namely, awareness raising, training, cleaner production assessments, demonstration projects, networking, matchmaking, knowledge management, interfacing with financial institutions and policy advice. In fact, these needs would lead to the identification of services that the centre could provide. Awareness raising, training, cleaner production assessments and demonstration projects could be viewed as the "basic" services the centre may provide to its clients during the initial three to five year period after its establishment. After this period, the centre may start providing other "strategic" services, namely networking, matchmaking, knowledge management, interfacing with financial institutions and policy advice. We will learn more about all these services and how they can be provided in **Parts 4 and 5** of this Manual.

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[2] Refer to **Section 1.4.1** of **Part 1** of this Manual for a complete list of "Cleaner Production and its Relation to other Similar-Sounding Concepts".

Note that a centre cannot address all the identified needs / services at the same time. It becomes important to assign priorities to the identified services. A careful consideration is required to plan the timing and execution of the programmes / initiatives necessary to attend to the identified services. Such prioritization and consideration will tend to follow a phased approach. Indeed, it may also follow an iterative approach, depending on changing priorities and situations within the focal sectors, economy, and so on. It is recommended that the centre limit itself to providing certain services in the initial thee to five years after its establishment. Thereafter, it should expand its scope to providing the remaining identified services.

This thought process will aid the centre in identifying a niche for itself. This will form the subject of our next section.

3.2.5 Identifying the Niche for the Centre

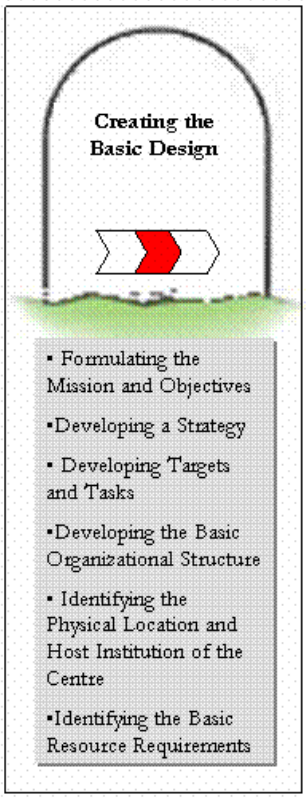
Once the needs (services) in cleaner production, on the one hand, and the cleaner production resources already available, on the other, have been identified, the Champion together with the other stakeholders can identify the niche that the centre should occupy. Through a "Strengths, Weaknesses, Opportunities and Threats" (SWOT) analysis or something similar, stakeholders can work on the needs in cleaner production that they have identified. They can determine which of these needs are already satisfied by existing institutions, and therefore which needs the centre should focus on. It is very important that a new centre should not duplicate capacities and resources that already exist, particularly since in many countries resources for new initiatives are scarce and must be used wisely.

During such an analysis, particular attention should be given to the cleaner production activities, resources and capacities that the stakeholders have. The fact that they are stakeholders in cleaner production suggests that they could already be active in the cleaner production field. Since the stakeholders need to closely identify with the centre for it to succeed, it is especially important that during this phase it is clear to all what roles the individual stakeholders could, and would, like to play in cleaner production. Clarification of this will ensure that the role chosen for the centre will be complementary to and not in competition with the stakeholders' role. It is important that stakeholder-specific Memoranda of Understanding (MoU) be drawn up and finalized at this point in time.

The logical conclusion of this is that the centre must create strong partnerships with those stakeholders and other institutions that are active

in the cleaner production field. Only by partnering with other institutions can the centre offer a complete response to the cleaner production needs of the chosen geographical area and focal sectors. Note that at this point the stakeholders could come to the conclusion that there is no need for a strong and active centre; rather, what may be needed is a small unit that could promote cleaner production and co-ordinate across the stakeholders to meet the responses to cleaner production needs. In other words, the centre's niche would simply be that of a cleaner production champion and network co-coordinator.

At this stage, it is important to document all pertinent decisions taken in the context of formulating the conceptual plan for the centre.



3.3 Creating the Basic Design for the Centre

- Formulate the mission and objectives of the centre;
- Develop the basic strategy to meet the objectives;
- Develop targets based on the objectives;
- Develop tasks which need to be carried out to meet those targets (who, what, when, where, how and how long);
- Elaborate the basic organizational structure of the centre; including the centre's physical location and the use of a host institution (or not); and
- Identify the basic resource requirements of the centre.

3.3.1 Formulating the Mission and the Objectives of the Centre

A mission statement is a means of committing to paper the basic premise / essence of the centre. Thus, its formulation requires careful consideration. The best way to formulate a mission statement is to start with a brainstorming session between all the stakeholders, looking for those key phrases and words that best capture what the new centre will be about. Once this is done, the stakeholders can delegate the crafting of the mission statement to one person with strong language skills. Using the results of the brainstorming session, this person will elaborate a draft of the mission statement, which he/she will submit to the other

stakeholders for review and comments. Remember that the best mission statements are short and concise.

The stakeholders should ensure that at least the following issues are covered in the mission statement:

- The geographical focus that has been chosen for the centre;
- The focal sectors which it will serve; and
- The ultimate purpose of its activities (e.g., to reduce environmental impacts at the source; to render the economy more efficient, and so on).

The mission statement is basically a means to translate the centre's vision or policy into action. Given below are a few examples of mission statements of some centres.

Given here is the "Policy for Quality and Environment", as formulated by the Vietnam Cleaner Production Centre[3].

Policy for Quality and Environment

The Vietnam Cleaner Production Centre is a knowledge-based organization delivering a wide range of high quality cleaner production solutions that gives added value to industry, consulting companies, research institutions, academia, and governmental organizations.

As a national focal point on cleaner production we are committed to continual improvement and prevention of pollution. We will comply with legislation and are committed to the International Declaration on Cleaner Production.

We will continuously strive to improve the quality of our solutions and services and to improve the effectiveness of our Integrated Management System.

[3] Vietnam Cleaner Production Centre: Introduction. Available at: www.un.org.vn/vncpc/introduction/index.html

The mission of the Kaunas Centre[4] in Lithuania is as follows:

> Mission of the Kaunas Centre in Lithuania
>
> **T**o become the primary centre in Lithuania for providing industrial sectors with relevant research, technical assistance and training on various environmental subjects (e.g. EMS) and critical management skills (e.g. problem solving and raising funds), all with the ultimate goal of introducing cleaner production techniques, preventing pollution, and achieving economic savings. These industry aimed services will be supplemented by educational efforts for related governmental organizations, NGOs and academia.

The mission of the Hungarian Cleaner Production Centre[5] is as follows:

> The Hungarian Cleaner Production Centre serves as a central coordinating and catalytic clearinghouse determined to:
>
> **C**ontribute to sustainable industrial development in Hungary;
>
> **I**mprove the environmental performance and competitive advantage of industry by means of cleaner production;
>
> **I**ncrease nation-wide awareness of cleaner production and sustainable development, and therefore;
>
> **R**each an overall reduction in environmental pollution.

Once the stakeholders have agreed on the mission statement for the centre, they need to set its objectives. These may change over time,

[4] Organization for Co-operation and Economic Development: Task Force for the Implementation of the Environmental Action Programmes for Central and Eastern Europe (EAP) CCNM/ENVIRONMENTAL/EAP (99)25. "Pollution Prevention Centre at the Institute of Environmental Engineering, Kaunas University of Technology, Lithuania" in *Cleaner Production Centres in Central and Eastern Europe and the New Independent States.*

[5] Organization for Co-operation and Economic Development: Task Force for the Implementation of the Environmental Action Programmes for Central and Eastern Europe (EAP) CCNM/ENVIRONMENTAL/EAP (99)25. "Hungarian Cleaner Production Centre" in *Cleaner Production Centres in Central and Eastern Europe and the New Independent States.*

depending on changing situations (regulatory and policy changes, modifications in the clients' needs, etc.). Little guidance can be given on what specific objectives a centre must have, because they will be very situation-specific. However, some general guidance can be given:

- The objectives should derive from the mission statement. Their purpose is to turn its naturally abstract language into concrete aims, so that the centre can build a strategy around them.

- The objectives should be both short-term as well as long-term; i.e. the steps the centre must take at the present time to fulfill its mission may not be what it may need to do in several years time, since the cleaner production needs that it is responding to can change, as can the overall economic and environmental context of the country.

- The Champion and stakeholders need to go through the exercise of updating the objectives for the centre on a periodic basis in the light of changing circumstances.

3.3.2 Developing a Strategy to Achieve the Objectives of the Centre

Once the initial objectives have been set, the Champion and stakeholders can lay down the overall strategy that the centre will have to follow to meet them. Again, this strategy will depend very much on the local conditions under which the centre is working. Decisions will need to be made concerning the details for the provision of services and their phasing to implement the strategy.

In general, the strategy should lay out in broad terms:

- The general set of services the centre will undertake; this will follow naturally from the decisions the stakeholders made about the niche the centre will fill;

- The phasing of the centre's services, i.e. the order in which it should provide them, and the period of time allocated to their provision. For instance, where little (if any) cleaner production activities have already been undertaken in the geographical area of interest, the strategy should stress that for the first six months, the centre will focus its activities on awareness-raising. Later on, this can be given less importance as the other activities of the centre get underway;

- The key clients or audiences that the centre should target for each of the services;

- The working partnerships the centre should pursue and formalize, and therefore the inputs the centre would require for its services from its partners;

- The resources (both personnel and non-personnel) that the centre will require in order to provide its services in a manner in which it can meet the objectives; and finally

- The programme the centre should pursue to cover the costs of the resources it needs.

It is important to realize that that there is an inherent relationship between different services; e.g., one particular service may set in motion the demand for other specific services. As mentioned earlier in **Section 3.2.4**, it becomes important to decide the phasing of the provision of services. Fostering partnerships in this context also becomes important, whereby a centre may decide to allocate certain services to partners in the future and move on to fulfilling its long-term objectives (e.g. providing other downstream services, creating a wider base for itself through networking, shaping government policy advice in relevant areas, and so on). Planning strategically will ensure that the centre remains lean, impacts a wider audience, and thus gets increased outcomes with minimized inputs.

The strategy should **not** concentrate on making short-term profits. While certain services may not earn much revenue (e.g. raising awareness), they are extremely crucial from the point of view of laying the foundation of cleaner production, and thus triggering other services. Similarly, the outcome of investments in education and research in cleaner technologies may take time to materialize; however, such strategies will allow the centre to reap the desired long-term benefits.

Below is an example of the strategies employed by the Kaunas Centre[6].

The mission of the Kaunas Centre will be achieved by concentrating on the following four strategic efforts:

Technical assistance (including waste minimization / cleaner production opportunity assessments, research, laboratory services, etc.) in Lithuania and other CEEC / NIS;

Environmental management (including training, auditing, consulting in EMS and standards, certification);

Financial intermediary (including training in "Financial Engineering", preparation of bankable cleaner production projects and loan applications, project monitoring and supervision, project progress reports); and

Education (including courses on cleaner production and EMS for undergraduate and postgraduate students, coordination of Ph.D. studies in environmental engineering.

3.3.3 Developing Targets and Tasks

Once the strategy of the centre has been formulated, the stakeholders will need to decide on the targets to be achieved and the tasks to be executed, in line with the objectives and, hence, the mission of the centre.

The targets will entail the accomplishment of short-term and long-term objectives of the centre. In this light, targets have a direct bearing on the resources the centre would need. Targets need to be "**s-m-a-r-t**"; i.e. ***S****pecific*, ***M****easurable*, ***A****ttainable*, ***R****ealistic* and ***T****raceable over time*. Setting targets is also an adaptive process; long-term targets may need to be reviewed and revised depending on the achievements of

[6] Organization for Co-operation and Economic Development: Task Force for the Implementation of the Environmental Action Programmes for Central and Eastern Europe (EAP) CCNM/ENVIRONMENTAL/EAP (99)25. "Pollution Prevention Centre at the Institute of Environmental Engineering, Kaunas University of Technology, Lithuania" in *Cleaner Production Centres in Central and Eastern Europe and the New Independent States.*

short-term targets and / or changing economic and environmental situations.

After deciding the targets for the centre, the stakeholders will have to allocate tasks needed to meet a particular target. The tasks will entail answering the following questions - who, what, when, where, how and how long. In this context, the stakeholders will be faced with the following questions:

- *Human resource requirements for the centre:* The number of people required, their skills, training needs (if any) and the possibilities of the host institution / stakeholders providing the centre with a part of its human resource requirements.

- *Basic (financial) resource requirements for the centre:* Seed funds, securing the shortfall in seed funds (if any), revenue stream generated from the delivery of the centre's services and the possibilities of the host institution / stakeholders providing the centre with a certain part of its amenities, which could help it lessen its capital and / or operating costs.

Both of the above aspects are discussed in detail in later sections of this part of the Manual.

As in the case of targets, tasks also need to be executed over a period of time. It is important that the tasks have quantified performance indicators against which the centre's progress can be measured (discussed to a greater extent in **Part 6** of this Manual). In this way, it will be easier to evaluate if the centre is succeeding, in terms of achieving its targets.

Let us now address the topic of human resource requirements at the centre, or more specifically, the basic organizational structure of the centre.

3.3.4 Developing the Basic Organizational Structure of the Centre

There are two important points that stakeholders should keep in mind while devising the basic organizational structure of the centre:

- Efficiency and effectiveness requires that a relatively independent centre be established, where its Director is put in the position where he / she can autonomously take decisions for the operation of the centre in the best manner possible;

- Establishing a centre should be a partnership process; i.e. the key stakeholders should be strongly involved in its establishment, and they are expected to be active partners of the centre. This underscores the need to have a mechanism through which the stakeholders can provide inputs about the performance of the centre.

This suggests that the basic organizational structure of a centre should have the centre itself, which implements the strategy that has been decided on, and a body or bodies (Steering Committee, Executive Board and Advisory Committee) to which it reports and which has / have basic oversight functions over the centre.

As far as the centre itself is concerned, experience suggests to have as simple and as small a structure as possible, to keep resource requirements and overheads low. The centre should be run by a Director, who in turn should have reporting directly to him / her a small number of professionals and some administrative support staff. The Director can then apportion between the professional staff the various tasks to be undertaken by the centre to implement the tasks, keeping for himself / herself the promotional, strategic and management functions.

Figure 3.2 provides a generic organizational structure for a centre, where the Director of the centre reports to an Executive Board and where an Advisory Committee[7] provides strategic advice to the Executive Board and the Director. The core staff reporting to the Director is responsible for the delivery and marketing of services. Other staff within the centre is responsible for matters pertaining to administration and other routine back-office functions. The centre is also supported by counterpart institutions and local or international consultants, who may be required to provide the necessary expertise in certain aspects of cleaner production and / or assist the centre in the delivery of services.

[7] In this Manual, the terms "Executive Board" and "Advisory Committee" are used to cover bodies with executive and advisory responsibilities, respectively. Other terms, such as "Steering Committee" or "Board of Directors", may also be used.

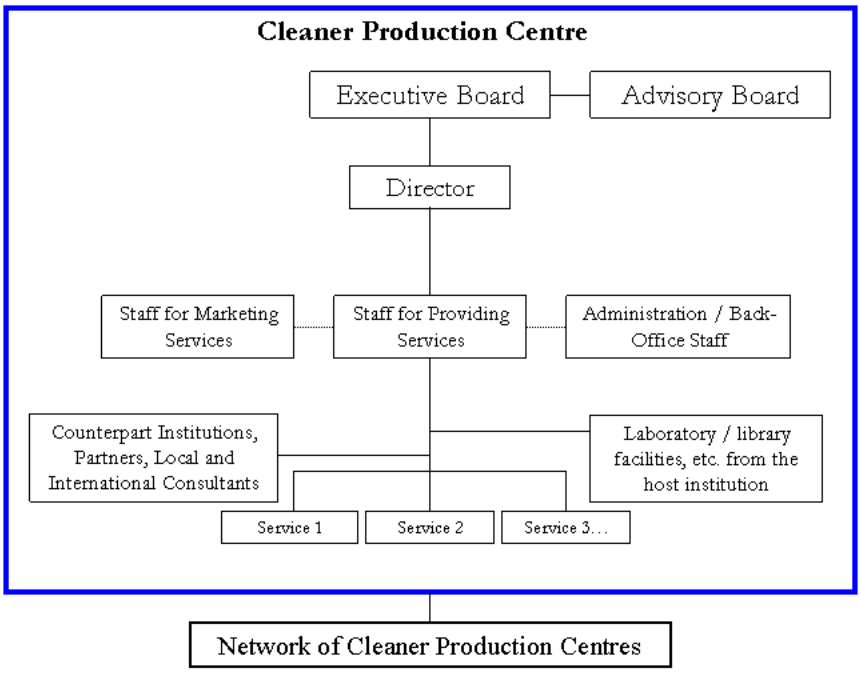


Figure 3.2: The Generic Organizational Structure of a Centre

Figure 3.3 shows the current organizational structure of the Vietnam Cleaner Production Centre[8]. Note how the organizational structure of this centre is organized based on the services provided by the centre, with national experts and counterparts providing inputs along the way.

[8] Vietnam Cleaner Production Centre: Organizational Set-up. Available at: http://www.un.org.vn/vncpc/introduction/organisational.htm

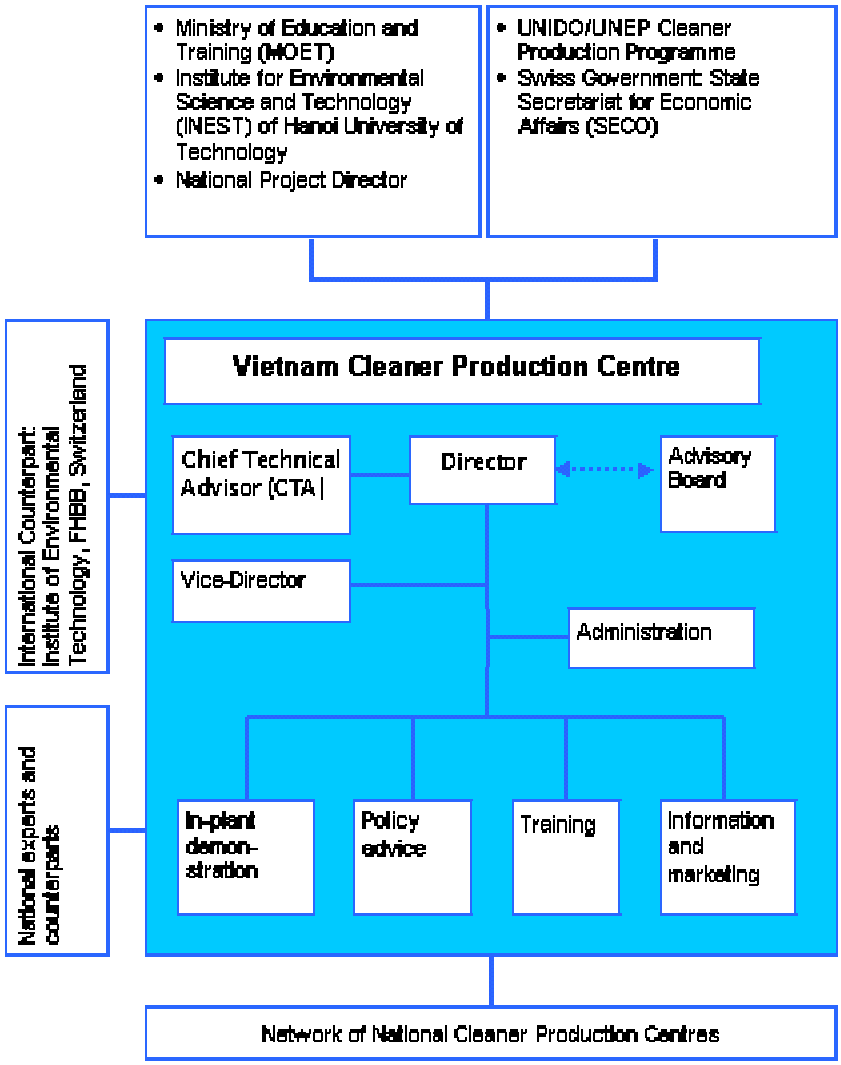


Figure 3.3: Organizational Structure of the Vietnam Cleaner Production Centre

This section cannot be completed without touching upon a relatively different model that can be (and has been) used for the organizational structure of a centre. There could be cases (given the nature of the centre the stakeholders wish to establish) where one stakeholder will dominate above all the others. For instance, if the stakeholders wish to establish a centre that works only for one industrial sector, the most obvious (and certainly the major) stakeholder in this kind of centre will be the sector's trade association. In this case, a better organizational structure could be one where the centre actually becomes a new addition to the stakeholder's organizational structure. In other words, the centre would be a new department or a new division in the stakeholder's

organization (refer also to **Section 3.3.5** of this Manaul). The executive oversight body of the stakeholder then becomes the oversight body of the centre. There could still be an Advisory Committee made up of other stakeholders with a lesser direct interest in the centre.

Oversight bodies: Advisory Committees and Executive Boards

As for the oversight body / bodies, there are several issues that need to be thought about - membership, size, and responsibilities.

In principle, all the centre's stakeholders could be members of the oversight body or bodies. In cases where relatively few stakeholders have been identified, it is best to have them all members of one oversight body. The basic responsibilities of this oversight body would be:

- Setting the objectives for the centre;
- Setting the strategic direction of the centre;
- Hiring the Director and the staff;
- Approving the work programmes submitted to it by the Director;
- Approving the budgets and financial statements submitted to it by the Director; and
- Monitoring the progress of the centre and its success in meeting its objectives in terms of accomplishment of targets.

Generally, an oversight body of this nature can function effectively if its membership is limited to five.

In this context, the NCPC in El Salvador has an important insight to share with us - "*We have 24 members on our Advisory Board. Trying to get consensus is impossible! Our Board of Directors, representing the private sector, university and government, works better.*"

If there are more than five stakeholders, a better alternative is to have two bodies, one with executive functions (termed in this Manual as "Executive Board") and one with advisory functions (termed in this Manual as "Advisory Committee"). In this case, the Executive Board can remain small, while the Advisory Committee can more easily have a larger membership. The Executive Board would be responsible for all the oversight functions listed above, except providing guidance

concerning the strategic direction for the centre. The major responsibility of the Advisory Committee would be to give this strategic advice to the Executive Board and Director.

Box 3.1 highlights the dos and don'ts for Advisory Committees and Executive Boards.

Box 3.1 Dos and Don'ts of Executive Boards and Advisory Committees

The **Executive Board** should have a **small membership** (not more than 5) to facilitate consensus building and decision-making.

Members of the Executive Board should be willing to **dedicate time** on a voluntary basis towards overseeing the centre.

Members of the Executive Board should have **good management / business skills**.

Members of the Executive Board may help actively in **assisting the Director to build the financial resources** of the centre. It is advisable for the members of the Executive Board to draw up a formal agreement amongst themselves, where each member declares what he / she will contribute to the centre.

The Advisory Committee should be constituted of members who are in **influential positions** or who are **well-known experts**.

The Advisory Committee should be composed of a **cross-section of stakeholders** (government, industry and other important communities), although membership should not be so large that it becomes difficult to manage (it is suggested that the Advisory Committee have 10 to 15 members).

The Advisory Committee is neither a decision-making nor a consensus-building body. It should provide strategic advice to the Executive Board and the Director.

All members should have a **genuine interest** in the success of the centre. Members who are likely to have conflicting priorities and/or individual interests that are not compatible with the collective interest of the centre should be avoided.

While this sharing of responsibilities between two bodies is a practical solution from a managerial point of view, it can be diplomatically delicate to implement. All stakeholders will want to be on the Executive Board, since it appears to be more important of the two bodies. This potentially embarrassing situation can be resolved by making membership of the Executive Board conditional on its members making a financial contribution (in cash or in kind) to the centre. Often, it will only be a small number of stakeholders that can, or are willing to, make such a contribution. This approach has the additional advantage of making the function of the Executive Board more important, since each member now has some financial ownership in the centre.

Given below are a few examples of Advisory Committees / Executive Boards of some centres.

Like most centres, the NCPC of India has an Advisory Committee, which consists of a broad range of influential members including:

- Ministry of Industry (Joint Secretary);
- Ministry of Environment (Senior Advisor);
- UNIDO (Country Director);
- Central Pollution Control Board (Chairman);
- Confederation of Indian Industries (Head - Environmental Management Division);
- National Productivity Council – the host institution (Director General)

The India NCPC no Executive Board, because this is an example of a centre that is to all intents and purposes an integral part of the host institution's organizational structure.

The Centre in Guatemala has an Executive Board and an Advisory Committee. Its Executive Board consists of:

- Cámara de Industria de Guatemala (National Chamber of Industry and the host institution),
- Presidencia de la Républica (the Office of the President of Guatemala),
- Universidad del Valle (University),
- Federación de Pequeña y Mediana Empresa (FEPYME or Federation of Small and Medium Enterprises),
- Swiss Government (for the term of funding),
- UNIDO / UNEP (for the term of funding).

To ensure good co-operation of the NCPC in Guatemala with small- and medium-sized enterprises, academic and governmental sectors, the Advisory Committee includes the following members:

- Universidad de San Carlos (University),
- Comisión Nacional de Medio Ambiente (CONAMA) (National Commission on the Environment),
- Consejo Nacional de Ciencia y Tecnología (CONCYT or National Council of Science and Technology),
- Comisión Centroamericana de Ambientey Desarrollo (CCAD or Central American Commission of Environment and Development). The co-operation of the NCPC with the CCAD is especially important to support the harmonization of national legislation within the region. The following institutions also co-operate closely with the NCPC: SYME (Programa Nacional para Fomento de la Micro y Pequeña Empresa or National Program for the Development of Small and Microentreprises) and SEGEPLAN (Ministerio de Planificación or Ministry of Planning).

The core staff of a centre

The core staff of the centre should consist of the following personnel:

Director

Responsibilities - Planning, management / administration, representing the centre, providing guidance and support to other staff, liaising with stakeholders, developing networks and marketing the services of the centre (mainly interfacing with financial institutions, and providing policy advice).

Qualifications - Technical or business background. Managerial qualities. Excellent communicator, rapport-building capabilities, contacts with stakeholders, team builder.

"Select a highly committed staff that really understands what cleaner production means and what it stands for. The deputies should be good technicians, but the Director should be an entrepreneur."

- Brazil Centre

Technical staff

Responsibilities - Delivering the centre's services (awareness raising, training, cleaner production assessments, demonstrations projects, knowledge management, networking, matchmaking and web-enabled services), preparing manuals, reports and other information materials.

Possible future needs could include additional technical personnel, an economist, an information management specialist, industry sector specialists, specialists in allied subjects (e.g., environmental management systems, energy efficiency, health and safety, and so on), and a policy analyst.

Qualifications - Technical capabilities, training and communication capabilities, ability to work with industries, team working ability.

Support staff (Secretary)

Responsibilities - Providing all support facilities, office maintenance, programme organization, accounts, etc.

Qualifications - Secretarial qualities, computer skills, knowledge of accounts, office organization and maintenance.

Subsequently, depending upon the need and demand, more staff may be added or contracted on a regular or as-needed basis.

Given below is an example of the core staff employed by the Centre in China.

- 1 Director, responsible for overall programme direction;

- 1 Deputy Director, for assisting overall programme direction and conducting implementation of projects;
- 1 Division Chief of cleaner production, for conducting cleaner production projects;
- 4 Technical staff of cleaner production division, for assisting conducting cleaner production projects;
- 1 Division Chief of environmental management system (EMS), for studying the relationship between cleaner production and EMS and conducting projects concerning ISO 14000;
- 3 Technical staff of EMS Division, for assisting the chief to conduct EMS projects;
- 1 Division Chief of public-relations and information exchange, for operating the China National Cleaner Production network and other daily tasks;
- 1 staff of public-relations and information exchange, for assisting the chief to deal with day-to-day tasks and translation tasks; and
- Support / secretarial staff.

Counterpart institution

A centre in developing countries and countries with economies in transition does not have, nor is it expected to have available to it in the country all the necessary expertise and skills to perform its task, especially during the initial stages of its establishment. Therefore, in their programme UNIDO and UNEP have always provided professional support to new centres in the form of twinning arrangements with an experienced counterpart institution. This institution is responsible for training and developing the centre's staff to undertake the tasks of cleaner production promotion and implementation. As the specific needs vary from centre to centre, UNIDO has found it important to ensure that this support be tailor-made to fit the individual requirements of the centre. Furthermore, as the responsibilities and functions of the centre evolve, UNIDO has ensured that the nature of the support needed also changes.

Areas in which centres may require support for building expertise include design and implementation of demonstration projects, systems and techniques for information acquisition, preparation of cleaner production financing proposals, preparation of manuals and reports,

project proposal preparation for local, national and / or international sources of funding, sectoral expertise and policy expertise. Apart from their experience and knowledge, counterpart institutions can also share certain facilities with the centre; i.e. laboratories, sampling /testing equipment, library access to pertinent journals and publications, etc.

It is important that the relationship between counterpart institutions and centres be clearly defined and transparent on both sides…

"We sometimes felt that the counterpart institution was furthering its own professional interests rather than ours. At times, it seemed reluctant to help us specify needs that it could not meet itself."

- Tanzania Centre

On the basis of the experience gained in the UNIDO/UNEP NCPC programme, stakeholders in a new CPC can consider several alternative strategies to provide their new centre such professional support.

- The simplest is to link centres to a counterpart institution with experience in cleaner production. From its home base, the counterpart institution supports the development of expertise in the centre through short-term missions to the centre, and responds to requests from the centre for information (e.g., on suppliers of cleaner technologies) from its home base. This was the strategy of choice in the first generation of NCPCs established by UNIDO.

- A variant on this base strategy is to station a senior professional from the counterpart institution at the centre for the first few years. Having one of its staff in place can greatly help the counterpart institution understand the centre's support needs and assess the evolution in those needs. This has been the approach adopted for the NCPC in Vietnam. Note that this approach can be considerably more costly than the base strategy.

- Another variant on the base strategy that has evolved as more and more CPCs mature involves transferring the experience and expertise gained by mature centres to new centres. In other words, mature centres can act as counterpart institutions themselves. The NCPCs in Brazil, the Czech Republic, India, Mexico, and Slovakia, for example, have started to offer their services to new NCPCs. It is also the strategy of choice when regional or local CPCs are being established in a country where a national CPC already exists.

- Yet another variant is to link a new CPC with several counterpart institutions, to better meet its different support needs. Either the support institutions can act independently from each other in their relations with the centre, or they can join together in some form of consortium so that their individual actions can be coordinated. For example, the former was the approach used by the NCPC in India, while the latter is being used by the NCPC in Morocco.

Box 3.2 highlights the dos and don'ts for counterpart institutions.

Box 3.2 Dos and Don'ts for Counterpart Institutions

The counterpart institution **should first build the centre's skills and expertise** in cleaner production assessment and training, as these are basic building blocks.

The need for counterpart expertise **evolves as a centre matures**. A certain amount of **flexibility is desirable** to enable the centre to obtain the needed expertise when required.

The centre should be fully aware of the range of expertise and skills that counterpart institutions have and the counterpart institutions should be **willing to share all their expertise**.

The counterpart institution should be **genuinely interested in identifying the professional needs of the centre** and providing the appropriate expertise required. It should **not** be motivated simply by a desire to further its own interests.

The counterpart institution should be able and willing to **source from outside** its own institution a particular expertise the centre wants but it does not have.

3.3.5 Identifying the Physical Location and the Host Institution of the Centre

Much thought has been given to where best to locate a centre. Two basic models have been proposed for this. One is to locate the centre in the premises of one of the stakeholders, which becomes its host institution. This approach has two major advantages:

- Initially, when the centre is unknown, it can easily "piggy-back" on its host institution, which can introduce it to its potential clients (the basic assumption being that the host institution is well known to, and well respected by the centre's client base – see below). In this way, the centre can get itself known more rapidly, and therefore can become operational in a shorter time.

- This approach reduces the demand on funds that the centre must have at the beginning of its life to pay for rent and utilities.

This model has always been chosen for the UNIDO/UNEP NCPCs. Since they have focused primarily on manufacturing industry, they have been located in industry support institutions such as industrial trade associations, chambers of commerce, productivity councils, technical universities, etc.

The disadvantage of this approach is that the host institution may come to feel a strong and exclusive sense of ownership towards the centre, as it feels it has made a significant in-kind contribution to the latter's finances. This then creates tensions with the other stakeholders, who feel excluded. It can also create managerial problems, with the host institution beginning to "micro-manage" the centre. This can be mitigated by bringing together other stakeholders as members of an Executive Board (discussed in a later section of this Manual), where they make decisions collectively about the centre, thus rightly perceiving themselves as a part of the centre.

The other model is to have the centre located in rented commercial space like a business centre. This assures that the centre is relatively independent of all its stakeholders, but it also means that a certain amount of funds must be available at the time of the centre's establishment to pay for its rent and utilities. It would also mean that the centre would have a less easy task in promoting itself with its potential client base. However, this situation could be mitigated by the Director starting his / her career in the centre by undertaking aggressive promotional campaigns.

Neither of these two models is "better" than the other. It is clear that both have their advantages and disadvantages. Note also that the stakeholders can adopt a hybrid of these two models, which has been adopted successfully by a number of NCPCs and other CPCs. Here, the centre starts by being hosted by one of its stakeholders, and then a few years later, when it is generating sufficient funds, it can move into rented commercial space and take on more of an independent operation.

In those cases where the stakeholders decide to use a host institution, UNIDO's experience shows what the typical profile of such a host institution might be. Centres should be hosted by well-established institutions, which will commit to providing office space, utilities and logistical support (communications, supplies, etc.), support staff and a facilitated access to industry, government and other stakeholders. The host institution may be a government-run organization (although it

should not have any enforcement powers), an industry association, an academic or technical institution, a nongovernmental organization or a non-profit association. What works best depends upon a country's culture and socio-economic context.

If the stakeholders opt for using a host institution, the selection needs to be done with great care. Having a strong supportive host institution can greatly enhance the success of a centre. And getting it wrong means having to start all over again!

It should be mentioned that host institutions have not always been able to meet their promised commitments to CPCs. This has led to situations in which a centre becomes under-staffed or alternative funding has to be found. As a result, the UNIDO/UNEP Programme now requires its NCPCs to develop business plans to enable them to plan activities around basic business principles and to update them according to local realities and financial possibilities.

Box 3.3 highlights the dos and don'ts of a host institution.

Box 3.3 Dos and Don'ts of a Host Institution

The host institution **must have a stake** in promoting cleaner production. Cleaner production should fit into the **mainstream business** of the host institution. The host institution should have the **confidence and trust of industry**, the centre's primary target for cleaner production. Otherwise, receptivity to cleaner production and sharing of information may be compromised.

The host institution should preferably have some **experience in running capacity building / development projects** and **be patient** and **supportive** during the centre's infancy period.

The long-term stability of the host institution should be examined in order to **avoid having to change host institutions before the centre has become self-sufficient.**

The host institution should be willing and able to provide **timely, logistical support** to the centre to enable it to start functioning and deliver output as soon as possible. It should **participate in the selection of a Director** to ensure a certain degree of compatibility.

The host institution should **not** be an institution having responsibilities for **ensuring compliance with environmental (or other) laws and regulations.** Being hosted by such an institution will tend to keep clients away from the centre, for fear that any legal or regulatory problems they have will become known to the compliance authorities. Instead, the host institution **should have strong links to the sector(s) that have been identified as the focus of the centre.**

3.3.6 Identifying the Basic Resource Requirements of the Centre

At this point, the stakeholders are in the position of being able to determine what the basic resource requirements of the new centre will be. The stakeholders can cost all these requirements on the basis of the local market conditions.

The costs will be essentially broken up into either capital costs or operating costs.

Capital costs could include office space, furniture, books, specialized periodicals, software, on-line cleaner production databases, equipment, office equipment (fax machines, phones, computers, photocopying machines, etc.), training equipment (overhead projectors, etc.), monitoring equipment (pH meters, volumetric flow meters, sampling equipment, other laboratory analysis equipment, etc.), vehicles for travel, and so on.

However, it may be prudent to keep capital costs as low as possible. The centre should look for opportunities to offload certain capital costs as operating costs. For example, host institutions could provide the centre access to laboratory equipment and laboratory analytical facilities. Thus, the centre need not invest large sums of capital unduly and may pay the host institution a fee for using such facilities, which would thus be absorbed as operating costs. Similarly, vehicles for travel may also form part of the centre's operating costs.

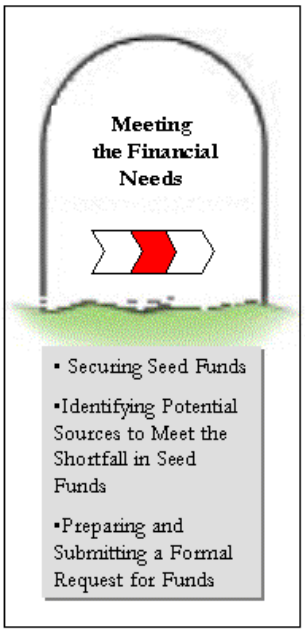
The main operating cost will be the salaries of centre staff, reflecting the fact that a centre's main resource requirement will be person-power. If the centre can be designed to work within a strong network of other institutions working on cleaner production, the person-power resources can be quite modest. On the other hand, if

the stakeholders decide on a centre design such that the centre works alone, the person-power needs could be significantly higher. Many centres work with no more than 5 professional staff and 2 administrative support staff even at full operating capacity. If the centre is designed to be part of a network, it will require access to the person-power of its partners. The centre will require access to national or international consultants (from within counterpart institutions or outside them) for specialized services that neither it nor its partners can supply, and also for capacity building within the centre.

Other items under operating costs would include office utilities (lighting, heating, air-conditioning), office stationary, vehicles for travel, charges for using laboratory facilities of the host institution, charges for using the host institution's facilities for conducting awareness raising and training functions (as part of the centre's services), charges for using space for conducting seminars / awareness / training sessions, costs associated with travelling on the field, costs of technical documentation, costs for printing promotional brochures, training materials etc., costs for establishment and upkeep of the centre's website, and so on.

It is recommended that the stakeholders minimize a centre's rental requirements and utility costs in the initial three to five years after its establishment by giving it (as an in-kind contribution) the necessary office space and utilities. Once it becomes financially self-sufficient, it may explore the options of renting or even owning its own offices. It may even consider opening local branches in different parts of the country / region.

At this stage, it is important to document all pertinent decisions taken in the context of creating the basic design for the centre.



3.4 Meeting the Financial Needs of the Centre

At this point, the stakeholders will have formulated a detailed design of how the centre will function, and how much funding will be required. It is now time to consider the issue of how to secure this funding. This is an issue that the stakeholders should devote considerable attention to. It makes little sense to go to all the trouble and expense of establishing a centre only to see it collapse a short time later because the necessary funding was not secured properly.

The centre should eventually be able to sustain itself financially, by providing services to its clients. However, there will be a time at the beginning of the centre's life (the first three to five years), when it cannot support itself completely, as it has not established its client base yet and is not fully geared to deliver the necessary range of services to its clients.

The challenge of securing funds therefore becomes two-fold. The first is to secure sufficient seed funds to sustain the centre over the first three to five years, during which time it has to establish its place in the market. The second is to assure the sustainability of the centre from a business point of view; i.e. ensure that the market for the centre's services is large enough, and its fee structure is set properly, so that it can generate enough income to cover its operating and capital costs. Income will be generated through revenue earned from the basic services delivered by the centre. The stakeholders will need to make initial projections of this revenue generation, as it will help meet some of the financial requirements of the centre.

The challenge of securing seed funds is discussed below. The challenge of securing funds for the long-term sustainability of the centre will be discussed in **Parts 4 and 5** of this Manual.

3.4.1 Securing Seed Funds for the Centre

Securing Contributions from the Stakeholders

Here, the stakeholders have to determine the contributions they can make during the centre's initial phase. These contributions can be either in cash or in kind. Monetary contributions would be preferred as they are easier to manage, but the reality is that most stakeholders will only be able to make in-kind contributions. As a guide, examples are given below of in-kind contributions that stakeholders have made to different centres around the world:

- Stakeholders can loan the centre members of their staff to work full-time or part-time for a few years. In this case, the stakeholders will continue to pay the salaries and social contributions of the loaned personnel. These persons act in effect as consultants for the centre, but the fees the centre can charge its clients for the services rendered by these persons remain with the centre to build up its reserves. Stakeholders involved in such a contribution can come to an understanding with the Director, that after a few years these persons may either become full-fledged staff members of the centre and the centre takes over paying them their salary, or they go back to their original institution but may be hired back as short-term consultants by the centre on an as-needed basis.

Note that deployment of part-time or seconded staff has its own problems. There is a lack of commitment from the personnel as they do not see a career with the centre. There can also be a lack of stability if the seconded staff is rotated. Finally, the seconding organizations may not be willing to send the best personnel, and often the seconded persons are those whom the organization wants to get rid of.

"Our host institution, the Chinese Research Academy of Environmental Sciences (CRAES), provided the necessary logistical support, including office space, supplies and favourable management fees, during the start-up phase. When you give a lot of early support to the centre, it can become profitable earlier."

- China Centre

- Stakeholders can assist the centre in its promotion activities. For instance, an industrial association can spend time and some costs (e.g., free advertising space in association magazines) to introduce the centre to its members. Stakeholders can also give the centre slots to promote its services in conferences or seminars they are organizing.

- As already mentioned earlier, it is very common for stakeholders to offer a centre the office space it needs for free, together with the relevant office furniture, furnishings and stationary (and more rarely equipment such as computers, photocopiers, fax machines, etc.). Later on, the centre can start paying rent for these facilities or move out and rent commercial space elsewhere.

- Where stakeholders offer free office space, they also often offer the centre free access to training rooms or conference rooms where the centre can put on cleaner production training courses and awareness-raising seminars.

- Where stakeholders offer free office space, they also often give lighting and heating/air conditioning for free. More rarely, they may cover the centre's telecommunication bills.

- If the stakeholders also have a pool of vehicles, they can offer the centre free use of the vehicles to visit clients.

- Stakeholders having laboratory analytical facilities can offer to undertake for free analyses that the centre needs done on its clients' waste streams.

Centres must have autonomous control over at least part of the funds initially used to establish them. For instance, a "discretionary budget" could be provided with a certain degree of flexibility and authority (e.g., choosing national consultants, etc.) to enable the Director to take certain decisions without having to wait for higher approval.

3.4.2 Identifying Potential Sources to Meet the Shortfall in Seed Funds

In the ideal case, the stakeholders together can make sufficient contributions of seed funds in cash or in kind to cover the needs of the centre for the first few years when it is establishing itself. However, if their contributions are not enough, then the shortfall must be covered by other sources. As a benchmark, experience with the UNIDO / UNEP NCPC Programme shows that an NCPC usually requires US$150,000 to US$200,000 a year of external funding (i.e. over and above the type of in-kind contributions from stakeholders cited above). Of this, US$50,000 to US$70,000 a year is spent on counterpart institutions, international consultants and other external resources.

For the sake of efficiency, the stakeholders should delegate to the Champion the task of securing the remaining seed funds. The Champion must then do two things:

- It must identify potential sources for these funds; and

- It must prepare, submit and promote a formal request for the funds.

Normally, the Champion will have two primary sources of funding to tap into - national funds (primarily from the government), and international funds.

If the national, regional or local government is a potential funding source, there is a good chance that it will already be a stakeholder in the centre. Thus, its capability to cover the needs for seed funds will have been explored already. However, it is possible that government authorities, which are not stakeholders, have certain funds that could be tapped into. For instance, the World Bank and other regional

Development Banks give countries technical and financial assistance for specific purposes. In such a case, the Champion could attempt to tap into these funds.

The alternative is for the Champion to try and secure the necessary funds from international donors. These are many and varied, and can be broadly classified as either bilateral funds or multilateral funds. A number of donor countries have given bilateral funds for establishing CPCs. It will be worthwhile for the Champion to identify the donor countries having active bilateral programmes in the country, and then approach the representatives of these countries to explore with them if the establishment of a CPC would fit into any of their priority areas.

With respect to multilateral funding, the most important player worldwide for funding NCPCs is UNIDO, although UNDP has also occasionally funded NCPCs. The Champion needs to approach the UNIDO country representative (if there is one), or otherwise communicate directly with the UNIDO Headquarters in Vienna. Similarly for UNDP, the stakeholder needs to approach the UNDP country representative.

At this stage, it is important to document all pertinent decisions taken in the context of meeting the financial needs of the centre.

3.4.3 Preparing and Submitting a Formal Request for Funds

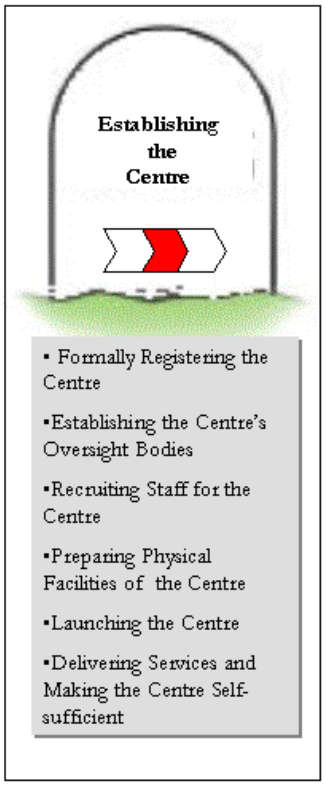
Once a promising source of funding has been identified, the Champion needs to prepare a formal request for funds. Each funding source normally has its own specific format for preparing funding requests, but in most cases they will follow the general format shown below:

- Outline the conceptual plan that is responsible for the genesis and operation of the centre;
- Outline the basic design for the centre; i.e. the mission, objectives, strategy, targets and tasks, along with the organizational structure and the basic resource requirements;
- Outline the identified financial needs of the centre, along with the earmarked seed funding;
- Outline the initial projections made for revenue generated as a result of delivering basic services;

- Based on the identified financial needs, earmarked seed funding, and initial projections of revenue generation from the delivery of basic services, outline the net shortfall in the financial needs of the centre; and lastly

- Outline the amount of funding being requested and the period for which the funding is being requested.

If the stakeholders have followed the methodology laid out in this part of the Manual, it will be easy for them to prepare a funding request, since all the necessary analysis has already been done. The documentation completed at the end of each milestone will also help enormously at this stage of the project.



3.5 Establishing the Centre

Assuming the stakeholders have secured all the necessary funding, the final task to turn the centre into a reality will be to formally establish it. This will require the stakeholders to do the following:

- Formally register the legal status of the centre;

- Establish the centre's oversight bodies and monitoring system(s);

- Recruit the Director and other staff; and

- Prepare the physical facilities of the centre.

3.5.1 Formally Registering the Centre

Even if it can be put off for a little time, in most countries, formal registration of a new centre eventually becomes a necessity for the following reasons.

- If the centre is to raise its own money and earn revenue from delivering services, it needs to be able to emit and receive official invoices. It will thus need to have a bank account in its name where its income can be deposited and from which its expenses can be deducted. This can only come about if the centre is a formally registered entity.

- The centre will employ staff. In such cases, national legislation often requires that it become a registered entity, so that income tax and

social contributions can be levied at source, and so that the staff is covered by the country's employment legislation.

Therefore, once the stakeholders have taken the pertinent decisions and documented them, it is best to register the centre as the first step in its formal establishment and set up the accounting / book-keeping systems for it.

The only exception to the need for registration would be those cases where the centre will not be an independent entity, but will be part of a larger institution. In this case, all the financial and personnel matters of the centre will be dealt with by that particular institution.

Regarding accounting / book-keeping systems, it may be that a certain accounting / book-keeping system is mandatory because of the legal status of the centre. This can create problems in cases where external funding has been necessary (see **Sections 3.4.2 and 3.4.3** of this Manual), because the sponsors often mandate some sort of accounting / book-keeping system of their own. In such cases, the stakeholders will have to negotiate with the sponsors to get them to modify their systems where these differ from those required by the country's own laws. In addition, where the sponsors require the same or more detailed book-keeping but in a different format, to avoid confusion and the expenditure of unnecessary time, the stakeholders should try to reach agreement with the sponsor for a harmonization of the two systems.

3.5.2 Establishing the Oversight Bodies for the Centre

By this stage, the stakeholders should have made the basic decisions about the oversight bodies of the centre (see **Section 3.3.4** of this Manual). Therefore, it should now be simply a question of implementing those decisions.

If they are not already set by the national legislation governing the legal status of the centre, it is advisable that the stakeholders come up with a short set of "rules" governing the manner in which the oversight bodies will be run, covering especially:

- The basic responsibilities of the bodies;
- How the chair of the bodies will be chosen;
- How decisions will be taken;

- With what frequency the bodies will meet; and
- How disputes will be resolved.

Once the stakeholders have taken the pertinent decisions and documented them, they may establish the oversight bodies for the centre.

3.5.3 Recruiting Staff for the Centre

The first major decision that the Executive Board will take is the recruitment of the staff of the centre, and in particular the Director. As can be imagined, the Director will be the key to the initial success of the centre. Therefore, the Executive Board should devote considerable time and attention to find and recruit the right person for this job.

The remaining staff is less critical than the Director, although it is important to get the right mix of skills (see **Section 3.3.4** of this Manual).

It is important that the Executive Board lay down the rules for employing full-time and part-time staff, as well as local and / or international consultants, and seconded staff. This may include (but not be limited to) laying down guidelines for recruitment of staff (required qualifications and skills, number of interviews required before the hiring process is finalized and so on), deciding on details concerning the orientation of centre's staff, their job profiles, duties and responsibilities, their pay structure, their paid / unpaid leave benefits, travel allowances, medical reimbursements, etc. The training needs for the hired staff would also need to be identified and periodically updated.

Once the Executive Board has taken the pertinent decisions and documented them, it may recruit staff for the centre.

3.5.4 Preparing the Physical Facilities of the Centre

The stakeholders should already have reached agreements concerning the physical facilities of the centre (see **Sections 3.3.5** and **3.3.6** of this Manual), the contributions to the physical facilities that will come from the stakeholders (see **Section 3.4.1** of this Manual), and those that will come from external funding sources (see **Section 3.4.2** of this Manual).

At this point, it is simply necessary to implement these agreements. This should not be done by the stakeholders, but by the Director as part of his / her duties of running the centre. However, it is possible that there will need to be meetings of the Executive Board to resolve certain issues.

It is also important for the centre to design the elements of the office space in a theme relevant to cleaner production and / or in an environmentally friendly manner (e.g., the centre could use lead-free pencils, recycled paper, unbleached paper napkins made from recycled content, non-plastic cutlery and non-styrofoam plates, water-conserving plumbing equipment, CFC-free air-conditioners, and so on).

Once the Executive Board and Director have taken the pertinent decisions and documented them, they may prepare the physical facilities for the centre.

3.5.5 Launching the Centre

The centre is now ready to launch itself into the market. It will need to promote and sell itself in the market. This step will require the designing a logo for the centre, preparation of attractive brochures, setting up a website, widely publicizing itself in all major local newspapers, deciding on the launching time, date and location, and so on.

Once the centre has been launched, it is ready to start operations.

3.5.6 Delivering Services and Making the Centre Self-sufficient

The centre is now operational. It should concentrate on building a client base, delivering services to its clients and becoming financially self-sufficient in the long run. These aspects will be fully explored in **Parts 4 and 5** of this Manual.

Eventually, once the centre has crossed the preliminary teething period (the initial three to five years), it has to achieve financial self-sufficiency, and run itself like any smart business centre. In line with this thought, it is vital that the centre:

- Evaluate its operations periodically and when needed;
- Strengthen its weak points; and

- Adapt to changes in external situations by revisiting and revitalizing the conceptual plan.

These aspects will be fully explored in **Part 6** of this Manual.

Part 4

How to Deliver *Basic* Services of a Cleaner Production Centre

What will we learn from Part 4?

4 How to Deliver Services of a Cleaner Production Centre (Guidance on Basic Services)

4.1 Introduction

The personnel targeted for this part of the Manual are the Directors of the centres and, to a lesser degree, the members of the Executive Board of the centre.

Although the range of services undertaken by each centre will be specific to that centre, the services in general fall into the nine categories outlined in **Part 3** of this Manual. These nine service categories are further grouped into two phases and shown below:

Phase-1 Foundation Phase (Basic Services):

1. Awareness-raising;
2. Training;
3. Cleaner Production Assessments; and
4. Demonstration Projects.

Phase-2 Extension Phase (Strategic Services):

5. Networking;
6. Match making;
7. Knowledge management;
8. Interfacing with financial institutions; and
9. Providing policy advice.

Awareness raising and networking form the core services under the foundation and extension phases respectively. These services do not by themselves generate revenue, however as shown in **Figure 4.1(a)**

and **Figure 4.1(b)**, they play critical roles in the creation of a market for other basic and strategic services.

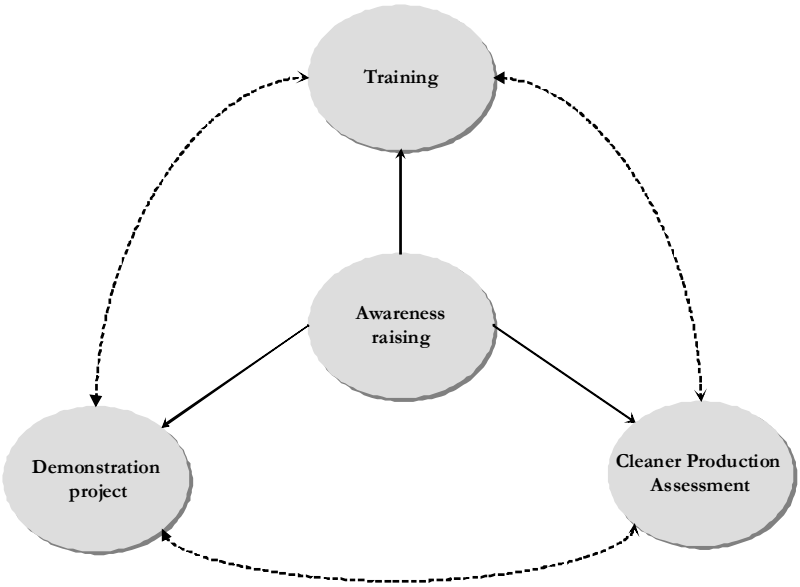


Figure 4.1(a): Inter-relationship between the Basic Services

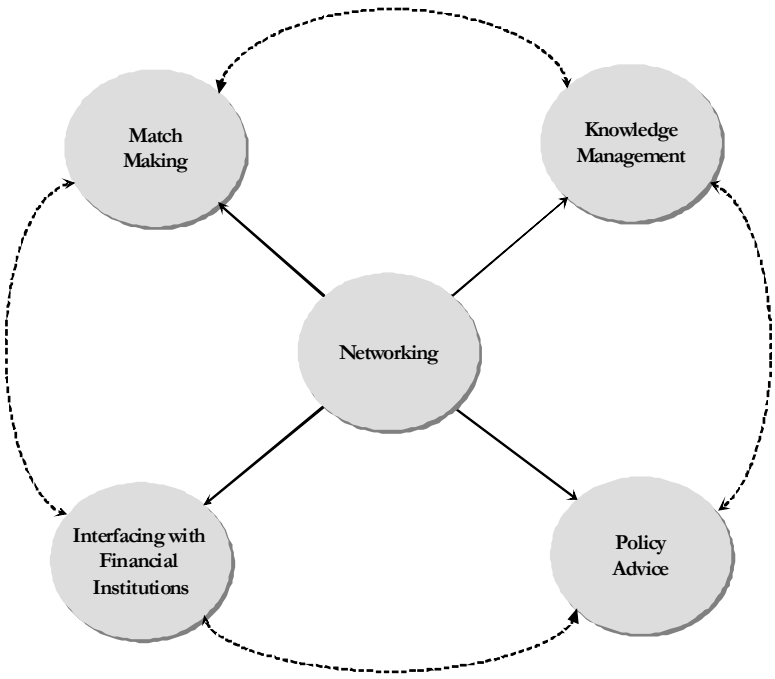


Figure 4.1(b): Inter-relationship between the Strategic Services

Figure 4.2 shows the typical progression of a centre from the foundation phase all the way to the strategic phase. The basic services of the centre do not stop at the end of the foundation phase, but continue, albeit in a more strategic form and operated under partnerships and networks. Again, this distinction here is more of a general guidance, and a centre may decide to adopt a mixed approach depending on the context and resources available.

In its initial stages, a centre will need to firmly establish its basic services and later graduate to an extension of those services. The basic services are important to give the centre credence in the eyes of its potential clients and build up their confidence in it, to help the centre understand the market, and to build the capacity of the centre. The strategic services further enhance the market development process, amplify the coverage of centre's services and elevate the role of centre at a national / regional level.

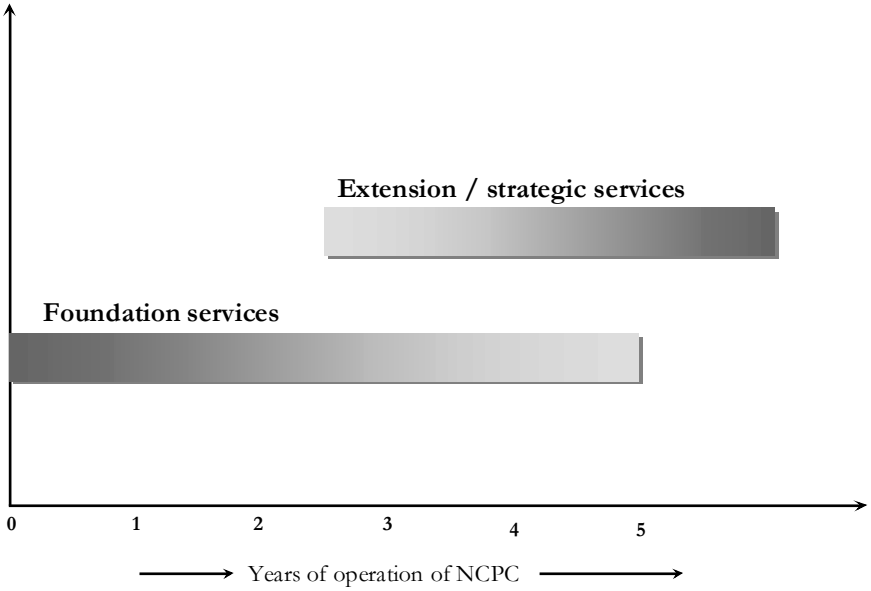


Figure 4.2: Progression between the Foundation and Extension Phases of a Centre

In this Part, we will focus on the four basic services provided by a Centre. **Part 5** of this Manual is devoted to remaining five services that are more akin to the strategic aspects of a Centre. In both the Parts, we will provide guidance on the steps to be followed, dos and don'ts etc, for each service. We will also learn about promoting

these services effectively and using them to make the centre financially self-sufficient.

4.2 Awareness-raising

The need for cleaner production is evident at all levels – that of enterprises, of government and industry-support institutions and even that of individuals. There is, however, little awareness about the nature and benefits of cleaner production. Thus, while there is undoubtedly a need for cleaner production, the demand for cleaner production related services is relatively low. The first and foremost task of the centre in such a situation is to raise awareness about cleaner production and its benefits, thereby creating a demand for cleaner production. Unless awareness is created, it is difficult for a centre to establish its niche. Good awareness creation, on the other hand, helps greatly in the promotion of the centre's services.

Typically, awareness-raising programmes should focus on various target stakeholders in order to ensure that awareness of cleaner production results in action. For every awareness-raising programme, there must be clarity in terms of the intended next step or the expected action, which then defines the objective of conducting awareness raising. Planning awareness-raising programmes with intended action in mind assists in bringing to bear the required scope and focus for the chosen target groups.

An objective of conducting awareness-raising programmes on cleaner production in an industrial cluster could be to develop as a next step cleaner production demonstration projects. Amongst financial institutions, an awareness-raising programme may be envisaged to enable the development of a cleaner production fund. The idea of exposing faculty at various universities to cleaner production could be to develop a cleaner production based curriculum.

Again, it is very important that awareness is not just created for a specific action but is sustained so that actions can continue, multiply and lead to the adoption or mainstreaming of cleaner production. Remember that creating awareness as a one-time activity is easier than sustaining awareness! In this perspective, it is important that the awareness-raising programmes are launched not on an ad-hoc basis but as part of a strategic operation.

Figure 4.3 illustrates the recommended cycle over six milestones for creating and sustaining awareness. We will outline each milestone in this cycle, emphasizing the various strategic elements.

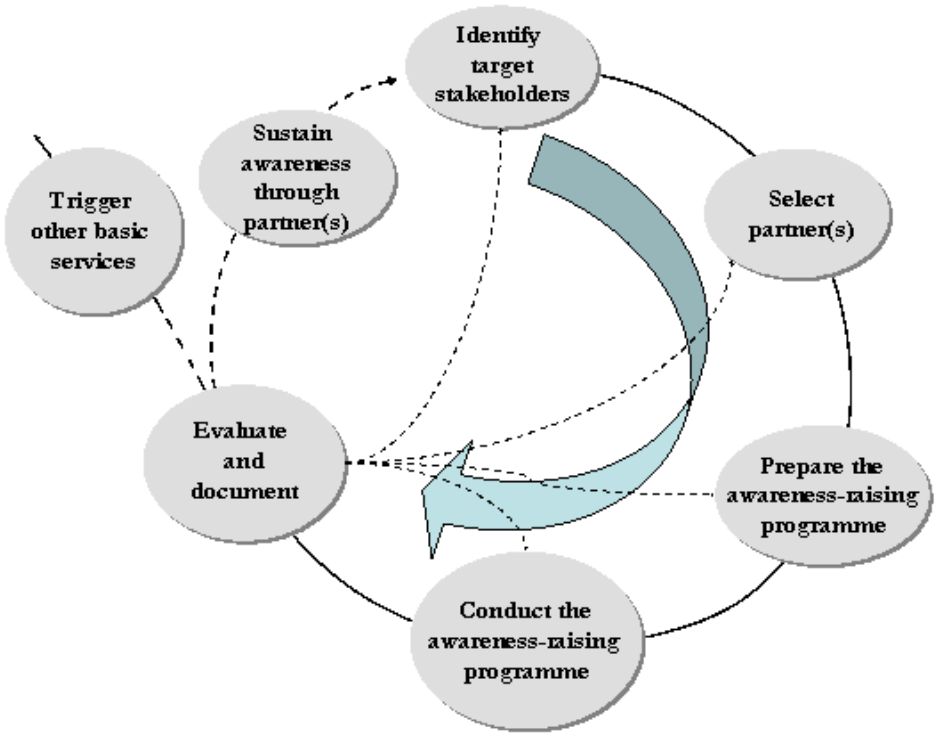


Figure 4.3: A Strategic Approach for Creation and Sustenance of Awareness-raising Programmes

4.2.1 Identification of Target Stakeholders

Understanding the target stakeholders is one of the most important steps in planning and conducting awareness-raising programmes. The key target stakeholders whose awareness needs to be raised are already identified in the conceptual plan. These could include government authorities, financial institutions, business organizations (i.e. manufacturing industries, service sector organizations, and their support institutions), R&D institutions, as well as academia, media and environmental NGOs, trade unions and associations etc. Some of these stakeholders may have been involved in the establishment of the centre as well.

For instance, if the focus is on the hospitality industry then it will be important to raise the awareness of stakeholders such as hotels, resorts, etc. On the other hand, if the focus is on the manufacturing sector, then industries in a cluster or across the supply chain will be the target stakeholders for awareness-raising programmes.

We should however note that the **mere identification of stakeholders is not sufficient** here; information on their geographic location / size distribution, cleaner production needs, barriers and opportunities is also necessary.

For example, if awareness is to be created in the tourist industry, then it is necessary to compile information about the hotels and resorts, their ownership (e.g. whether a hotel is part of an international chain), their capacities (number of rooms) and occupancy rates, the resource-related pressures they are under; e.g. water and electricity, the environmental issues they face; e.g. disposal of kitchen waste; whether there is any hotels association and whether there have been any previous cleaner production related seminars etc.

We should also bear in mind that awareness-raising programmes need not be restricted to one target stakeholder. Bringing together related stakeholders makes such programmes more effective.

For instance, if an awareness-raising programme is launched with industries as the prime target stakeholders, it may be useful to also involve the financing institutions and key officials of the relevant ministries (e.g. industry, commerce and environment). Their presence can enrich the discussions because of their experience and different perspectives. At the same time, these representatives can get sensitized and oriented to some of the more pressing issues faced by the industries and hence undertake some of the de-bottlenecking steps on a proactive basis.

Sometimes, bringing together businesses across the supply-chain of key products can also be a good strategy for launching awareness-raising programmes. For example, an awareness-raising programme could be organized around newly imposed eco-labels on textiles, and the objective of the programme could be to show how cleaner production assessments could assist in securing eco-labels in a **profitable** manner. Here, the target group could consist of cotton growers, yarn and fabric processors, garment makers, fashion merchants, dyes and chemical suppliers, textile technology

equipment providers and export houses. It is important to communicate here that changes made by one stakeholders (in process and products) need to be responded to by other stakeholders to get the desired results.

If a third party such as a centre approaches the target stakeholders with a new concept such as cleaner production then there is a possibility that the concept may remain alien to the target stakeholders. There could be some resistance.

On the other hand, if the centre approaches the target stakeholders along with a partner, who is already known or familiar, then many barriers get removed.

4.2.2 Selection of (a) Partner(s)

Finding a partner to work with is very important in strategizing awareness-raising programmes. Partners often assist in ice-breaking and in jumpstarting the awareness-raising activity.

Partners are needed for several reasons. First, they understand the target stakeholders better in terms of barriers and preferences. Second, they hold key information about the target stakeholders that is useful in customizing awareness-raising programmes. Third, any earlier work done by the partners becomes an add-on and hence reduces duplication of content. Fourth, the partners can help in reducing the costs of awareness-raising programmes by sharing resources or by connecting the centre to possible sponsors or donors. Finally, and most importantly, after a series of awareness-raising programmes, partners can become the change agents and work with the centre as ambassadors to continue promoting the cleaner production concept. This helps greatly in sustaining awareness.

If the target audience is the industry, say for example a leather tanning cluster, then the leather industries association or leather research institute could be the possible partner. In the case of financing institutions, the partner could be the national bankers association.

Partners need to belong to the same geographic area as the stakeholders and have a healthy relationship with them. These partners should have good reputations and networking experiences with the stakeholders. Importantly, partners must have a stake beyond the awareness-raising activities. For instance, a leather research association interested to become a partner to the centre must be keen to demonstrate the cleaner technologies they have developed on an industrial scale.

Box 4.1 below presents a checklist for selecting the right partner(s).

Box 4.1 Checklist for Selecting the Right Partner(s) for Awareness-raising Programmes

The partner should have had some **past experience** with conducting awareness raising programmes (not necessarily on cleaner production).

The partner should enjoy a **respected and important position** amongst the target stakeholders.

The partner should have **high networking potential** with the target stakeholders.

The partner should have an **interest** and **stake** in the overall awareness creation activity.

The partner should possess **sufficient knowledge** about the target stakeholders.

The partner should be **willing to share resources** with the Centre in the preparation and conduct of the awareness-raising programmes.

The partner should be **willing to provide a platform** to the Centre during the conduct of its own outreach programmes.

4.2.3 Preparations for an Awareness-raising Programme

The next milestone is preparations for the awareness-raising programme. Here, the important decisions deal with the content (scope and focus) and appropriate delivery mechanisms. These aspects require careful consideration as content and delivery mechanisms are closely related.

Content and delivery mechanisms are best determined by holding brainstorming sessions with the partner(s) and by organizing focus group meetings with key stakeholders. Apart from judging the perception of the stakeholders, the following questions should be raised in the brainstorming sessions:

- What works? What doesn't? Why?

- What must be avoided? What should not be missed?
- Who must be present? Who must not be present?

Answers to these questions influence the design, development and delivery of the content. In this process, the centre builds the capacity of the partner(s) as well.

"We could only do two half-day awareness-creating seminars a month when we tried to do everything ourselves – organisation, lecture, handling participants, etc. Now, we are able to do 70 or more awareness-creating workshops a year by 'piggybacking' on others' events, such as industry association meetings. We also look for non-technical opportunities, such as the Lions Club, which are also good ways of reaching our target audiences."

- NCPC, India

Deciding the content

The content of the awareness programme should preferably be in a language and style that the stakeholders are most familiar with. As a general principle the content should be easy to read and grasp and not overwhelming. This may require text to the point and in a summary form that uses bullets, boxes and deploys effective visuals.

The content of the awareness programme should be based on four important elements viz. concept, experience, methodology and contacts. Such content structure generally addresses most of the barriers that need to be resolved.

a. *Concept*: This element should include a summary of the evolving relationship between the target stakeholders and the environment, the definition of cleaner production, its relationship with other concepts that are relevant or better known to the target stakeholders, and the benefits of cleaner production. Ideally, the concept should be communicated through a driving message.

The driving message will differ depending on the target stakeholders. For instance, for manufacturing industries the driving message could be "cleaner production to save raw materials, water and energy", "cleaner production to improve productivity", "cleaner production to improve health and safety", "cleaner production to reduce the quantities of waste and pollution generated and the costs of their control and proper management", etc. In such messaging, it could well be more effective (depending on the target stakeholders) to emphasize the economic and business related benefits more than the environmental benefits.

It is critical to pass the message that practicing cleaner production entails an increase in productivity by virtue of increased outputs and / or reduced inputs, which in turn leads to increased profitability.

Remember that there is no universal remedy to overcome all the barriers. For example, in the case of state-owned enterprises, the managers typically focus on meeting set production targets. They are not required to make profits; the prices of products are fixed, and the costs of inputs are often subsidized. The only way to prod these managers into action is by sensitizing other stakeholders; e.g. local regulators, environmental NGOs in the neighborhood and the trade unions. Such managers are typically laggards, respond only on pressures and unfortunately look at cleaner production only when directed.

Again, not all owners are interested in maximizing profits. A good many may be quite content with the current level of profit their enterprise is generating and feel no great pressure to further increase profits by reducing operating costs or enhancing efficiency. These owners are often not aware of the changing situations; e.g. emergence of new competitors, supply-chain pressures such as environmental and social codes of conduct, market regulations such as eco-labels, stricter rules on compliance and tightening of environmental standards, etc. Focusing the message on the rising pressures and the advantages of cleaner production as a proactive strategy could help here to overcome the barrier.

This is where citing experience counts and hence has a critical role in the content.

b. *Experience*: The experience with cleaner production is best communicated through case studies. Ideally, the case studies should include national or local experiences. The case studies should cover a wide range of possibilities such as no-cost or low-cost measures for the implementation of high benefit options. It is important that these case studies are presented in a consistent format, complete with technical and financial details. Such case studies may also stimulate demonstration projects, which can in turn lead to spin-offs on cleaner production related investments.

c. *Methodology*: The methodology or scheme is important in order to communicate to the audience the ways to put the cleaner production concept into practice; viz. cleaner production assessments, or scheme for a demonstration project, etc. It is also important to clarify linkages with other systems and methodologies [e.g. the ISO 14001 Environmental Management System (EMS), life-

cycle assessment, etc.], so that the audience understands their similarities and distinguishing features[1].

d. *Contacts*: Contacts are important as they provide the stakeholders with an opportunity to obtain more specific information or seek appointments for one-to-one meetings.

Deciding the delivery mechanisms

Several mechanisms can be employed in the delivery of content, and they could be used either singly or in combination, whichever gives the best results. The delivery mechanisms should be suitable to the type of content and target stakeholders. Awareness-raising mechanisms are most effective when they take into account local conditions, language, culture, traditions, etc. Here, the partner can provide useful insight to the centre based on its past experiences. The delivery mechanisms can be broadly divided into event-based and tool-based approaches. The event-based delivery mechanisms include:

- One-to-one meetings;
- Seminars / conferences;
- Workshops;
- Organising field visits;
- Holding or participating in exhibitions; and
- Conducting radio and television shows.

Seminars / conferences and workshops are the most commonly used delivery mechanisms. While seminars and conferences focus on the concept and case studies, workshops are useful to deepen the concept in terms of methodologies and to gain experiences of putting the cleaner production concept into practice. Half-day seminars are particularly useful in influencing top management, whereas one-day workshops focusing on themes such as energy efficiency, water conservation etc. are more suited (effective) for middle-level management. Getting the centre staff to participate in a seminar or a workshop on a related topic organized by a partner or

[1] Refer to **Section 1.4.2** of **Part 1** of this Manual for an elaboration on "Cleaner Production and Environmental Management Systems".

other key stakeholder is good strategy, especially in the early days of operation of the Centre.

Keep in mind while organizing such seminars / conferences, that the primary focus of awareness raising is retained. The focus should not diverge into skill-building or training at this stage.

One-to-one meetings serve as good follow-up mechanisms after a seminar or a workshop, moving a stakeholder to the next intended step such as undertaking a cleaner production assessment or taking part in a demonstration project. Field visits are a good complement or add-on to a seminar or a workshop. Generally, a field-visit by the attendees to a seminar or workshop to a facility where cleaner production has been implemented helps in raising awareness effectively. Holding exhibitions is also a useful method of raising awareness on cleaner techniques and technologies -- both the know-how and the equipment. In the early stages, it may be difficult and resource intensive for a centre to organize an exhibition on its own; however, Directors should certainly explore putting a stall or a booth at exhibitions organized by others.

Conducting radio and television shows is useful to communicate the cleaner production concept to a wide cross-section of businesses and the general community. These shows are effective if a campaign-based approach is used, where the Director of the centre interviews every week or fortnightly business leaders who have taken a lead in implementing cleaner production. Such shows would typically require a sponsor (or multiple sponsors), since the centre would probably be unable to budget for them. In order to avoid conflicts of interest, care should be taken to ensure that the business leaders being interviewed do not form part of the sponsor family. Rather, sponsors may be sourced from the Government, corporations (other than those being interviewed) and relevant trust funds.

The tool-based delivery mechanism can be used by a centre in isolation or in combination with the event-based delivery mechanisms described above. These mechanisms include:

- Developing videos;
- Distributing brochures, banners, posters;
- Bringing out newsletters;
- Operating websites;

- Writing newspaper articles; and
- Publishing articles in scientific or business journals and periodicals.

Typically, videos are prepared at a stage when a centre has successfully completed a number of cleaner production assessments and demonstration projects. Here, videos are basically created to document and narrate the experience thereby making them effective tools in the seminars and workshops.

Brochures, banners and posters are useful to promote as well as to sustain the awareness-raising programmes. For example, brochures are effective if distributed before a seminar or a workshop. Banners may be provided to those organizations that have signed an MoU with the Centre to undertake a cleaner production assessment or a demonstration project. When such banners are placed on the gates of the factories, the workers of the factory as well as the community in the neighborhood get sensitized about cleaner production. Posters are an excellent mechanism for communicating the concept of cleaner production to workers in the work place, as well as the company / enterprise staff.

Operation of websites, newsletters and scientific articles (in a journal) should be the preferred mechanism for introducing cleaner production to professionals and other stakeholders such as community-based NGOs, regulators and administrators. The websites should also include feedback and registration forms, so as to understand the nature and information needs of frequent visitors.

4.2.4 Conducting Awareness-raising Programmes

Conducting awareness-raising programmes refers to logistics, sharing of responsibilities, promotion of the event, and actual conduct of the event.

Logistics include deciding on the venue, timing and duration of the awareness-raising programme. Promoting and conducting the actual programme are the joint responsibility of both the centre and the partner(s). We will confine ourselves here to the event-based delivery mechanisms described in the earlier section.

Who should conduct awareness-raising programmes?

The Director of the centre must spearhead the awareness-raising programmes, at least in the initial phases. Later, the senior staff of the centre may carry out this function.

The representative(s) from the partner organization(s) should also play an important role. Other important speakers could be local lead stakeholders; e.g. a representative of a company that has implemented a cleaner production demonstration project, or representatives from Implementing Agencies if tough new regulations have been enacted, which the Government is determined to implement.

When should awareness-raising programmes be conducted?

There are some practical points that need to be kept in mind while deciding the timing and schedule for awareness-raising programs:

- Where possible, time an awareness-raising programme to coincide with any major policy or regulatory changes affecting the target stakeholders (e.g. removal of a subsidy that would increase cost of raw material, or tightening of effluent standards etc.).

- Alternatively, conduct awareness-raising programmes following any major market development; e.g. imposition of an eco-label.

- Target presentations for slots during major seminars / workshops where a large gathering of target stakeholders is expected.

- Avoid conducting programmes during local holidays, periods of financial closing (monthly or annual) and peak production / business times (in the case of manufacturing or service organizations).

Where should awareness-raising programmes be conducted?

Deciding the venue of the programmes is significant from the following perspectives:

"Instead of organizing our own meetings and workshops ourselves, which proved to be very expensive, we now are doing more presentations at industrial meetings. Especially the smaller chambers of commerce and industry – at the municipal or regional levels – as this is more effective because more interested people go there instead of going to the large chambers."

- NCPC, Mexico

- The venue should be easily accessible to most of the participants or target stakeholders.
- The venue should also be decided based on the content of the programme. For instance, awareness-raising programmes targeted to promote demonstration projects could best be conducted on-site (i.e. at a facility where demonstrations have been already undertaken) rather than in a conference room.
- If a field visit is planned after a seminar, the venue should be close to the facility that will be visited.

4.3 Training

Training is typically the next activity a centre will get involved in once the awareness-raising programmes have been going for a while. Training helps to build the capacity of professionals so that they can put the cleaner production concept into practice. Training is both resource intensive and time consuming and hence a strategic approach is necessary.

We will develop the topic of training in this section following a similar approach to the one used in creating awareness (see **Figure 4.4**). Each of the milestones of the cycle described below is explained in the following sections.

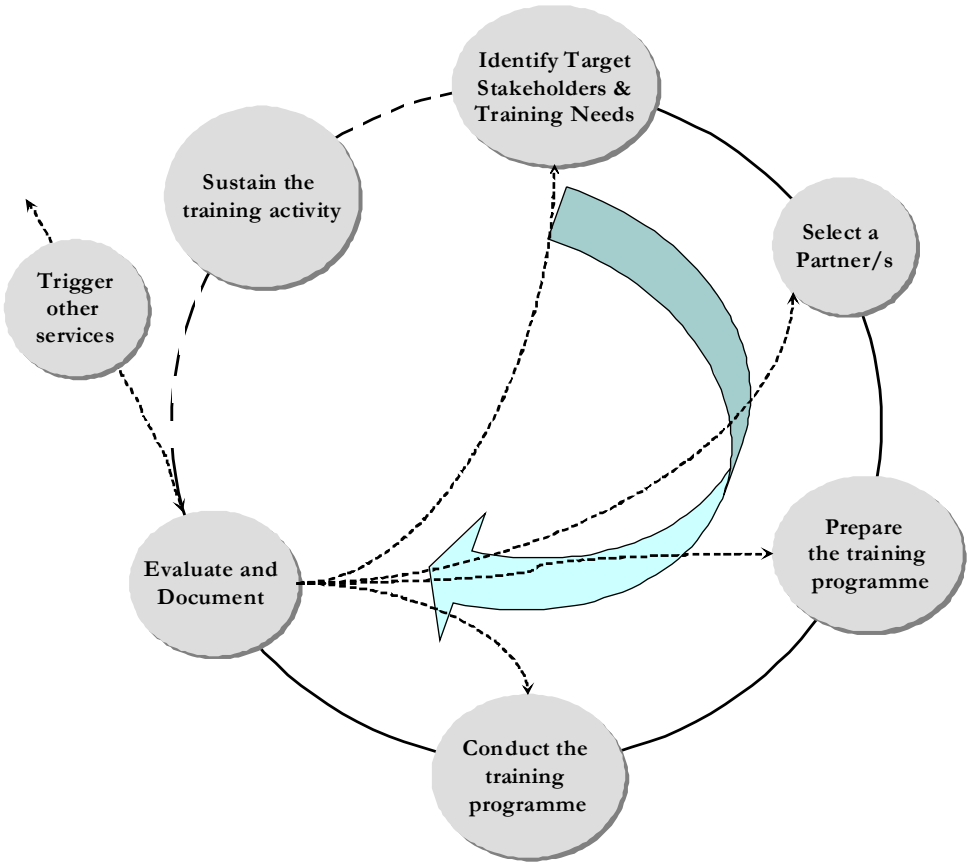


Figure 4.4: A Strategic Approach for Creation and Sustenance of Training Programmes

4.3.1 Identification of Target Stakeholders and Training Needs

The first task for a centre is to identify the target stakeholders for training and to understand their training needs. Typically, the target stakeholders are those where the awareness creation process has been already initiated.

To plan training programmes, the Director of the centre should prepare what is known as a Training Needs Assessment (TNA). The basic outcome of a TNA is to understand the training modules needed for the various types of stakeholders. A TNA is best prepared by sending questionnaires to representative stakeholders followed by one-to-one meetings.

The questionnaire should include topics of training modules with a brief description of their contents, and the representative stakeholder

(typically the training officer of the institution) should indicate which training modules are relevant and indicate the number of staff/members that could be trained under each module. The questionnaire should also seek comments on the proposed contents/ coverage of the training modules. Additional training modules may also be listed. The outcome of such a survey across the target stakeholders can be captured in a format as shown in **Table 4.1**.

Table 4.1: A Format for Training Needs Assessment[a]

Trainee Types	Topics of Training Modules					
	Cleaner Production Assessments	Economic and environmental evaluation of options	Cleaner technologies	Eco-design	Cleaner Production Policies	….
Managers						
Technical staff						
Consultants						
Financial specialists						
Officers from Ministries						
…						

[a] Number of staff to be filled in the blank spaces

In the long run, it is recommended that Directors prepare a training brochure with the annual schedule of training programmes that the centre will offer. An up-to-date TNA would form the logical input to such a brochure. The brochure should be disseminated to various target stakeholders so that interested persons can identify appropriate training programmes and plan to attend them. The brochure would provide details like coverage of each training module, target stakeholders, faculty profile, schedule, venue, contact persons, and so on.

4.3.2 Selection of (a) Partner(s)

It is obvious that the centre should not attempt to deliver all the needed training modules by itself. The Director of the centre should seek appropriate partner(s) to help in undertaking this task.

We have already noted the requirement, importance and criteria for selecting a partner for the purposes of awareness raising. The same criteria apply for selecting a partner for conducting training as well.

Generally, the partner in awareness-raising programmes should be the first choice for training as well. However, it is possible that the partner selected for awareness raising has less interest in training or is less experienced in conducting training programmes. In such cases, it may be useful to explore additional partners. Typically, universities offering courses on environmental management, energy technology, business management etc., or vocational training institutes are potential partners.

It is worth stressing here that it is extremely crucial for the centre to get this task right at the outset, as one of the additional objectives of conducting training is to develop a network of trainers/training institutions that could assist the centre in meeting its future training needs. This is typically the Training of Trainers approach.

Finally, unlike the awareness-raising programmes, the relationship between the centre and the training partner(s) is important in view of two important aspects:

- Training, unlike an awareness-raising programme, is potentially a revenue generating service. Hence models of revenue sharing need to be clearly defined and perhaps formalized with the training partner(s).

- Training leads to the preparation of specialized content that can have implications of Intellectual Property Rights (IPR). It is important, therefore, to define the ownership of training materials upfront in this perspective.

Box 4.2 highlights the dos and don'ts for nurturing the training partner.

Box 4.2 Dos and Don'ts for Nurturing the Training Partner (s)

Do **not** treat the partner as an outsider.

Ensure that the partner **understands** what is expected of him / her / them; i.e. in terms of donning a part of the training mantle of the Centre, in the future.

Where possible, **sign an MoU** with the partner. This could underscore details of sustaining the training cycle on behalf of the Centre in the future, details of intellectual ownership, revenue-sharing and so on.

4.3.3 Preparation for the Training Programme

Preparation for the training programme would entail the centre's interaction with the partner on the following:

1. The content of the training programme

2. The preferred delivery mechanisms

Deciding the content

The content of the training programme should preferably be in the language and style the stakeholders are most familiar with. As a general principle the content should be easy to read and grasp and not overwhelming. It is important that the content of the training programme reflects the actual training needs and not the content that a centre or its partner can easily provide.

The content of the training programme should be based on four important components; viz. lecture notes, self-assessment questions, case studies and resources. It should test the conceptual, analytical and quantitative understanding of the trainee. Self-assessment questions help the trainer and the participant understand the extent of assimilation of the overall contents of the programme; i.e. the concept, familiarity with the procedures and tools (e.g. material and energy balances, ecomaps, process flow diagrams, etc.[2]), and their applications. To achieve this end, self-assessment exercises could include short problems and quizzes. Case studies induce a problem solving approach by the trainee. Resources can be used by the trainee at a later date as a reference material. Resources can typically include benchmarks, technology fact sheets, important formulae, etc. Such a basic structure of content helps in building the necessary competence of the trainee in the chosen training module.

[2] The terms "material and energy balance", "ecomap" and "process flow diagram" are explained in later sections of this Part of the Manual.

In situations where cleaner production is to be delivered as a new concept, the content of the training programme should focus on creating core competencies. For instance, the content could include the methodology for cleaner production assessments and exposure to some of the basic tools (e.g. preparation of material and energy balances, conducting cause analysis, identification and screening of cleaner production options, preparing implementation plans, etc.).

If the core competencies are already in place, then the content could include broader topics that are more quantitative, or knowledge-driven and discussion-oriented. This can include cleaner technology options in specific sectors, economic and environmental evaluation of options, and allied areas such as environmental cost accounting, cleaner production and EMS, cleaner production policy, cleaner production in educational curricula, etc.

At a tertiary level, i.e. on maturity, training could address concepts that are closely related to cleaner production; e.g. health and safety, green productivity, eco-design, life-cycle assessment and so on.

Deciding the delivery mechanism

There are a number of possibilities in deciding on the delivery mechanisms. The following are some of the commonly used delivery mechanisms. Generally, a mix is recommended to get the best results.

- Classroom instruction;
- Group work based or case study driven instruction; and
- Field or facility based instruction.

Classroom instruction is effective when trainees are to be exposed to fundamental topics such as cleaner production methodology, life-cycle assessments, etc. Group work based or case study driven training sessions are recommended when trainees are to be exposed to problem solving approaches; e.g. setting up of a cleaner production demonstration project. Facility based or in-plant instruction (or training by doing) is preferred when the trainees from the same organization are to be trained for a specific objective; e.g. implementation of cleaner production options etc. This form of training is often used in conducting facility based cleaner production assessments.

Again, training can be delivered in different forms such as:

- A continuous training event; e.g. over three days to five days at one time; or
- A discrete training event; e.g. one day a week over a long duration; e.g. three months; or
- A flexible learning event; e.g. distance learning.

These models should be considered as options to suit the convenience of the trainees. Long duration, discrete training events are best suited when operating a continuing education programme on cleaner production. A continuous training event; e.g. a hands-on training workshop over say 3 to 5 days, is useful to build focused skills in a relatively short time. Distance learning (e.g. by correspondence or via the Internet) is effective to provide basic training on cleaner production to a large number of stakeholders. However, this technique is appropriate only when the training resources are sufficiently built and have been adequately tested or accredited.

4.3.4 Conducting the Training Programme

Conducting training refers to the logistics, sharing of responsibilities, preparation of the training materials, promotion of the event, and actual conduct of the event. Logistics include deciding on the venue, providing required training equipment, and deciding on the timing and duration of the training programme. The promotion and conduction of these training programmes is generally the joint responsibility of the centre and the partner.

Training programmes must be conducted in a disciplined and standardized manner. All the persons involved in conducting the training programme should be provided with standardized templates to prepare lecture notes and overhead projections. Details such as type of font, size, and formatting should be specified to achieve uniformity in the training materials. All materials should be carefully proofread. Key portions of the text may require to be translated depending on the background of the trainees. Hence, the training materials should be prepared well in advance.

The centre should develop a number of checklists for selecting and inspecting the venue, organizing training equipment (e.g. projector, boards, flip charts, pens, microphone system, etc.), assembling and

packaging the training kit (lecture notes, disks / CD-ROMs, files / folders, pens, etc.). It is important that some of the principles of cleaner production be followed while conducting the training programme itself; e.g. photocopying should be done on both sides of the paper, plastic folders / files should be avoided, etc.

How should the training programme be organized?

It is desirable that the training programme includes the following items, apart from the conduct of the actual technical sessions:

- A short presentation on the purpose or objectives of the training programme;
- A self introduction of the participants and faculty;
- Time slotted for discussions/questions after each presentation or session;
- Adequate time for experience sharing by the participants;
- Time reserved at the beginning and close of each day for making any practical announcements;
- Sessions to assess the trainees (short quizzes, group work, etc.); and
- A closing session on evaluation of the training programme.

It is equally important for the trainer(s) to pay attention to time management during the planning, preparation and conduct of the training programme. Here, the senior staff of the centre (e.g. the Director) will have to play the moderator's role.

Who should be conducting the training programme?

The selection of the training faculty is a critical aspect. The faculty must have practical experience in cleaner production and / or allied areas. In addition, the training faculty must be excellent communicators; good communicators make good trainers, whereas technically proficient persons alone may not always be good trainers.

Training programmes run by a single faculty are not effective, however competent the training faculty may be. Hence, the centre should involve at least two to three lead faculty members in designing the content and implementing the training programme. Again, the faculty should be drawn from a mix of experience; e.g. from university, industry, financing institution etc. This helps in widening the perspective. Since a number of different faculty members belonging to different organizations are generally used, the centre should play the role of a "training manager". In this capacity, the centre should organize a meeting of the entire faculty before the conduct of a training programme. This meeting should be used to get to know each other, reduce overlaps in the content, and maintain a consistency in messaging cleaner production.

4.4 Cleaner Production Assessments

The Cleaner Production Assessment (CPA) is perhaps the core service a centre can offer an enterprise. A good CPA helps the enterprise in many ways. The benefits of a CPA include:

- Identification, characterization and quantification of waste streams and thus environmental and economic assessments of loss of resources (material and energy)

- Identification of easy to implement and low-cost cleaner production options that enterprises can immediately implement; and

- Preparation of investment proposals to financing institutions for undertaking medium to high cost cleaner production measures that may require technology or equipment change.

Additional benefits of a CPA include:

- Building a "cleaner production culture" in the company, which is crucial for long-term sustainability;

- Generating local examples / case studies which could be effectively used in training and awareness-raising programmes;

- Helping in the estimation of the potential of cleaner production in the concerned sector and thus in the formation of the basis for sectoral policy reforms; and

- Helping in identifying the technology and skill development needs of the company and sector.

In fact, conducting the CPA is an excellent method of building competence of the staff at the centre, as well as the staff in the participating company.

A CPA should be conducted in a systematic form and not on an ad-hoc basis. A structured approach is necessary to get the best results. Such an approach ensures that the outcomes of CPA are consistent with those identified in the organization's broader planning process.

4.4.1 The Generic CPA Process

A generic CPA process consists of the following steps:

- Planning and organization;
- Pre-assessment;
- Assessment;
- Feasibility analysis;
- Implementation; and
- Monitoring.

Figure 4.5 shows these steps and the related tasks of a typical CPA process.

In this section, we will learn about the CPA process and understand each milestone with associated tools and examples.

While the explanations are oriented to a typical manufacturing enterprise, the guidance is equally applicable to enterprises engaged in service sectors. We will also discuss some of the variations in the generic CPA process.

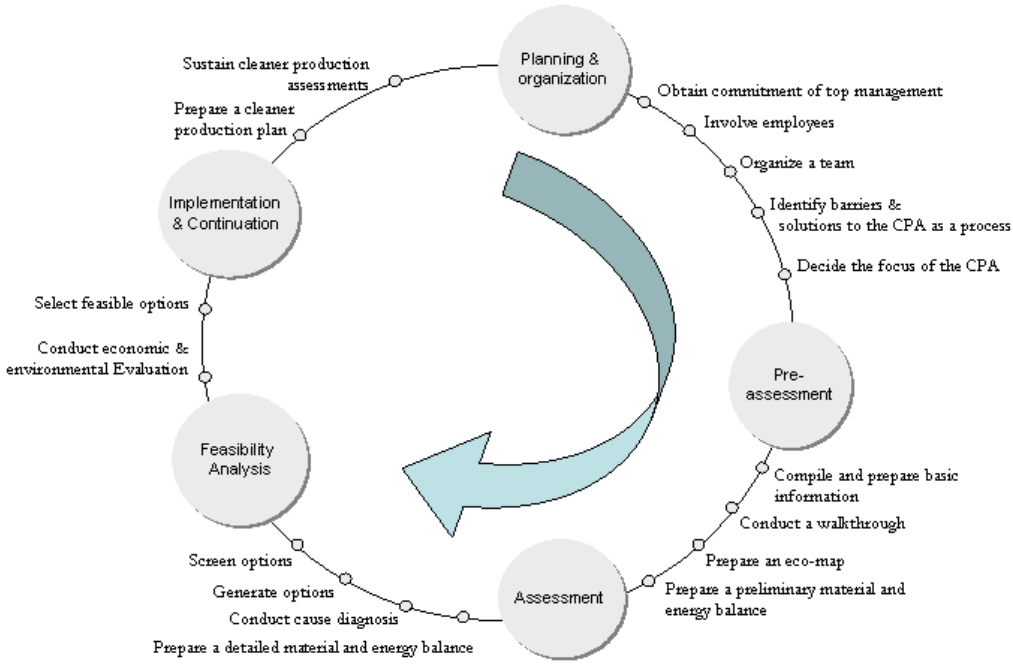


Figure 4.5: Steps and Tasks in the Generic CPA Process

4.4.2 Planning and Organization

Experience shows that the following elements are important for the successful start of a CPA:

- Obtain commitment of top management;
- Involve employees;
- Organize a cleaner production team;
- Identify impediments and solutions to the CPA *as a process*; and
- Decide the focus of the CPA.

Planning can begin once one or a few of the staff members of an enterprise become interested in cleaner production. Often, this is a result of the awareness-raising and training programmes. However, a

CPA can only be initiated after a decision has been made by the management to take action.

Obtain commitment of top management

If the enterprise decides to involve the centre, a meeting is normally required between the centre and the top management of the enterprise to formalize the decision. Typically, an MoU should be drawn up between the centre and the enterprise, defining the objectives of the CPA, a work plan that indicates time frame, the sharing of responsibilities and sharing of the outcomes, and the fee.

The management of an enterprise has to set the stage for the CPA, in order to ensure cooperation and participation of the staff members. Other than signing an MoU, the commitment of top management takes the form of:

- Directing the formation of a cleaner production team;
- Making the required resources available; and
- Being responsive to the results of CPA.

Involve employees

The success of a CPA also depends on the collaboration of the staff. It is important to remember that successful CPAs are not carried out by persons external to the enterprise, such as consultants or the staff of the centre, but by the staff of the enterprise itself, supported if and where necessary by external persons. The staff includes not only the senior management but also the staff on the shop-floor, involved in everyday operations and maintenance. The staff on the shop-floor often has a better understanding of the process and is able to come up with suggestions for improvement. Again, the staff involvement should not be limited to technical or production staff. There can be a considerable role for other departments such as purchasing, marketing, accounts and administration. These staff members provide useful data, especially on "inputs" and "outputs"; assist in the assessment of the economic and financial feasibility of cleaner production options; provide information on alternative raw materials; or, provide market feedback when redesign of products is envisaged.

Organize a cleaner production team

CPAs are best performed by teams, so the formation of one or more teams is an important part of the planning of a CPA. The teams should consist of staff of the enterprise, supported and assisted where necessary by the staff of the centre or by local consultants. Efforts should be made to gel the members of the team by holding frequent meetings. Getting the right mix of team members is crucial, otherwise it is possible that the team may face hindrances from within as well as outside (e.g. from the staff and the workers of the enterprise).

For large organizations, a team could consist of a core team (formed with representatives from different departments) and a few sub-teams for specific tasks. For small and medium scale units, on the other hand, the team could just have the owner or proprietor and a supervisor or manager who looks after the day-to-day operations. This team should initiate, co-ordinate and supervise the CPA activity. In order to be effective, the team should have, on a collective basis, enough knowledge to analyze and review the present production practices. They should have the creativity to explore, develop and evaluate modifications in the production practices. Finally, they must have the competence to implement the economically feasible interventions.

Identify impediments and solutions to the CPA as a process

In order to develop workable solutions, the cleaner production team should identify impediments in the CPA process for a particular enterprise. For instance, there could be impediments in obtaining information from some of the departments. The team should highlight such difficulties right away so that adequate directives can be issued by the management to resolve the issue before the start of the CPA itself. Other impediments could include lack of awareness and / or skills amongst the workers and staff of the enterprise on cleaner production. Solutions to such impediments would typically include performing in-plant awareness-raising sessions, conducting associated training activities, providing and explaining relevant case studies and so on.

Decide the focus of the CPA

Deciding the focus of the CPA involves making decisions concerning:

- The *scope*; i.e. whether to include the entire plant or limit the CPA to certain units / departments; and

- The *emphasis* in terms of materials; e.g. water, energy or chemicals.

In the case of a textile industry, for instance, the garmenting department is often excluded, as it does not lead to major consumption of resources or generation of wastes or emissions. In the case of a cement industry, water is not given much emphasis in the CPA as against focus on energy and materials.

4.4.3 Pre-assessment

The first step the cleaner production team will execute is a pre-assessment. This consists of four important tasks:

- Compiling and preparing the basic information;

- Conducting a walkthrough;

- Preparing an eco-map;

- Carrying out preliminary material and energy balances.

Compile and prepare basic information

In this step, the cleaner production team generates two important outputs:

1. A Process Flow Diagram (PFD; and

2. An eco-map of the site.

We will learn about how the team can produce these two outputs in this sub-section.

Preparation of Process Flow Diagram

The preparation of a PFD is an important step in the CPA. To construct a PFD, it is best for the cleaner production team to start by listing the important unit operations right from receipt of raw materials to the storage / dispatch of final products. Next, each of the unit operations can be shown in a block diagram indicating detailed steps with relevant

inputs and outputs. By connecting the block diagrams of individual unit operations, a PFD can be constructed. Sometimes, the best way to create and firm up a PFD is to conduct a number of walkthroughs (see next section).

While preparing a PFD the team should keep the following points in mind:

- Use blocks to denote the operations. For each block, write the name of the operation and any special operating conditions that need to be highlighted; e.g. for a dyeing operation, it may be pertinent to indicate 90° C and 1.2 atmospheric pressure.

- Show points of inspection or quality control in the PFD. Indicate what happens if the material quality is not according to standards. You may need to show whether the materials are rejected or whether they are reprocessed with and without certain additions. This can be done by developing separate flow charts of the rejection scenario.

- Show all inputs and outputs at each block, indicating major raw materials, intermediate and final products, water and steam as applicable; wastewater, air and solid waste emissions. If quantitative records are available, then these could be shown either on the PFD in the form of tables or referred to as attachments to the PFD.

- The PFD should use various symbols to add more information about the process. For instance, indicate clearly whether the operations are batch or continuous. Also, solid and dotted lines can be used to show continuous or intermittent release of emissions, respectively. Colour codes may also be used; e.g. green lines to indicate recycled streams and red lines to indicate release of wastes, etc. All these symbols need to be reflected in a key to the PFD. It is also useful to show the time required for each operation as a typical range; e.g. "2 to 4 hours", to improve understanding of the process.

- Due attention should be paid to capture start up, shut down and maintenance related activities; seasonal product or production related changes etc. This is best done by preparing a flowchart that indicates how a process or unit operation is operated for a special situation.

Figure 4.6(a) shows an illustration of a PFD for a wet-textile processing factory.

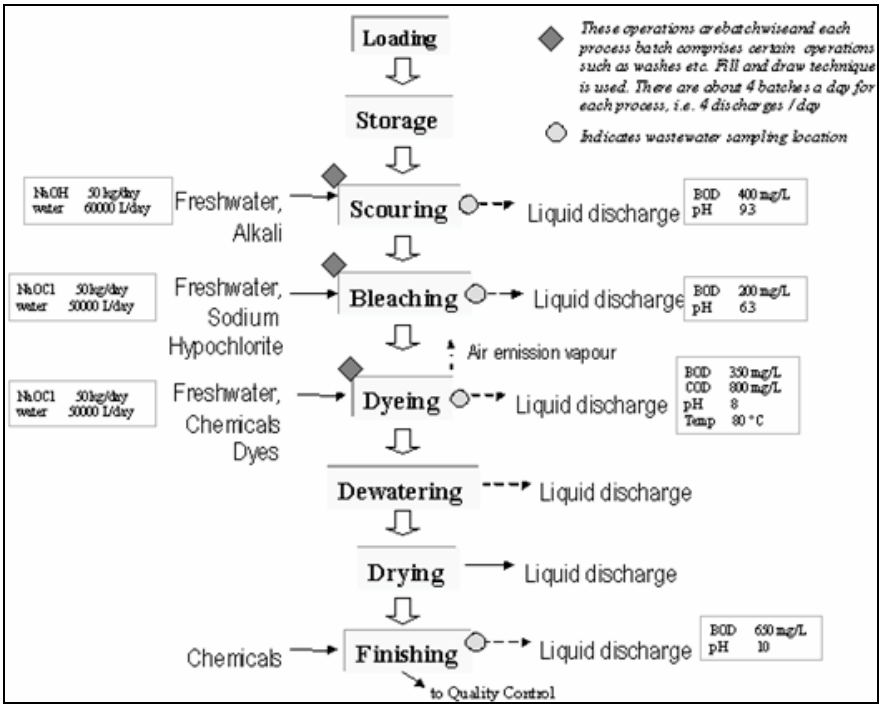


Figure 4.6(a): A PFD for a Wet-textile Processing Factory

Figure 4.6(b) provides a flowchart showing decision points for special situations within it; i.e. whether bleaching and scouring is required, whether the material needs to be dyed.

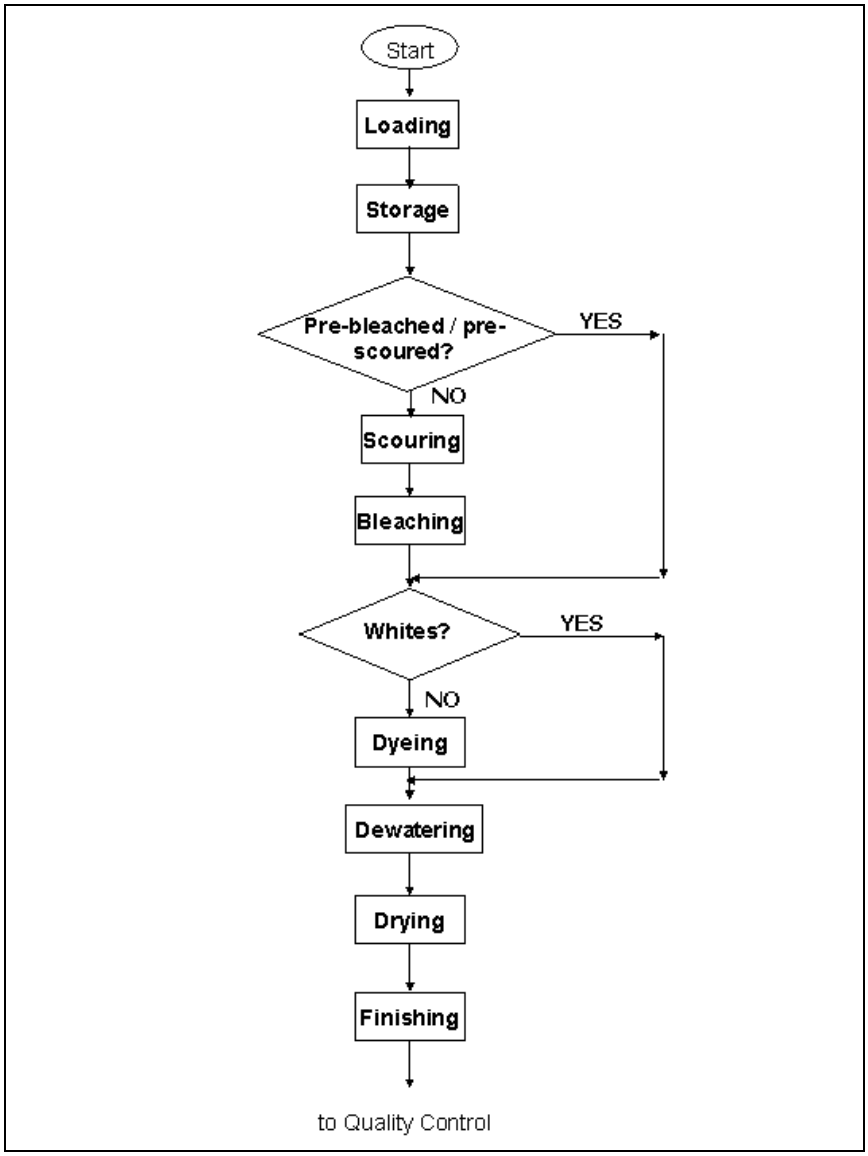


Figure 4.6(b): A Flowchart Indicating a Process Operation in a Wet-textile Processing Unit for Special Situations

Conducting a walkthrough

A walkthrough is the single most effective technique for getting first-hand information about a production operation in a short time. The cleaner production team should not carry out a walkthrough when the operations are closed (e.g. on the weekend, or during low production cycles, or night shifts). The team should begin every walkthrough from the raw materials receiving area and end it at the department concerned

with the finished product. A walkthrough thus essentially follows the PFD.

The walkthrough should also cover all the support utilities such as boilers, power generators, fuel storage tanks, pump-houses, refrigeration plants, raw water treatment plants, wastewater treatment facilities, etc.

Box 4.3 provides a checklist of recommended questions while conducting the walkthrough. These questions provide leads for discussions and, importantly, to get an insight on cleaner production options.

Box 4.3 Checklist of Questions to be Asked During the Walkthrough

Work floor or shop floor -

- Is the floor dirty or ponded?
- Can the workers move about easily? Is there unnecessary piling of raw materials and stocks?
- Is the layout optimum; i.e. can the workflow be improved to minimize movement of materials and walking time?

Storage areas -

- Is the storage system FIFO (i.e. first in first out; raw material is utilized based on the date of procurement, giving preference to old stock) or LIFO (last in first out; fresh raw material is utilized first, while the old stock of raw material remains unutilized)?
- How are the received raw materials checked for quality?
- Are there frequent instances of receiving raw materials that do not meet the required specifications? What happens to the rejects?

Equipment and process -

- Is the process operated as per the Standard Operating Practice laid down by the equipment/technology provider? What are the reasons if there are any variations?
- Is the equipment upkeep regularly conducted? What are the operating efficiencies of the equipment? Are machine breakdowns or problems recorded and their causes corrected regularly?
- Are quality assurance / quality control done for the finished and intermediate products? How frequently? What are the

current results?

Boiler and steam distribution system -

- Are there any leaking joints, glands, valves, safety valves?
- Is the condensate being returned to the maximum extent possible?
- Are the condensate return lines and feed tanks jacketed or lagged?
- Are steam traps of correct types being used for each process?
- What is the fuel used? Is it of a consistent quality and composition?
- What is the source of water? Is the raw water treated before use?
- What is the type of boiler (e.g. single pass / double pass, etc.)? How frequently does the boiler blow down?

Waste and emissions -

- Is the waste properly collected, segregated and transported?
- Is the waste generation continuous? Or in spurts?
- Are any measurements made of waste generated or emissions emitted?
- Are any valuable raw materials or products wasted as part of the emissions? Is it possible to reuse or recycle them if recovered?

Box 4.4 lists the dos and don'ts that may be followed while conducting the walkthrough.

Box 4.4 Dos and Don'ts to be Followed During the Walkthrough

Do **not** find faults. A walk-through is not for fault finding. It is to understand **material and energy flows** better, and to generate ideas for **efficiency gains**, **higher profitability** and **overall environmental improvement**. A walk-through is also to "make friends" for **future contacts** and **possible partnerships**. Hence, do not be critical, but be **constructive** and make **suggestions**.

Do **not** dominate or take over the conversation. During the walkthrough, give a chance for the responsible staff to speak and explain.

Do **not** ask questions to show your knowledge about the process or **digress** by sharing information that you know but is **not relevant**.
Ask questions only when you must. If you do not understand explanations provided and feel that they are absolutely critical, then make a request to explain again. **Do not feel shy to express your inability to understand.**

Do **not** leave the group. It can project a not-so-polite image.

Ensure that you **meet the timeline** earlier agreed.

Always keep track of the outputs you are expected to produce. **Observations should be made** to allow for the correct development of the layout and the PFD. **Notes should be taken** to allow computation of preliminary material balances. It is also important to obtain information on **individual operations** and key **operational sequences**.

Box 4.5 presents some of the resources that the team would need to prepare for before conducting a walkthrough.

Box 4.5 What You Should Equip Yourself with While Conducting the Walkthrough

A camera to take photographs (note that if outsiders are involved in the team permission from the management for use of the camera is essential).

Scrap book A3 size to make quick sketches, especially for layouts, Eco-maps (see the next sub-section) and PFD.

Color pens or highlighters to mark important points.

A tape recorder to record your site observations; however, care should be taken that it does not intimidate personnel on the factory floor.

Preparation of an eco-map[1]

Eco-mapping is a very useful tool for a cleaner production team to use, especially for capturing the observations made during the walkthrough. It is a simple and practical tool to represent visually issues of concern as well as note some of the good practices. Using an eco-map, corrective measures can be implemented to improve not only the environmental performance of a company but also the efficiency of its operations.

Eco-maps are often direct indicators of the housekeeping status of the enterprise. Eco-maps can be developed for specific themes as the following:

- Water consumption and wastewater discharge;
- Energy use;
- Solid waste generation;
- Odours, noise and dust; and
- Safety and environmental risks.

To draw up eco-maps it is easiest to use layout maps of the site. The enterprise may already have such layout maps. If so, before using them it is important that the team adds / verifies the various details by actual inspection. Many a time, records like maps are not always updated. If the enterprise does not have layout maps, the team should construct them. As far as possible, the team should ensure that layout maps are drawn to scale, preferably on A3 size sheets, covering the following:

- *Layout map of the entire operations in the organization*: This map should show the internal roads, entry and exits, raw materials storage, waste storage, processing, disposal facilities, utilities such as boilers, stack positions, storm water drains and wastewater outlets.
- *Layout map of key departments:* For enterprises with a number of large departments, layout maps may be drawn for departments of concern indicating the positions of the major

[1] For more information on eco-mapping, visit the web page of the International Network for Environmental Management on Eco-mapping at: http://www.inem.org/htdocs/ecomapping/ecomapping_cs.html

equipment, water piping; steam lines; drains and vents / stacks. If the department has multiple floors then a separate layout map is required for each floor.

Figure 4.7 shows an illustration of a typical plant layout.

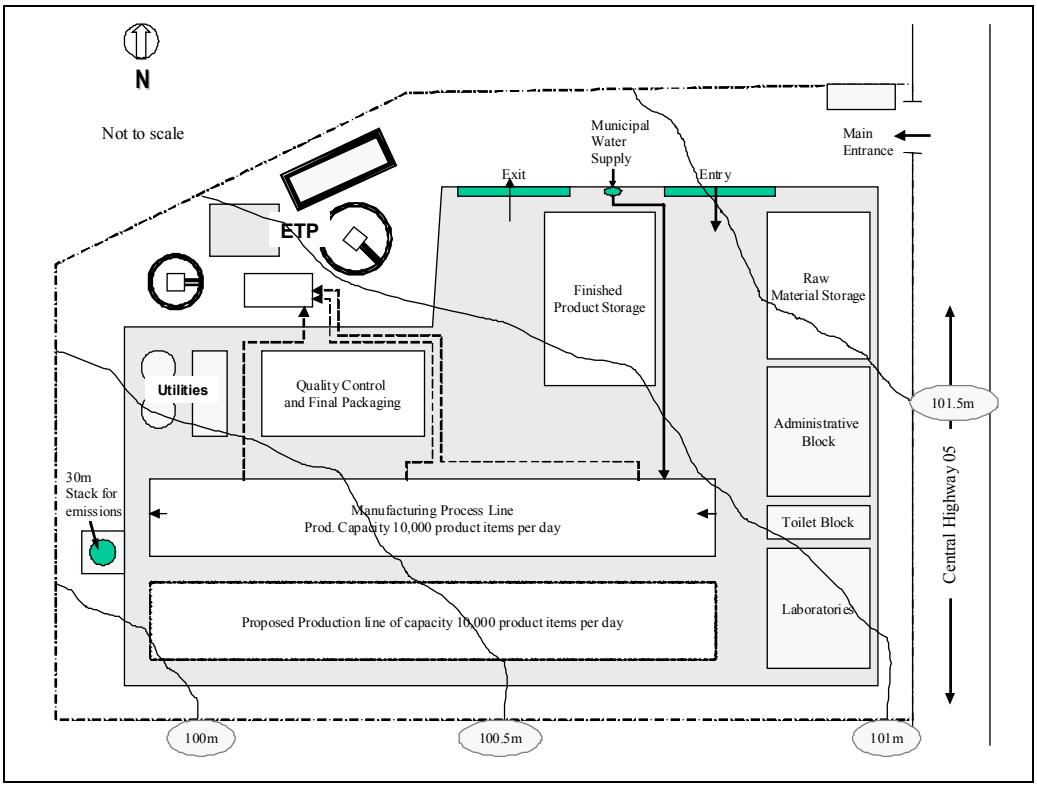


Figure 4.7: Typical Layout Map for a Manufacturing Factory

For each eco-map, the team should make sure to include everything related to the particular problem being studied. For instance, an eco-map for water consumption and wastewater discharge must pinpoint the location of overflows, spills or excessive use of water etc. These areas can be further marked using colour codes or distinct symbols to show areas that have to be monitored or areas where problems will have to be dealt with as soon as possible. **Figure 4.8** shows a typical eco-map.

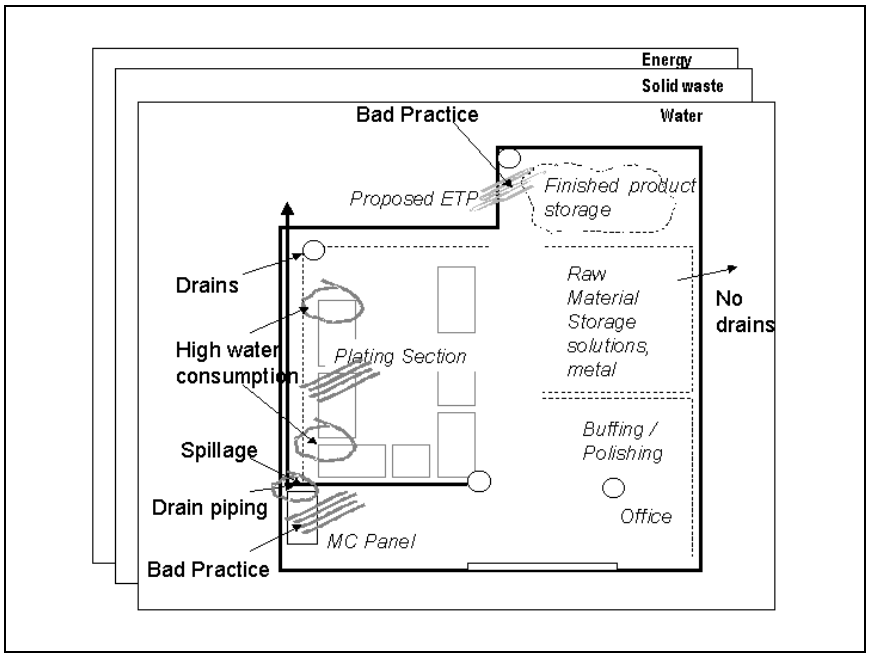


Figure 4.8: An Illustration of an Eco-Map for Water in an Electroplating Factory

The team should use eco-maps in the task of problem identification, where visual overlays of eco-maps for various utilities or resources can identify problems. Also, they can be used during monitoring and review, where the eco-map developed *before* can be compared with the updated eco-map after cleaner production option implementation so as to examine the change. To ensure that eco-maps continue to serve their purpose, they should be updated once a year or every time the work site is renovated or operations expanded.

Preparation of a preliminary material and energy balance

A material and energy (M&E) balance is a basic inventory tool, which allows for the quantitative recording of material and energy inputs and outputs. The basis of the material balance is the PFD. An essential step in the M&E balance is to check that "what goes in must come out somewhere." All inputs should thus have related outputs.

Material balances are typically carried out to make an inventory of the material flows (raw materials, chemicals, water, energy etc.) entering and leaving a manufacturing / service company. Energy balances are useful to find options to minimize the use of energy or to recover the energy lost in the system.

The first task for the team here is to conduct a preliminary M&E balance at processes or departments that have been identified in the planning stage as the focus.

Preliminary M&E balances are normally prepared using secondary data, supported by the information recorded during the walkthrough. Water and energy bills paid give some idea of their consumption levels. On the output side, production figures or orders serviced over a certain period of time can give an estimate of average production. Obtaining figures on wastes and emissions is generally more difficult. Sometimes, concentration data for water and air pollutants exist, which can be estimated back to mass emissions, while data on mass or volumes of solid waste are sometimes available. Often, approximate calculations will need to be used, based on "typical" values given in the literature.

A material balance normally requires a tie compound, which forms the basis for measuring the efficiency of the processes. The selection of the tie compound is a function of several possible parameters; it could be:

- *An expensive resource*
- *A toxic or hazardous compound*
- *A resource common to most of the processes*
- *A parameter which is easy to measure / record*

An energy balance is generally carried out through the following steps:

1. For each type of fuel used (e.g. electricity, gas, diesel, fuel oil, etc.), write down the amount consumed over a given period, along with the per unit cost and the total cost for the period, show which of the fuels is used in each area of operations, and show energy flows between the areas.

2. Estimate the proportion of each fuel used in each area of the operations. To do this, the cleaner production team should prepare a list of the rated energy consumption of the equipment, number of equipments and the type of the fuel used. Once done for each of the areas, the percentage usage of each fuel in each area can be calculated.

Generally, M&E balances at this level are best set by examining three months of data and computing monthly averages. Care should be taken to ensure that all quantification is expressed in the right units (preferably SI units), that they are uniform, and that the associated costs are provided.

4.4.4 Assessment

Preparation of detailed material & energy balance

It is probable that the cleaner production team finds substantial discrepancies in the preliminary M&E balance. This may require rediscussing the assumptions behind the numbers, conducting measurements, and making whatever revisions are necessary to the data used for inputs and outputs. Hence, the next task for the team is to prepare detailed material and energy balances around certain parts of the PFD. Developing a detailed material balance for each operation is neither practical nor relevant. The critical operations are generally chosen based on:

- The focus of the CPA and results of the preliminary M&E balance arrived at in the earlier steps; and

- The types of materials and processes used; i.e. operations are selected where hazardous materials are used or where materials used are expensive or where materials are used in quantities exceeding the benchmarks. Detailed M&E balances are often performed when the processes have long operational sequences.

Before concluding the M&E balance it could be extremely useful to assign costs to the materials lost or the waste streams that have been identified in the balance. Experience has shown that this could be the single most important information in convincing the management of an enterprise, of the value of cleaner production and securing their commitment for the next steps. While assigning a monetary value to the materials or waste streams, the team should consider the following:

- The cost of raw materials / intermediate products / final products lost in the waste streams (e.g., the costs of unexhausted dye in waste dye liquor);
- The cost of energy in waste streams, in terms of the energy consumed to heat or chill them;
- The cost of treatment / handling / disposal of waste streams, including tipping or discharge fees if any;
- The costs incurred, if any, in protecting the workers and maintaining safe working conditions (e.g., shop floor exhaust systems);

- The potential liability costs from a possible accidental spill, discharge, or leakage.

These costs should be determined at least for each major waste stream. Specific costs (i.e., costs per unit mass / volume of a waste stream) should also be determined so as to be able to compute the savings by reducing or avoiding waste streams. Obviously, the high-cost waste streams would be the most interesting ones to focus on from an economic point of view.

Thus a detailed M&E balance provides the team clues to identify the cause of waste generation or low productivity. We will provide guidance on how to do cause diagnosis in the next sub-section.

Figure 4.9(a) presents an example of a detailed material balance in a wet-textile processing unit.

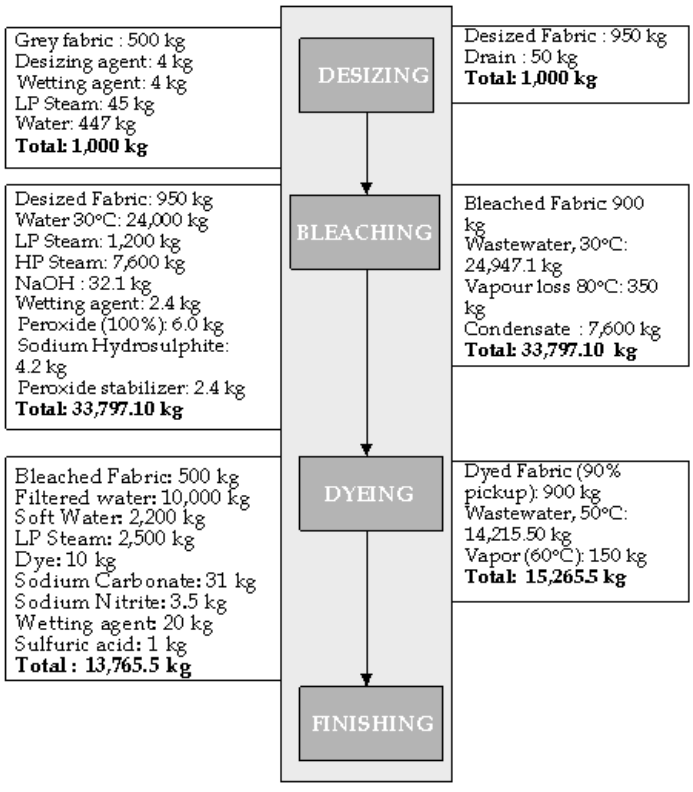


Figure 4.9(a): A Detailed Material Balance in a Wet-textile Processing Unit

Figure 4.9(b) shows a detailed energy balance in the same processing unit.

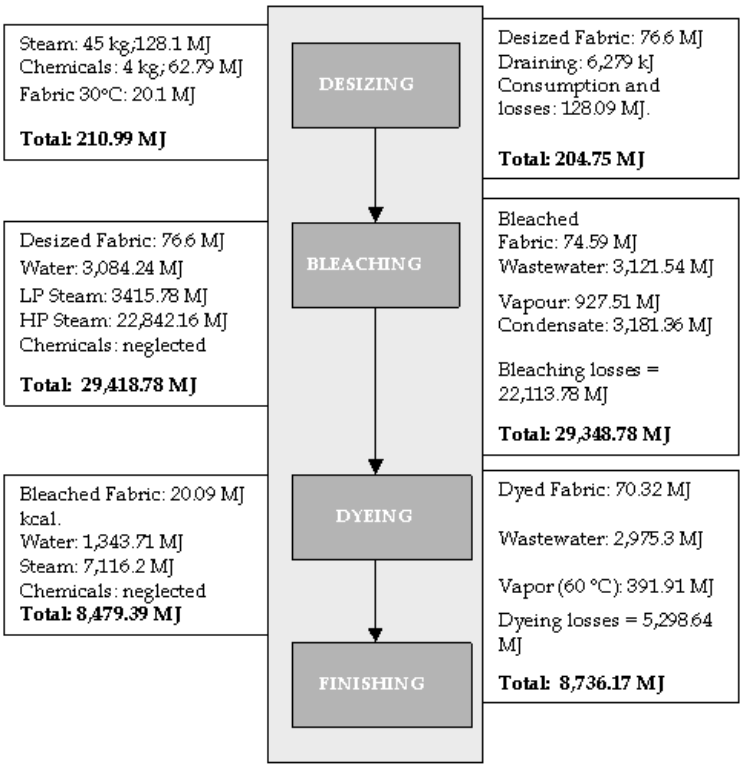


Figure 4.9(b): A Detailed Energy Balance in a Wet-textile Processing Unit

Cause diagnosis through the fishbone diagram

The cleaner production team now needs to start generating cleaner production options. This will be possible through conducting what is known as a cause diagnosis. As the name suggests, the cause diagnosis exercise involves asking the question **"why?"; i.e. "why did such a problem or outcome occur?"**. It is essentially an exercise to hypothesize over the root causes of any problem.

The team can more effectively conduct a cause diagnosis by using a tool known as the **fishbone diagram**. The fishbone diagram is an excellent tool for cause diagnosis in **complex situations where a number of factors are likely to be involved**. Once such a diagram has been

prepared, the team can effectively use it for the generation of cleaner production options (explained in more detail in the following sub-sections).

The technique used in preparing a fishbone diagram is given below. We will use the textile dyeing process as an example. Let us assume that a winch is used as the dyeing equipment.[2] Refer to **Figure 4.10** below.

1. Identify the **principal problem** that is to be diagnosed and write it next to the head of the fish. For instance, one of the common problems in textile dyeing is that the shade of the dyed fabric does not match with the shade specified by the client. This is referred to as "low Right First Time (RFT)". This causes excessive product reject, thus lowering productivity and generating waste (improperly dyed cloth).

2. Identify the **primary causes** of the problem. Primary causes are typically categorized **generically** as **Man, Method, Material** and **Machine**. To illustrate further, primary causes to the principal problem of low RFT could be:

   (a) "Lack of supervision" (Category = **Man**);

   (b) "Dyeing operation not properly carried out" (Category = **Method**);

   (c) "Poor quality of input materials" (Category = **Material**); and

   (d) "Uneven pulling of fabric in the dye liquor" (Category = **Machine**).

   These primary causes are to be listed on the "primary fish bones", as shown in **Figure 4.10**.

3. Every primary cause is the outcome of one or more **secondary causes**. Consequently, this step involves identifying the secondary cause(s) attributable to **each** primary cause. To carry

[2] A winch is an open-top machine with a tub-like structure where the fabric in a "rope" form is pulled through a dye liquor for a number of hours. It is one of the cheapest pieces of equipment used for dyeing, and is therefore extensively used by small and medium sized enterprises.

the illustration further from point (2b) noted above, the dyeing operation may not have been properly carried out due to:

(a) Excessive use of salt in the dyeing operation;

(b) Incorrect procedure followed while dosing the chemicals.

Similarly, for point (2c) noted above, the poor quality of input materials may have been the result of:

(c) Impurities in the dyes used for the dyeing operation;

(d) Auxiliaries for the dyeing operation having exceeded their shelf-life;

(e) Improper storage of fabric used in the dyeing operation; and

(f) Poor quality of water used in the dyeing operation.

These secondary causes are to be listed on the "secondary fish bones", as shown in **Figure 4.10**.

Note that the technique of identifying the possible primary / secondary causes of any problem involves asking the question **"why?"; i.e. "why did such a problem or outcome occur?"**

Interestingly, certain causes appear several times in the diagnosis of primary (or perhaps even secondary) causes. Common examples in this case include “poor water quality used in the dyeing operation” and “lack of clear and concise work instructions”. This allows us to identify common causes, which when corrected could resolve several productivity and environment related issues. Options that address correction of the common causes thus become priority options in drawing the implementation plan.

The fishbone diagram is complete at this point. Primary and secondary causes may be colour-coded for the sake of clarity, although this is not a must. **Figure 4.10** shows the completed fishbone diagram for the preceding example.

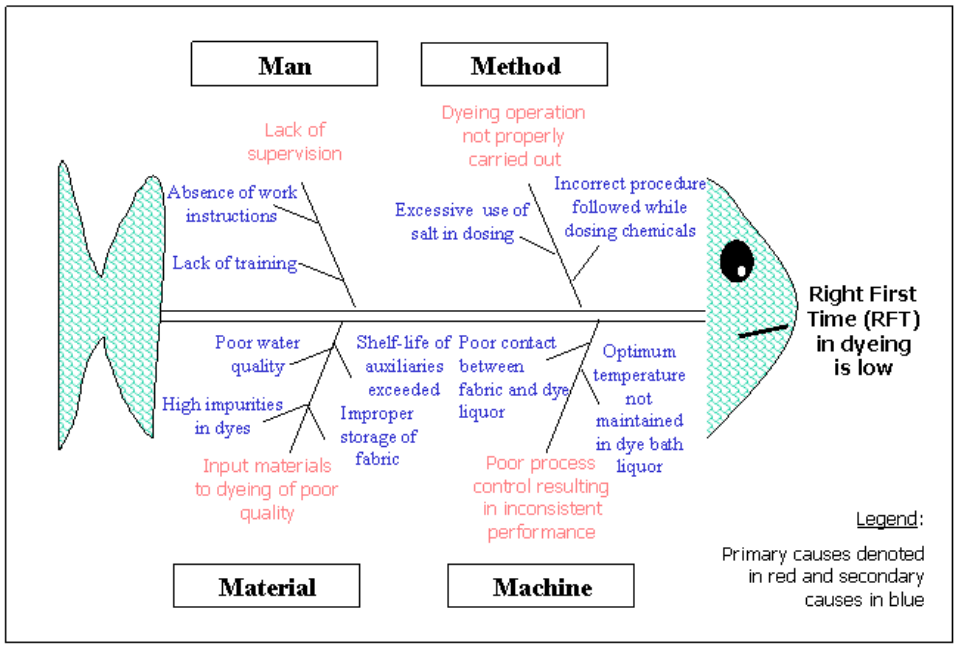


Figure 4.10: Illustration of a Fishbone Diagram to Facilitate Cause Diagnosis in the Dyeing Process

Allotting priorities to the causes identified in the fishbone diagram

The causes identified in the fishbone diagram are only "probable" causes. Thus, the next step is to calculate **the extent to which each particular cause contributes to the principal problem**. The cleaner production team needs to analyse the **extent** to which each of these probable causes contributes to the dyeing operation not being carried out satisfactorily. Such an analysis is possible through observations, record keeping, and setting up well-planned controlled experiments designed to isolate a specific secondary cause.

These efforts can assist the team in **validating** the primary and secondary causes and prioritizing cause elimination.

Tools such as Pareto analysis[3] may be used if a number of primary and secondary causes are to be analysed. The Pareto analysis is used

[3] Sometimes also called the 80/20 rule. This means that 80% of the problems are caused by 20% of the activities, and it is this important 20% that should be concentrated on. Source: Kanji G. and Asher M. (1996) "100 Methods for Total Quality Management."

to separate the most important causes of a problem from the many trivial ones, and thereby identify the most important problems for the team to concentrate on.

Many cleaner production teams stumble at this juncture, since estimating the relative importance of each probable cause seems a wearisome task. **It cannot be stressed too much that teams should be strongly encouraged to push through with this step completely, since it can avoid significant wastage of time (and money) later on in the CPA.**

Cleaner production option generation through brainstorming

Once the points of action and priorities are understood and listed, the cleaner production team should move on to the logical next phase; i.e. option generation.

Option generation is a creative process, and is best performed, as in the case of the cause diagnosis, by the team as well as the enterprise personnel. Including the enterprise personnel in this activity would lead them to have a sense of ownership of the generated options and a deeper sense of understanding as to why a certain option is finally recommended for implementation. The option generation exercise is conducted through **brainstorming**, a commonly used tool for generating ideas. Given a particular item which needs to be resolved, the team and the enterprise personnel have to deliberate on the ways and means of obtaining a solution to it. In this sense, the cause diagnosis described in the earlier section provides a starting framework for the brainstorming exercise.

In a typical brainstorming session, an idea may be proposed by a person, which may be supported and / or extended by other persons. Further discussions yields other new, transformed, opposing and / or supporting ideas, **thus paving the way for the generation of cleaner production options**. The principle question to be asked during the brainstorming session is **"how?"; i.e. "how does one solve this particular problem effectively?"**

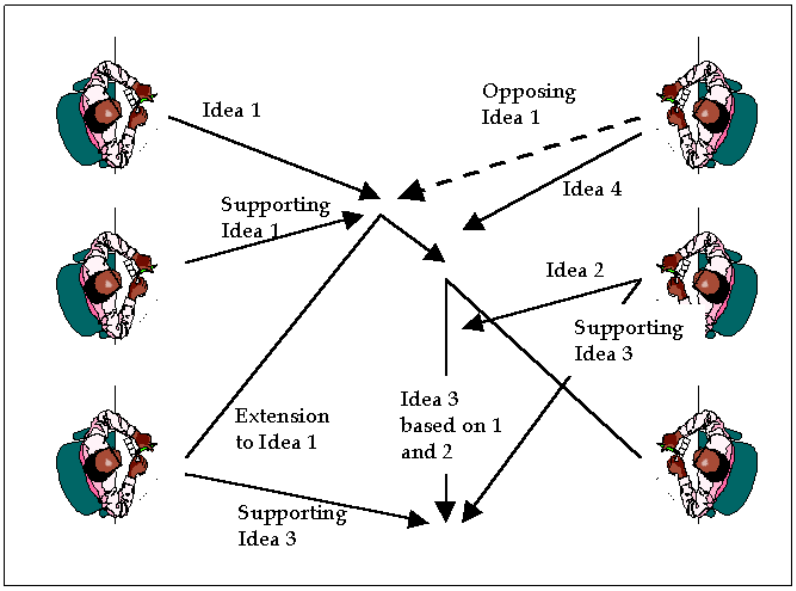


Figure 4.11: Generating Options through Brainstorming

Cleaner production options could fall under one of the following categories:

Housekeeping – Improvements to work practices and methods, proper maintenance of equipment etc., fall under this category. Efficient housekeeping can provide significant benefits in terms of saving resources. These options are typically low cost and provide low to moderate benefits[4].

A simple example of good housekeeping in a dyeing operation is to clean the floors and machines of dirt, grease, rust, etc. regularly, which will reduce the possibility of accidentally soiling the fabric, and thus minimize the need for extra washing.

Management and personnel practices – Management and personnel practices include effective supervision, employee training, enhancing operator skills, and the provision of incentives and bonuses to encourage employees to conscientiously strive to reduce waste and emissions. These options are typically low cost and can provide moderate to high benefits.

[4] For more information on housekeeping, refer to the "Good Housekeeping Guide for Small and Medium-sized Enterprises". Available as: www.getf.org/file/toolmanager/O16F15343.pdf

Process optimization – Process optimization involves rationalization of the process sequence, combining or modifying process operations to save on resources and time, and improve process efficiency. For instance, certain washing operations may not be required due to changes in raw materials or product specifications.

Raw material substitution – Primary / auxiliary raw materials can be substituted if better options exist in terms of costs, process efficiency, and reduced health and safety related hazards. Such an approach may be necessary if the materials already in use are difficult to source, or become expensive, or come under the purview of new environmental or health and safety regulations. In all cases of material substitution, it is crucial to test the suitability of the new material in terms of environmental and economic benefits, optimum concentration, product quality, productivity, and improved working conditions.

For instance, sodium sulphide and acidified dichromate tend to be used as auxiliary agents in the sulphur black textile dyeing process[5]. However, both these agents are toxic and hazardous to handle. Their usage may leave harmful residues in the finished fabric and generate effluents that are difficult to treat and damage the environment. Both these agents may be safely substituted without a decline in fabric quality, thus eliminating adverse health and environmental impacts. Sodium sulphide may be replaced with glucose or dextrose, whereas acidified dichromate may be substituted with sodium perborate or ammonium persulphate. The substitution of chemical dyes with natural dyes may also be cited as an example of raw material substitution.

New technology – Adopting and transferring new technologies can often reduce resource consumption, minimize wastes, as well as increase the throughput or the productivity. These options are often capital intensive, but can lead to potentially high benefits. Modifications in equipment design can be another option, which tends to be slightly less or equally capital intensive as the option for new technology, and can lead to potentially high benefits.

New product design – Changing the product design can cause impacts on both the "upstream" as well as "downstream" side of the product

[5] Sulphur black dyes are generally used to produce a jet black colour in cotton fibres. Sulphur dyes are insoluble and must first be converted to a water soluble form by adding an agent – traditionally sodium sulphide – so that the dyes can be absorbed by the fibre. After dyeing the fabric, the dye is converted back to insoluble form with the addition of another agent, often acidified dichromates.

life-cycle. Product re-design for instance, can reduce the quantity or toxicity of materials in a product, or reduce the use of energy, water and other materials during use, or reduce packaging requirements, or increase the "recyclability" of used components. This can lead to benefits such as reduced consumption of natural resources, increased productivity, and reduced environmental risks. Often, this helps in both establishing as well as widening the market. Product re-design is, however, a major business strategy and may require feasibility studies and market surveys, especially if the supply-chain around the product is already established and is complex.

Recovery of useful byproducts / resources – This cleaner production option entails the recovery of wastes as byproducts / resources, which may have useful applications within the industry itself or outside it. This type of options essentially leads to the reuse / recycle, and thus minimization, of waste as well as to cost savings.

A common example of recovery from a waste stream for many industries is heat recovery through the use of heat exchangers. Such options are typically medium cost and can provide moderate to high benefits.

Onsite recycling and reuse – Onsite recycling and reuse involves the return of a waste material either to the originating process or to another process as a substitute for an input material.

For instance, in the case of a textile dyeing unit, instead of draining off the last cold washes, they can be collected in an underground tank, adjusted for pH[6], and then filtered prior to reuse in subsequent washing operations. These options are typically low to medium cost and can provide moderate to high benefits.

The team should always be made to remember that in general it is better to not generate a waste in the first place, rather than generate it and later recycle or recover / reuse it. **Therefore, the team should only consider the latter type of options once all the others that could prevent waste generation have been examined.**

In reality, many of the options a team will identify result as a combination of the above categories so as to produce cost-effective and sustainable results. For instance, any option of new technology should be preceded and followed by improvements in management

[6] "pH" is a term used universally to express the intensity of an acidic or alkaline solution.

and training. In addition, many a time, the option of new technology also requires substitution of raw materials.

It is important to bear in mind that some of the chosen options may require major changes in the processes or equipment or product. Often, these will dramatically reduce waste generation or increase productivity, but they also often imply considerable investments.

Finally, it is equally important to bear in mind that certain chosen options will require thorough laboratory / bench scale / pilot studies to ensure that the product quality does not degrade as a result of their application, and that it is acceptable to the market.

To round off this section, let us now combine our example of the cause diagnosis through the fishbone diagram with the identification of possible options for cleaner production in the form of a table (see **Table 4.2**).

Table 4.2: Matching the Problems Diagnosed using the Fishbone Diagram with Possible Cleaner Production Options

Generic categories as per the Fishbone Diagram	Primary causes	Secondary causes	Possible cleaner production options	Category of cleaner production option
Man	Lack of supervision	Absence of clear work instructions	Develop work instructions as Standard Operating Practices (SOPs). Get the SOPs reviewed by external experts. Closely monitor improvements or identify problems faced, if any, in the implementation of the SOPs. Build a record keeping system to monitor SOP related compliance.	Management and personnel practices
		Lack of training	Organize shop floor based training programmes for the workers and supervisors.	Management and personnel practices
Method	Dyeing operation not properly carried out	Excessive use of salt in dosing	Improve worker instruction and supervision. Redesign the dyeing recipe by changing composition and materials e.g. use of low salt dyes.	Management and personnel practices, Process optimization, Raw material substitution

Generic categories as per the Fishbone Diagram	Primary causes	Secondary causes	Possible cleaner production options	Category of cleaner production option
		Incorrect procedure followed while dosing chemicals	Improve worker instruction and supervision.	Management and personnel practices
Material	Input materials are of poor quality	High impurities in dyes	Get the dye purity checked by independent institutions over a number of samples and across commonly used shades, change the supplier if necessary	Raw material substitution
		Shelf-life of auxiliaries exceeded	Improve the inspection at the receiving unit. Check the container labelling, storage and supply systems.	Management and personnel practices
		Improper storage of fabric	Ensure proper storage of scoured/bleached materials e.g. on wooden blocks, wrapping to avoid soiling	Management and personnel practices, housekeeping
		Poor water quality	Analyse the water for constituents such as hardness, total dissolved solids, pH and iron / manganese content, and compare the measured levels with recommended standards. Treat water to ensure that the constituents are within the recommended standards.	Raw material substitution
Machinery	Poor process control resulting in inconsistent performance	Optimum temperature not maintained in the dye bath liquor	Check the steam inlet position and steam pressure to ensure that heating is optimum. Take readings of temperature of the liquor before and after requisite modifications	Process optimization, New technology

Generic categories as per the Fishbone Diagram	Primary causes	Secondary causes	Possible cleaner production options	Category of cleaner production option
		Poor contact between fabric and dye liquor	Explore changing from a winch to a jet dyeing machine that is enclosed, operates under pressure and imparts better contact between fabric and dye liquor.	New equipment

4.4.5 Feasibility Analysis

Preliminary screening of options

Once the options are identified through brainstorming, it is important to check whether all causes identified are adequately addressed by the options or whether additional options are required to resolve any causes that still remain outstanding.

The cleaner production team then needs to undertake a preliminary, rapid screening of the cleaner production options developed so as to decide on implementation priorities. In such a screening exercise, the options could be categorized into two classes:

Directly implementable options: Those simple options that are obvious and can be implemented straightaway. Generally, options related to housekeeping (e.g., plugging leaks and avoiding spills) or simple process optimization (e.g., control of excess air in combustion systems) fall into this category. For these options no further detailed feasibility analysis is required. Furthermore, their immediate implementation gives management real, tangible benefits in a short period, which makes them more comfortable with the cleaner production assessment.

Options requiring further analysis: Those options that are technically and/or economically more complex. Most of the options related to management improvement, raw material substitution, and equipment / technology change, would fall into this category. Some of these options could even be put into a sub-category: those that

require much more information collection or are difficult to implement (due to reasons such as very high costs, lack of technology, requiring major changes, etc.). These can be left pending for later consideration.

Detailed screening of options

The team can now undertake a detailed screening of the options in the category requiring further analysis in order to determine which of the options are technically feasible, and ascertain both the economic and the environmental benefits of implementing these options. Each of these aspects is described below.

Technical evaluation

The technical evaluation should cover the following aspects:

Materials and energy consumption – For each option, it is important to establish material and energy balances for conditions before and after implementation to quantify the materials and energy savings that will result.

Product / byproduct quality – Assess the product / by product quality before and after the implementation of the option.

Right First Time – Provide estimates on the possible improvement of the RFT corresponding to before and after option implementation.

It is also important to examine the following aspects from the point of view of implementation.

Human resources required – whether the option can be implemented by in-house staff, or whether external expertise or collaboration with partner organization is required.

Risks in implementing the option - Some options may not be fully proven and may require laboratory scale experiments or pilot studies to assess the outcomes before a full-scale implementation is carried out. Some options may affect the key production process or product features, so the potential impact on the business if the option does not work as planned is very high.

Ease of implementation – The technical ease with which an option can be implemented will depend on such things as the layout

of the production processes and of the auxiliary services such as steam lines, water lines, inert gas lines, etc., the physical space available, the maintenance requirements, the training requirements, etc. Also, if options require working on key production processes, the timing of the options' implementation becomes critical. If the option requires major changes in, or interruptions to, production patterns, any loss in production needs to be factored into the economic analysis of the option.

Time required for implementation – Time required if equipment or material needs to be procured, installed or commissioned including consideration of shut-down time for affecting the implementation of the option.

Cross-linkages with other options – Whether a particular option is linked to implementation of other options and / or whether the option is best implemented stand-alone or in consideration with other options.

Environmental evaluation

The environmental evaluation of an option should ideally take into account its impacts on the entire lifecycle of a product or a service, wherever practically possible. In practical situations, however, the evaluation is often restricted to on-site and off-site (neighbourhood) environmental improvements.

The environmental evaluation should include estimation of following benefits that each option can bring about:

- Likely reduction in the quantity of waste/emission released (expressed on a mass basis);
- Likely reduction in the release of hazardous, toxic, or non-biodegradable wastes/emissions (expressed on a mass basis);
- Likely reduction in the consumption of renewable natural resources (expressed on a mass basis);
- Likely reduction in consumption of non-renewable natural resources, e.g. fossil fuels consumed (expressed on a mass basis);
- Likely reduction in noise levels;

- Likely reduction in odour nuisance (due to elimination of an odorous compound);

- Likely reduction in the on-site risk levels (from the point of process safety);

- Likely reduction in the release of globally important pollutants, viz. ozone depleting substances, greenhouse gas emissions.

Economic evaluation

The team must now evaluate the economic benefits of all the reductions in waste generation and resource consumption that each option can bring about. It must estimate the immediately obvious savings in the purchase costs of materials and fuels, the treatment and disposal costs avoided as well as the material and waste stream costs (identified during the M&E balance earlier). However, it must also estimate less obvious financial benefits such reduced sick days for workers or generally higher worker productivity, lower personnel costs from reducing the burden of special management and reporting of hazardous materials, wastes and pollution, reduced worker and environmental liability, potential profits from sale of waste as by-product, from carbon dioxide credits, etc. Experience has shown that such an *expanded* financial assessment often helps in considerably improving the economic feasibility of an option.

The team must also estimate the economic costs of each option, in the form of investments in new technology or equipment, but also in terms of training and other costs ancillary to the implementation of the option.

These benefits and costs are then analyzed and computed using various evaluation criteria [e.g. pay back period, Net Present Value (NPV), Internal Rate of Return (IRR), etc.].

A simple **payback period** is evaluated based on a comparison of the annual savings and the initial investment. It simply indicates the time period to return the initial investment.

It is calculated as,

Payback Period in years = (Capital Investment/Annual Savings)

The payback period should be generally considered only as a ballpark assessment as it ignores depreciation of the investment made and the time value of money. Usually, investment decisions can only be made on the basis of payback period alone if the investment required is low and / or the returns are high so that the payback period is less than two years.

If these conditions are not met, a better approach is to use the concepts of NPV or IRR. These concepts consider the time value of cash inflows and outflows during the useful life of the investment made. This kind of economic evaluation requires information on:

- The capital costs associated with any investments required;
- Net revenue, which is computed as a difference between total revenue (that could be higher than the base case) and the operating costs (that are typically lower in the changed scenario); and
- Rates of interest and depreciation to enable computation of the Present Value.

The following are the equations that can be used for computation of NPV:

$$NPV = -(CF_0) + \sum_{i=0}^{i=n} \frac{Net\ Cashflow_i}{(1+r)^i}$$

CF_o = Cash outflow in the first year (capital investment)
r = opportunity cost of capital (i.e. for a rate of 10% 'r' would be 0.1)
n = useful life of the investment in years

For an investment to be financially viable NPV must be greater than zero.

Another indicator commonly used along with NPV is the **Profitability Index (PI)**. PI is computed as the ratio of the present value of the total cash inflows to the present value of the total cash outflows. For an investment to be financially viable, PI must be greater than 1.

IRR is essentially that rate of return on an investment that ensures that during the investment's lifetime the net cash inflows (i.e. inflows – outflows) are equal to zero, i.e., IRR is the value of r that gives zero as the value of NPV:

$$NPV = -(CF_0) + \sum_{i=0}^{i=n} \frac{Net\ Cashflow_i}{(1+r)^i} = 0$$

This problem is solved by assuming r and then following an interpolation procedure. The IRR is then compared with the rate of interest of the borrowings that may be needed from the market. Typically, if the IRR is lower than the market borrowing rate, then the investment is not considered to be financially viable.

It is useful to carry out a sensitivity analysis to understand the "ruggedness" of an option. This can be done by varying the expected efficiencies or yields, prices that the by-products may fetch in the market, or the capital costs of new equipment, and see how much of an effect these have on the outcome. This can help in building both optimistic and pessimistic scenarios to test how sensitive the IRR or NPV are to the data assumed in the economic analysis.

Consider an example of changing six existing winch machines to three jet dyeing machines at a textile dyeing unit. Jet dyeing machines are superior to winch machines in productivity, resource consumption, dyeing quality and versatility. Effectively, three jet machines will result in the same level of production as will six winch machines.

Figure 4.12 presents a cash flow diagram showing various inflows and outflows. The results of payback, NPV and IRR are also given.

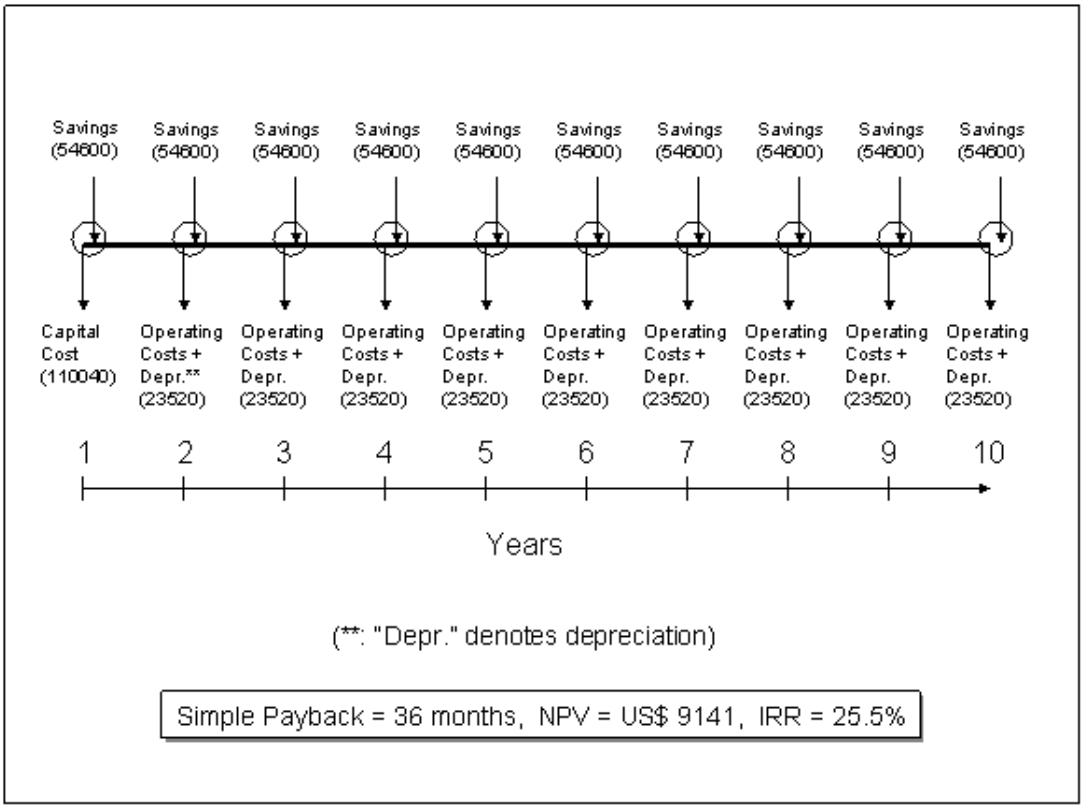


Figure 4.12: Inflows and Outflows:
Replacing Six Winch Machines with Three Jet Dyeing Machines

Savings of US$ 54,600 each year are due to the improved right first time with jet dyeing machines. Improved right first time means less processing and hence less water, energy and dye consumption. Apart from reducing purchase costs, these reductions also decrease costs for wastewater treatment. The amount of US$ 23,520 corresponds to increased operation and maintenance cost of the jet dyeing machines over each year and the annual depreciation of the equipment in its life period. Depreciation is calculated based on linear rate and assuming zero salvage value of the equipment at the end of its life period. The capital costs at the 0^{th} year indicate the costs incurred for purchasing the new jet machines (including the installation costs).

The calculations for determining NPV for this example are shown below. An interest rate of 10% has been assumed.

$$NPV = -110040 + \frac{(54600 - 23520)}{(1+0.1)^1} + \frac{(54600 - 23520)}{(1+0.1)^2} + ... + \frac{(54600 - 23520)}{(1+0.1)^{10}}$$

$$NPV = US\$9141$$

The IRR can be computed through an interpolation process such that NPV is equal to zero.

Based on the equation below:

$$NPV = -(CF_0) + \sum_{i=0}^{i=n} \frac{Net\ Cashflow_i}{(1+r)^i} = 0$$

NPV = US$ 80,934 for r = 10%

NPV = US$ 45,944 for r = 15%

NPV = US$ 20,262 for r = 20%

NPV = US$ 929 for r = 25%

NPV = US$ 13,954 for r = 30%

Since the NPV has started increasing, the IRR must be between 25 to 30%. Taking mid-points as the next trials

NPV = US$ 5,475 for r = 27%

NPV = US$ 2,363 for r= 26%

And so on to find r = 25.5% as IRR for NPV to be close to zero.

The cash flows can be more complex than the one showed above. The costs of machine operation and maintenance could increase over time. Similarly, the savings could be more as the unit rates for water, energy and dyes are expected to increase. In such cases, software tools such as P2Finance can be used that allow for computation of NPV and IRR for non-uniform cash inflows and outflows[7].

It is important to note that NPV and IRR should always be studied together for a realistic analysis. For instance, it is possible that the

[7] The software package for P2Finance may be downloaded from http://www.tellus.org/general/software.html

absolute returns from an investment are more than those of another investment even when the IRR value for the former is lower than the latter. Thus a study of the IRR alone could be misleading while deciding the investment options.

4.4.6 Implementation of Cleaner Production Options

The three evaluations help to eliminate options that are not viable. The remaining options may be considered in the preparation of a cleaner production implementation plan.

Prioritization of cleaner production options

In most cases, after conducting the feasibility analysis, it will emerge that different options have differing levels of technical feasibility, economic viability, and environmental performance. Since it is not desirable to implement all the options at the same time it will be necessary for the team to prioritize the cleaner production options. To assist the process of prioritization, a common evaluation framework will be necessary. A weighted-sum method could be considered for this purpose.

In this method, the team will assign weights to each of the three aspects of the feasibility analysis (technical feasibility, economical viability, environmental performance). These weights could be decided through a brainstorming session and involving the top management. The weights will vary from enterprise to enterprise, depending on their technical competence, financial conditions, environmental sensitivity etc. For example, a financially healthy small-scale enterprise facing considerable environmental pressures may decide to give the highest weightage to environmental performance (say, 50%), less to technical feasibility (say, 30%) and least to financial viability (the remaining 20%). This indicates that the enterprise is most keen to reduce pollution load but does not have high levels of capability to undertake technically involved options.

Once weights are assigned, simple indicators such as "scores" can be developed to assess the relative performance of each option. For example, economic viability could be assessed based on the payback period / NPV / IRR. Environmental performance could be assessed based on percent pollutant load reduction. Technical feasibility could be assessed based on technical complexity, requirements for new equipment / technology, requirement of additional technical skills, etc. Each option is then evaluated on a

subjective basis and scores assigned to each of the three aspects. Scores could have a range such as 0 to 10 where lower scores will imply poor attainment of the performance etc. For example, two options may have IRR of 15% and 33% respectively and hence may be assigned scores of 8 and 5 on the aspect of economic viability.

The weighted sum of the scores will give an index for each option, on the basis of which priorities may be assigned. It should be noted that the intention is not to prioritize each option individually but to group them into categories such as "top priority", "medium priority", and "low priority". This exercise would then be the basis for preparing the implementation plan.

Table 4.3 below presents an illustration of such analysis for prioritizing the cleaner production options.

Table 4.3: Deciding Priorities for Implementation Among Cleaner Production Options

Weights and cleaner production options	Technical Feasibility	Economic viability	Environmental performance	Total weighted index
Weights (%)	**30**	**45**	**25**	**100**
Scores for Option One	6	6	7	**6.25**
Scores for Option Two	7	9	6	**7.65**
Scores for Option Three	3	4	8	**4.70**
Scores for Option Four	5	8	3	**5.85**
Scores for Option Five	9	9	7	**8.50**

Based on above, Option Five may be considered as high priority, followed by Options One and Two as medium priority, followed by

Options Three and Four. Such a method of prioritization helps in the development of an implementation plan.

Preparing a cleaner production implementation plan

An implementation plan consists of the organization of the projects required to implement the options, the mobilization of the necessary funds and human resources, and logistics. Training, monitoring and establishment of a management system such as EMS are also often important components of an implementation plan.

The implementation plan should clearly define the timing, tasks and responsibilities. This involves:

- Prioritizing implementation of options depending on available resources;
- Preparing the required technical specifications, site preparation, preparing bidding documentation, short-listing submissions, etc.; and
- Allocating responsibilities and setting up monitoring/review schedules.

The cleaner production team should give first priority to implementing options that are low in cost, easy to implement and / or are a pre-requisite for the implementation of other options. This should be followed by options that require more investment, laboratory or pilot trials, or interruption in production schedules.

Many a time, options are implemented during or immediately after the CPAs at enterprises. The very conduct of a CPA in this form becomes a demonstration for others to follow.

Sustaining cleaner production assessment

The application of CPA and implementation of cleaner production options will often require changes in the organization and management system of the enterprise.

The key areas of changes are: integration of new technical knowledge; understanding new operating practices, laying down revised purchasing procedures, installing and operating new equipment, or changing the packaging and marketing of the products / by-products. These changes

will include modified preventive maintenance schedules, waste segregation and recycling practices, etc.

It is important, therefore, to ensure that the CPA is implemented as an on-going activity, by integrating the concept of cleaner production into the enterprise's management system.

4.5 Demonstration Projects

4.5.1 Introduction

During 1997-98, in-plant assessments carried out by the National Cleaner Production Centres in China, Mexico, the Czech Republic, the Slovak Republic, Hungary, Zimbabwe, India, for 71 enterprises (comprised of 35 small- and medium-sized enterprises, 25 large enterprises, 11 non-industrial establishments) showed that about 80% of the cleaner production options identified pertain to the categories of good housekeeping, better process control and equipment/hardware modification/replacement. Of the total options identified, 64% were implemented during the duration of the demonstration project.

Experience has indicated that the best way to persuade enterprises and institutions to adopt and implement cleaner production is by showing them the results from practical demonstrations. A common barrier to cleaner production is the lack of local examples demonstrating that cleaner production can be applied in the local context to any industrial sector and that waste can be turned into profit. Local entrepreneurs are usually not aware of the scope and potential of cleaner production. A key activity of CPCs, particularly in the beginning, is in-plant demonstration projects, which assist volunteer local companies undertake a CPA and to implement the results, and publicize the results of the CPA to as many other companies as possible.

Generally speaking, a demonstration project is the operation of some hardware (typically a technology, but also materials) or the use of software (for instance, a methodology) that is innovative. Sometimes a demonstration may be warranted because the hardware or software was developed or proven elsewhere but has not been yet adapted to the local situation. Sometimes a demonstration may be needed because not enough technical and financial information is available on **implementing** the hardware or software. Finally, demonstration may involve a hardware or software that has an element of risk of the unknown that dissuades stakeholders from its application. A demonstration in this case is essentially a confidence building measure.

Many a time, demonstration projects are considered as means to prove a new technology; e.g. an efficient process or equipment. In the UNEP / UNIDO NCPC Programme, demonstration projects are not intended for this purpose. Demonstration projects are basically to showcase a methodology; viz. CPA.

4.5.2 An Overview of Cleaner Production Demonstration Projects

In the early stages, i.e. 1990-1995, demonstration projects were basically catalyzed through several donor-assisted programmes on cleaner production. These projects were more or less technology-equipment driven and were launched to facilitate the dissemination of results to

convince industries of the economic and environmental benefits of cleaner production. The manufacturing sectors where most of the demonstrations were carried out were textile industries, pulp and paper industries, metal finishing works and tanneries.

"Do not make the mistake of imposing yourself as a fault-finding specialist. It is not enough to identify cleaner production opportunities; company personnel have to implement them for the demonstration project to be successful. Try to get the words from their mouth.

Make them own the cleaner production options as if they have developed them. Then you have a fair chance of getting it implemented."

- India NCPC

One of the early demonstration projects was PRISMA[8]. This project was launched in 1988. It had two principal objectives:

- To show the Dutch industry that the prevention of waste and emissions is possible in the short term and that it offers benefits to both companies and the environment.

- To formulate recommendations for an effective pollution prevention policy.

In many ways, PRISMA created the framework for all cleaner production demonstration projects that followed.

Some other trend-setting demonstration projects have been DESIRE[9] in India (implemented by National Productivity Council, New Delhi, with UNIDO), ProduksiH in Indonesia (implemented by the Indonesia Environmental Impact Management Agency, or BAPEDAL, with the support of Gesellschaft für Technische Zusammenarbeit GmbH or GTZ, Germany), and SEAM[10] in Egypt (implemented by the Egyptian Environmental Affairs Agency or EEAA with the support of Department for International Development, or DfID, UK).

Many of the early demonstration projects on cleaner production were fully funded through grants, principally from the international donor agencies cited above, so that the participating enterprises were not required to make a financial commitment. However, the current trend is to require a formal assurance from enterprises that agree to participate (in the form an MOU or otherwise) to commit human resources and sometimes a small, nearly token, amount of money, to ensure meaningful participation in the demonstration and ownership of the results, as well as continuation of cleaner production activities after the demonstration is over.

[8] The acronym "PRISMA" stands for "Project Industriele Successen Met Afvalpreventie".
[9] The acronym "DESIRE" stands for "Diverse, Environment, Simple, Innovative, Rational, and Economical".
[10] The acronym "SEAM" stands for "Support for Environmental Assessment and Management".

The Asian Productivity Organization, or APO, based in Tokyo, has supported a number of Green Productivity Demonstration Projects (GPDP), which are very similar to cleaner production demonstration projects, in various Asian countries. The United States Agency for International Development (USAID) under the Environmental Pollution Prevention Project (EP3), which concluded in 1998, the World Environment Centre (WEC) and the World Cleaner Production Society (WCPS), have all co-financed and facilitated a large number of demonstration projects in various regions.

The results of all these demonstrations generally have been positive, and case studies / fact sheets have been prepared for distribution or have been uploaded on web sites for wider dissemination. Videos that show interviews with the industry personnel and the facilitators have also been prepared in several cases.

Most of the cleaner production demonstration projects have primarily focused on preventing or reducing waste or pollution, or increasing efficiency. Issues such as market access, supply chain requirements, occupational safety and health, and community participation have often not been adequately covered, if at all. An exception is the SEAM Programme in Egypt, which has supported demonstration projects focusing on protecting / widening Egyptian exports to the European Union and US markets by securing ecolabels. The demonstrations here have shown that the companies not only secured ecolabels and widened their export market, but also increased their productivity and cut down costs of input resources.

In general, cleaner production demonstration projects have taken place in the manufacturing sector. Promoting demonstrations in the service sectors and communities is a recent phenomenon. APO has, for instance, initiated Green Productivity Demonstration Projects in the tourism sector and has set up demonstrations in communities in Vietnam. The Cleaner Production and Industrial Efficiency (CPIE) project in Thailand, supported by the Asian Development Bank (ADB), is demonstrating the utility of the 5S[11] concept for implementing cleaner production in a small textile printing company.

[11] Based on Japanese words that begin with 'S' (*Seiri* = organization, *Seiton* = neatness, *Seiso* = cleaning, *Seiketsu* = standardization, and *Shitsuke* = discipline), the 5S Philosophy focuses on effective work place organization and standardized work procedures. 5S can simplify your work environment, reduces waste and non-productive activity while improving quality, efficiency and safety. Refer to: Osada T. (1991) "The 5S's – Five Keys to a Total Quality Environment."

Cleaner production demonstration projects have always been a strong element of the UNIDO/UNEP NCPC Programme. As stated earlier, in this programme, emphasis is given to demonstrating a methodology rather than technology, new materials, know-how, or equipment. This concept has been now adopted by other programmes as well. For instance, in the Cleaner Production and Industrial Efficiency (CPIE) project supported by Asian Development Bank, the demonstration project at a textile printing factory consisted of implementing the 5S methodology, and showing the environmental and economic benefits of doing this. In a study conducted in 1994/95, the Danish International Cooperation Agency (DANIDA)[12] has emphasized that the effectiveness of demonstration projects is limited if the concept is confined to a narrow technical approach.

4.5.3 Benefits of Demonstration Projects

The primary objective of the demonstration projects is to show, at the local level, the potential, relevance and applicability of cleaner production approaches, with a view to encouraging their wider adoption across the target stakeholders.

In this perspective, the demonstration projects have several side-benefits for the centres:

- They provide the Directors with an opportunity to build locally relevant case studies for preparing content for awareness-raising materials. In this sense, demonstration projects are an awareness-raising mechanism.

- Demonstration projects help CPCs to widen their market. Enterprises that participate in the demonstration realize the "cleaner production advantage" and help in spreading the message across the sector or in the geographical cluster.

- They provide an opportunity for the centre staff to understand and be trained in CPA and implementation methods, especially in the early years of operation.

- They help in establishing partnerships and networks with local consultants. This enables the centre to build up a group of experts

[12] "Analysis of Donor programmes for promotion of Environmental Management, Pilot Programme for Promotion of Environment Management in the Private Sector of Developing Countries", GTZ, April 1998.

who can undertake further cleaner production assessments and demonstrations.

- They help in building capacities at the participating enterprises to sustain cleaner production.
- Finally, they help in building the centre's "consultant qualifications" that will help in marketing the centre's services.

4.5.4 Preparatory Activities

Identification of the stakeholders in the demonstration project

Other than the enterprises themselves, which will be the "guinea pigs" for a demonstration project, the stakeholders in a demonstration project typically include:

- Enterprise associations;
- Relevant research / technology institutions;
- Financing institutions; and
- The Cleaner Production Centre.

Generally, regulatory agencies are not involved as stakeholders since their involvement can create barriers.

Selecting the enterprises

Selection of enterprises is often the key to a successful demonstration project. The enterprises are generally identified by examining the priority sectors of economic activities, size and geographical distribution of the enterprise and prevailing environmental problems.

The PROPEL[13] Programme [in Colombia, supported by the International Network for Environmental Management (INEM), Germany] and SEAM / Egypt (supported by DfID in partnership with EEAA) completed sectoral reviews at the outset to identify priority sectors, and then identified geographic locations and facilities of

[13] The acronym "PROPEL" stands for "Promoción de la Pequeña Empresa Eco-Eficiente Latinoaméricana".

importance to which to propose demonstration projects. USAID's EP3 programme in Indonesia focused on areas that were relevant to many small and medium scale enterprises of a particular sector of focus.

In these cases, sectors for demonstrations were chosen on the grounds of economic and environmental importance, current technology and financial absorption capabilities, as well as the magnitude of populations dependent on the sector for employment.

It is extremely important for Directors to choose very carefully the enterprises that will participate in a demonstration project. If participants do not actively participate then the value of the whole demonstration project is jeopardized. With experience, existing Centres have evolved various strategies to ensure that they choose participants well.

- It is important to secure commitment and willingness for the demonstration project from the highest levels of the enterprise, for instance, the owner in a small enterprise, the site manager, and so on.

- It is good to choose wherever possible enterprises whose owner/top management is dynamic, forward-looking, risk-taking, and seen perhaps by the local competitors as being a "leader". Such persons will be more willing to take on the "unknown" that a demonstration project consists of and carry through the commitment.

For example, the criteria which the India NCPC uses are:

Significant multiplier effect: The basic purpose of a demonstration project is to show and convince other industries of the potential and feasibility of cleaner production. It is therefore essential that the sector selected is large enough to have a significant multiplier effect.

The multiplier effect is governed by two factors:

- Number of clusters of similar units; and

- Total number of units in the selected sector.

A sector with a large number of units in clusters would be preferable to one with a few dispersed units.

High possibility of replication by other units: For an effective multiplier effect is important that **demonstrated** cleaner production measures be replicated by other units throughout the sector. Two factors should thus be considered when selecting an industry sector:

- Uniformity of production processes and products; and
- Availability of technical manpower within the units.

Substantial cleaner production potential: Not all industry sectors have the same potential for cleaner production. In the early stages, when success needs to be demonstrated to prove the usefulness of the centre, industry sectors with the greatest cleaner production potential should be selected over those where it may be more difficult to obtain clear results.

Significant pollution intensity: The advantages of cleaner production may at first be more persuasive in industry sectors that are pollution intensive rather than those in which pollution is much less, although the cleaner production potential will also need to be considered. Pollution intensity could be measured in terms of waste quantity, toxicity, concentration of pollutants in waste streams, etc. cleaner production in a pollution intensive sector could also lead to a substantial decline in end-of-pipe pollution control requirements, thus making cleaner production a more obvious and attractive preference.

High economic importance: It has been the experience of the India NCPC that industry sectors which are important in the national economic scenario accept newer concepts like cleaner production more readily. The economic importance of the sector has several facets such as impact on imports/exports, overall gross output, relationship with other up-stream or down-stream sectors, etc.

Good potential cooperation from industries: Industry cooperation in cleaner production assessment and implementation is vital for a successful demonstration project. It has been observed that the cooperation from industries varies widely from sector to sector as well as from place to place.

Stable financial health of the sector: In the experience of the India NCPC, there is no clear correlation between an industry sector's financial situation and its receptivity to cleaner production. The sectors which have reached a plateau of growth and can foresee a possible decline in future profits unless corrective measures are

taken, have tended to be the most suitable ones for early successes.

Intense intra-sectoral competition: Industry sectors characterised by intense competition tend to be the most receptive to cleaner production. However, when cleaner production demonstrations have proved successful, there is less willingness to share the information with other units in the industry.

Sufficiently organised sectoral structure: To obtain early success, the Centre should begin with industry sectors which are sufficiently organised to be able to initiate and sustain a cleaner production programme. Industry sectors with informal structures are likely to have greater difficulty in obtaining success for reasons such as lack of trained / technical manpower, over-burdened management, lack of measurement/monitoring facilities, etc.

High national priorities: Finally, the selection of sectors should also recognise governmental priorities (e.g. Ministry of Environment, Ministry of Industry, Pollution Control Boards, etc.) as in the long run, demonstration projects will not serve much purpose unless they are also able to further government polices and programmes.

It may be useful to identify enterprises for demonstrations by holding awareness and training programmes. Promotional events could also be held such as seminars with one to one meetings inviting the target stakeholders. These events can be organized in partnership with the relevant industrial associations or even with financing institutions / government authorities that may sponsor the demonstration project.

Once the stakeholders are identified for demonstration, it is wise to formalize the agreement on the part of an enterprise to take part in a demonstration project, by signing a MoU. In the UNEP / UNIDO NCPC Programme, demonstrations are essentially the conduct of CPAs. The demonstrations are performed in groups where CPAs are undertaken at the same time, governed by the agreement. The MoU helps in establishing a clear understanding on individual as well as collective responsibilities.

Box 4.6 lists some of the dos and don'ts in identification of enterprises.

Box 4.6 Dos and Don'ts in Identifying Enterprises for Demonstration Projects

Develop criteria for selecting priority sectors and companies for demonstration projects.

Only really willing and convinced companies should be considered for demonstration projects.

The contracts with companies should clearly **specify** the **roles** and **responsibilities** of the **enterprise** as well as those of the **centre.**

Selecting Other Stakeholders

It is important to involve those institutions, such as industrial associations, that support the sector to which the demonstration enterprises belong. Since the primary purpose of the demonstration projects is to disseminate the results as widely as possible within the relevant sector, these institutions can be an extremely important mechanism for doing this. In addition, staff of these institutions can be given a thorough training in the basic cleaner production methodologies through the demonstration projects, which they can use to continue offering cleaner production services to their members.

Research and technology institutions can be important if and when research needs to be done on possible modifications to equipment, processes, or raw materials. They will have the laboratory facilities and expertise to carry out such research. In addition, if the staff of such institutions is trained in cleaner production concepts they can add this to the services they already offer, thus increasing the value of these services.

Finally, financial institutions can be important stakeholders in demonstration projects if these could result in the identification of cleaner production options that will be require significant investments to be implemented. Furthermore, the involvement of financial institutions in the details of a demonstration project can greatly increase their awareness of the role that environmental requirements can play in the value (or loss thereof) of industrial investments, which can have important feedback effects on their loan policies.

4.5.5 Conducting the Demonstration Project

After the agreements are executed and commitments have been made in the form of an MoU, the implementation of the demonstration project should be commenced. Implementation is a partnership activity and the sole responsibility of the centre. It is strategic that the centre includes training as a part of the CPA cum demonstration activity to build capacity of the enterprises that have volunteered. Including training of company personnel as part of a demonstration project ensures that cleaner production continues after the external experts leave. Demonstration projects are only one component of a broader programme to build awareness and local capacity for cleaner production.

The Vietnam Cleaner Production Centre trains cleaner production trainers with a systematic, in-depth training programme, consisting of seven modules. During the programme, participants go through a complete cleaner production assessment, coached by national and international experts.

Currently, the programme is directly linked to in-plant demonstration projects; therefore the trainees are given a good practical as well as theoretical grounding in cleaner production by the end of the course. A selection of these trained national experts have been serving as cleaner production trainers / coaches in Phase II, by the end of which the centre plans to have conducted about 15 in-plant demonstration projects. Some of those trained will work as independent consultants on cleaner production.

The China National Cleaner Production Centre has conducted in-plant demonstration / training programmes in some 100 enterprises and cleaner production demonstration activities in more than 20 provinces and large cities. At the start of a cleaner production assessment in an enterprise, the centre provides a one-day introductory seminar for managers and owners of the enterprises to disseminate information on experience with cleaner production techniques and technologies. In each of the 100 enterprises where cleaner production assessments have been carried out, a comparison was done of the extent of pollution generated before and after implementation of cleaner production options using the material balance prepared at the plant level. In all its cleaner production assessments, the centre provides technical expertise for the implementation of cleaner production options at company level. The centre has held seminars to share results with industry associations,

local environmental protection bureaus, etc.

When the NCPC in Tunisia did its demonstration projects, it combined training with CPAs in companies, a factor which the centre believes made the "cleaner production demonstration projects run properly". The centre built mostly upon the existing expertise and technical capacity of the companies, as it did not have much funding for international consultants. This strategy had two advantages – the expertise stayed within the company and it created a "sustainable momentum"; once the programme was completed, the personnel associated with it continued with the cleaner production philosophy.

Box 4.7 below summarizes dos and don'ts in the conduct of demonstration projects.

Box 4.7 Dos and Don'ts for Conducting Demonstration Projects

The implementation phase should not wait for the whole assessment to be complete. The implementation of straightforward cleaner production options should take place **alongside the assessment** so that the enterprise can start seeing the savings.

Take time to develop good relationships with enterprise personnel – the number of demonstration projects is less important than their effectiveness.

Include the enterprise's financial managers in the demonstration project so that the enterprise can accurately calculate its economic interest in adopting cleaner production options.

Find ways to **motivate enterprises** which do not implement even no- or low-cost options, or to recover the costs to the centre of their involvement if they don't.

Evaluate demonstration projects **periodically** for a better understanding of which options did or did not get implemented, **and why.**

If enterprises don't implement capital-intensive cleaner production options for lack of finance, develop the expertise to

convert such cleaner production options into bankable loan proposals and act as intermediary between financial institutions and the enterprises.

The objective of a demonstration project should **not** just be to identify a number of cleaner production options and present them in the form of a report; it should be **a satisfactory completion of the project with the maximum possible level of implementation of cleaner production options identified**, and to **build enterprise expertise** to spread cleaner production in the enterprise and industry sector.

4.5.6 How to Disseminate the Results of the Demonstration Project

"Nothing works better within an industry group than a colleague telling them about things. Demonstration companies should become ambassadors of cleaner production. This they will only do if they get something out of it. So you need to make sure that you are passing on the skills, not taking the expertise out with you. This may take several months of building up relationships, but if you are not able to develop personal relationships with your partners, the project will not be sustainable."

- India NCPC

This is a key part of demonstration projects, because it is only if this is done well that the project can **truly** be said to have **demonstrated** cleaner production and its benefits. Based on the experience gathered by existing centres, Directors can consider various means of dissemination.

At the end of the demonstration project, centres should hold one or more seminars to which they invite as many as possible of the enterprises that belong to the sector or geographic zone that was covered by the demonstration project, as well as other concerned stakeholders, where the results of the demonstration project are presented. The impact is greatest if the enterprises that took part in the demonstration project present their results and discuss their experiences.

In the case of sector-specific demonstration project, centres may team up with a sector association or other sectoral support institution (e.g. a sectoral research association) to organize such a seminar. Such partnering might draw more organizations / institutions to the event.

Centres should also prepare a report that outlines the results of the demonstration project in the form of a guidance manual. The purpose of this manual is to assist other enterprises that have been motivated by the presentation of the demonstration project's results or in some other way to launch cleaner production assessments and other activities. For the sake of comprehension, it should be produced in all the necessary local languages. Centres can also prepare one-page leaflets on some of the more significant results that came out of the demonstration project, as mailers for inclusion as part of the promotional material of the centre.

If funds are available, then centres can make a video of the demonstration project. This can be expensive, since it requires the use of highly experienced professionals, but it gives a product that can lead to a better and wider communication of the concept, working and the results. As an alternative to creating their own videos, centres could consider partnering with a local television station.

Whatever dissemination mechanisms Directors adopt, they must make sure that the information about the demonstrations is reaching the target stakeholders. **Box 4.8** provides guidance on the dissemination of information.

Box 4.8 Dos and Don'ts for Disseminating Results of Demonstration Projects

The objective of information dissemination should be to provide information which is required by the user **(demand-driven) rather than** providing information simply because it exists **(supply driven).**

Different stakeholders have different information needs. A centre should **do an 'information needs' survey** to identify and understand actual information needs. **Specific information packages should then be developed** taking into account the **relevance** of the information to the user, its presentation in a **'directly usable' format** and the **user's capability and facility to apply the information.**

Maximize use of **existing** information dissemination channels and networks **instead of creating new ones**. Piggyback on existing nodal points (industry associations, government agencies, etc.) as a resource-effective means of providing information.

Information dissemination is **continuously evolving**; the information needs of yesterday may be quite different from the needs of today and tomorrow. **Develop a feedback system to continuously assess and meet user needs.**

Feedback from local cleaner production users should be **made accessible to regional and global networks** to enable others to integrate grass roots needs into development projects.

4.5.7 The Role of the Centre in Selecting, Planning and Conducting Demonstration Projects

The centre should be involved in the demonstration project as a mentor, a facilitator, as well as in the guise of a professional manager. The points below summarize the role of the centre in this perspective.

1. Select the sector or geographical area in which a demonstration project will take place.

2. Publicize to the members of the chosen sectors or in the chosen geographical areas the fact that a demonstration project will be held for them.

3. Select the enterprises (or other organizations and institutions) that will take part in the demonstration project.

4. Come to a formal agreement with the selected enterprises and organizations/ institutions about the form and content of their participation in the demonstration project.

5. Set the schedule for the demonstration project.

6. Provide methodological inputs and technical support. Include training as a part of the demonstration activity.

7. Select (and if necessary contract with) the national consultants who will mentor the enterprises (or organizations / institutions) during the demonstration project and possibly the person who will be the team leader for the whole project.

8. Monitor the progress of the demonstration project, and if necessary take corrective action if there is slippage in the schedule or other problems.

9. Ensure that the necessary photographs, videos, etc. are taken during the work to track progress and to use as promotional material later on.

10. Prepare the overall project report.

11. Hold the necessary awareness-raising and dissemination campaigns at the end of the project.

Part 5

How to Deliver *Strategic* Services of Cleaner Production Centres

What will we learn from Part 5?

5 How to Deliver Services of a Cleaner Production Centre (Guidance on Strategic Services)

5.1 Introduction

Having discussed the manner of delivery of the basic services offered by the centre in **Part 4** of this Manual, we now turn to the strategic services that the centre needs to supply. Strategic services build upon the confidence and the credence attained by the centre through the delivery of its basic services. They assist in amplifying both the geographical coverage and intensity of basic services, and help in the creation of an environment that enables the mainstreaming of cleaner production. These services play a great role in elevating the position of a centre, widening its market and assisting it to achieve financial sustainability. The strategic services that will be discussed in this Part include:

- Networking;
- Matchmaking;
- Knowledge management;
- Interfacing with financial institutions; and
- Policy advice.

The sections that follow will provide guidance on each of these services.

5.2 Networking

Networking is synonymous with marketing, and is therefore one of the essential services a centre should undertake. Basically, networking is a strategy for cultivating relationships, improving market intelligence and enhancing the image of the centre. The Director of the centre is the best person to take charge of the centre's networking activities.

5.2.1 Who Should be Networked

Networking should be undertaken in order to keep the various stakeholders of the centre informed about its activities and services. Networking enables sharing of experiences, building of new partnerships and widening the market base of the centre. In this perspective, networking activities should be carried out in at least the following three areas:

- Networking amongst the members of the executive board, advisory committee, and other peer groups;
- Networking across the stakeholders where services are provided or targeted (i.e. the centre's clientele); and
- Networking with other CPCs / NCPCs, potential donors, etc. This form of networking is critical to increase the centre's visibility and secure additional funding.

In the initial stages, networking is, for the most part, carried out on an informal basis through one-to-one meetings, by participation in other events, etc. As these relationships mature or as interests start overlapping, more formal mechanisms should be introduced so as to establish centre's **very own** network.

5.2.2 Establishing the Network

A network can be established and operated through a variety of techniques. These include the following:

- Holding independent as well as joint events (e.g., roundtables, exhibitions). If such events are used as networking mechanisms, then they must be organized on a **regular** basis (e.g., annual roundtables on cleaner production or biennial exhibitions on cleaner technologies, etc.). A one-time event or events held once in a while do not help in establishing a network;
- Participating in events organized by others;
- Formulating joint products (e.g. newsletters, knowledge bases on a CD-ROM);
- Undertaking joint services (e.g. training, cleaner production assessments);

- Publishing newsletters and operating websites. Here, joint possibilities are sharing of mailing addresses or members to the websites. Possibilities of joint memberships may also be considered;

- Organizing consultative meetings on a regular basis between the members of the executive board, advisory committee and the partners. Partners refer to the organizations that assist the centre in the delivery of services or whose capacities have been built; and

- Signing an MoU, which can act as a formal mechanism to firm up networking arrangements. Ideally, these kinds of MoUs should be drafted on a broad basis with annexes that define specific agreements so as to allow future insertions or modifications.

Box 5.1 highlights the dos and don'ts that apply to networking activities in any area.

Box 5.1 Dos and Don'ts for Networking

Do not embark on a networking venture without being **absolutely clear as to the intent** of the activity (i.e. the whys, whos, whats and hows).

Ensure that adequate **funding** is available for all actions that are envisaged during the planning stage for any networking venture.

Where possible, **formalize partnerships** through MoUs or other such agreements with the involved parties.

Ensure that such MoUs and other such agreements are **updated** periodically and / or when the need arises.

Remember that for the network to **gain credibility**, it should be adopted and endorsed by all relevant organizations working on cleaner production dissemination in that particular locality / region / country.

Always attempt to provide **value for service** to your members, to retain their participation in and / or contributions to the network.

Advertise the network to the farthest extent possible. This will increase the centre's outreach and visibility, and very importantly, will keep the network operational and vibrant.

5.3 Matchmaking

5.3.1 Connecting Seekers and Providers

Matchmaking is a service that connects "seekers" with "providers" or "buyers" with "sellers". In cleaner production, the seekers include the following:

- Enterprises and consultants seeking cleaner technologies (e.g., process know-how and equipment, etc.), and suppliers of materials (e.g., eco-friendly products, etc.);
- Enterprises, government and communities that are looking for technical experts or consultants;
- Enterprises, government and communities seeking sponsors to finance cleaner production investments;
- Financing institutions seeking good projects to fund (often, they have money but no projects);
- Sponsors/donors seeking innovative ideas, projects, etc. on cleaner production;
- Enterprises, government and communities that are looking for trainers, training sessions / courses, knowledge bases etc.; and
- Enterprises seeking suppliers of wastes as a cheap substitute for the raw materials presently used[1].

The providers typically include the following:

- Technology / equipment suppliers;
- Consultants;

[1] Waste exchange hovers on the edges of the definition of cleaner production (refer to **Section 1.4.1** and **Figure 1.5** of **Part 1** of this Manual). However, such practices are common and do offer an environmental benefit, so much so that they deserve to be mentioned in this particular context.

- Trainers, educators;
- Sponsors / financial institutions; and
- Waste generating businesses.

Essentially, the principal service of matchmaking is connecting a seeker with the correct provider(s). The centre's role in such cases is strictly that of a middleman or a facilitator.

5.3.2 Extensions to Matchmaking

There are possibilities for extending the basic matchmaking service of the middleman or facilitator by offering assistance to fructify a transaction. If requested, and found feasible in the local or national context, a centre could provide at least three extension services:

- *Accreditation of a provider:* The centre may use its own criteria or criteria established and accepted elsewhere in deciding whether a product or technology is "eco-friendly". Here, the centre could conduct the required field investigations (e.g., a cleaner production assessment with life cycle perspective, or an environmental technology assessment) at the cost of the seller or the provider. This service could include a one-time fee for accreditation, in addition to an annual inspection fee for maintaining it.

- *Assistance in completing the transaction between the buyer and the seller:* The centre could counsel the buyer or seller, and / or conduct independent studies required in ensuring a successful transaction.

- *Providing intelligence reports:* Many a time, developers and suppliers are interested in understanding the needs of the market vis-à-vis a product or a technology they are offering, or are about to offer. For instance, an R&D institution may like the centre to provide a one-time / regular feedback on the types of cleaner production technologies that are generally requested by the market. The centre could distill such reports based on the requests it receives or transactions it undertakes, and provide the study as a service to interested suppliers.

5.3.3 Mechanisms of Matchmaking

A centre can use a variety of mechanisms to provide matchmaking services. Examples include the following:

- Publishing "Buyer-Seller guides" on technology, eco-friendly materials for greening a supply chain;
- Holding buyer-seller meets; and
- Operating business-to-business (B2B) websites which allow online transactions of buying and selling of technology / equipment / wastes. This is a very effective means of matchmaking because here, transactions can take place 24 hours a day, 7 days a week, with relatively little input of resources from the centre. In addition, the transactions can be monitored online and put into a database for future reference and follow-up.

Centres could earn revenue by way of brokerage or transaction fees or even success fees. Additional revenue could come from membership fees; i.e. the fees charged in order to get listed in the buyer-seller guides and websites. As described earlier, revenues could also be collected from accreditation and inspection services.

5.4 Knowledge Management

As the networking activities expand, the centre will gain access to a vast repository of information on cleaner production and other related resources. The task, then, is to organize, review and process this information and deliver it to meet the information needs of the centre's various stakeholders. It is also important to ensure that channels are established to update the information so collected on a regular basis. Such issues are essentially addressed in the task of knowledge management. Knowledge includes holding of data, derived information and accumulated experience.

As knowledge management can be a daunting task, it becomes critical for the centre to build revenues out of this service. In this context, it is more strategic that the centre engages only in "productizing" the knowledge pooled from other sources rather than getting involved in the task of developing primary data or information per se. Once again, these activities are best carried out through partnerships. However, special attention does need to be given to Intellectual Property Rights (IPR), since the products may very well have some commercial value.

5.4.1 Deliveries in Knowledge Management

Typical demands for knowledge in the cleaner production area that are generally not met by a single organization include the following:

- How-to manuals, guidance documents on cleaner production assessment;
- Sector-specific best practices;
- Case studies;
- Technology fact sheets, Material Safety Data Sheets, banned substances and technologies;
- Benchmarks on resource consumption, waste generation etc.;
- Financing resources, funding criteria;
- Eco-labels, brands, their environmental and social requirements or codes of conduct; and
- Compilation of national and international environmental regulations, emission / effluent standards.

A centre could attempt to meet these demands through a variety of mechanisms such as the following:

- *Publications:* The centre could publish guidance manuals or technology fact sheets for selected sectors based on its experiences from various services (matchmaking, cleaner production assessments, demonstration projects etc.). These publications may be priced.
- *Computer-based products:* CD-ROMs could be sold to interested clients. They could contain searchable databases on Material Safety Data Sheets, banned substances and processes, technology fact-sheets, sectoral benchmarks contact lists of technology / equipment providers, etc.
- *Web-based delivery:* This is one of the most effective and least expensive modes of delivering information to anyone across the world — 24 hours a day, 7 days a week. A membership fee could be charged for the web site and members could access regular uploads of manuals, databases, etc.

5.5 Interfacing with Financial Institutions

5.5.1 Reasons for Interfacing with Financial Institutions

Financial institutions are important for a centre from two perspectives:

- *As sources of funding for business clients:* Financial institutions could provide funding to enterprises or other institutions on the basis of loans or partial grants or on the basis of equity (i.e. partial ownership), to implement cleaner production options. Here, a centre could play a catalytic role in assisting their clients in the preparation of a bankable project or a basket of projects.

- *As clients:* Financial institutions may require technical assistance in finding and appraising low-risk and high-return projects. A centre could provide such a service on a consultancy basis.

It is therefore necessary for the centre to build relationships with key financial institutions.

5.5.2 Referring of Cleaner Production Projects to Financial Institutions

Not all cleaner production options are good material for referral to financial institutions. Options such as housekeeping, direct reuse / recovery / recycle, process rationalization and optimization, material substitution, upkeep of equipment maintenance etc., are generally best financed internally (i.e. through the enterprise's own funds). This is because not only are the capital investments needed for these options often very low, but also because the payback periods are reasonably short (less than six months).

Options such as indirect reuse / recovery / recycle (requiring pre-treatment), process / equipment modification etc., generally fall into the moderate investment category, where a mix of internal and external finance (through a financial institution) can be sought. The skill here lies in arriving at the correct blend of internal-external finance, and providing appropriate advice to the enterprise.

Options such as equipment / process change, installation of automated systems, product redesign etc., generally require moderate to high

investments, where external finance could be the principal source of funding.

In order to present a "systems approach" to the financial institution, which it will appreciate, as well as to improve the net payback period or Internal Rate of Return (IRR), it may be strategic to combine options from all of the above three categories.

Before funding any cleaner production options, a financial institution requires sound economic analyses (e.g., computation of payback, IRR etc.), an evaluation of the financial situation of the business / enterprise (balance sheets, profit and loss statements) and a statement of the environmental / social benefits to be derived from the cleaner production option(s). These requirements are generally specified in the loan application forms.

Before preparing the documentation, it is important to decide upon the financial institution that will be approached for assistance, as the conditions for giving loans, grants, etc. may vary to quite an extent from one individual financial institution to another. For instance, some financial institutions offer low-interest loans but with caps (i.e., the maximum amount of money that can be lent per facility / enterprise), or only for companies of a certain size; others offer loan guarantee schemes, to help with lack of collateral; still others operate specially designed concessional funds loans but only for investments for a particular purpose (e.g., replacement of chlorofluorocarbons, reduction of energy consumption, etc.). There will also often be requirements for the requester to commit their own contribution (e.g., 25% of the project cost).

Box 5.2 provides some typical requirements for preparing loan proposals.

Box 5.2 Typical Requirements for Preparing Proposals for Loans from Financial Institutions

- Past credit history and references
- Purpose of the loan
- Expected cash flows from the project
- Expected profitability of the project (e.g. Net Present Value, Internal Rate of Return)
- Assessment of the risks of the project, risk management measures
- An explanation of how the project relates to the business of the facility / enterprise
- Past financial statements (balance sheet, profit and loss statements)
- Forecasted cash flows
- Information on the management of the facility / enterprise

5.5.3 Options for Financing

A centre may like to position the funding needs for a client by examining options such as those listed below:

- *Seeking loans - Normal commercial lending:* This option is suitable for low risk and moderate benefit interventions. The institutions prefer to see cases where the IRR is higher than the prime lending rate.
- *Seeking loans - Accessing special funds with soft or concessional loans:* This option is appropriate for interventions with medium risk and moderate-to-high benefits. This option is relevant if the object or purpose of the special

fund is in line with the concept and expected benefits of the cleaner production investment. Projects that lead to the elimination of a toxic substance, improvement of worker health and safety or alleviation of neighborhood nuisance may qualify for softer funds. However, it may be required that such projects cross over a minimum or threshold IRR. It may also be necessary to attempt a quantification of the environmental benefits in monetary terms to the greatest extent possible (e.g., using the Total Cost Assessment approach).

- *Seeking equity in the form of venture capital*: This option is appropriate for medium to high risk but high benefit interventions. Here, the documentation could become copious, as the financial institution could ask for equity in the enterprise as a proviso to concessional venture capital funds. In this case, until the capital invested is returned, a representative of the financial institution remains a part of the Board of Directors of the enterprise. Projects to demonstrate high-investment technology may fall in this category.

- *Seeking equity in the form of a Joint Venture:* This option will typically entail the participation of a technology provider in the form of equity. This model is perhaps relevant where high capital and moderate risks are involved and where there are restrictions on the transfer of technology. Many times, the technology provider is not keen on transferring the technology entirely, and prefers to maintain a stake, thereby having a claim on a portion of the project benefits. In such cases (similar to the venture capital approach), a representative of the technology provider sits on the Board of Directors of the enterprise. It is possible to channel high-investment demonstration projects with this approach. Note that the documentation for setting up a Joint Venture can be rather complex, so a commitment to this approach needs to be carefully weighed first.

5.5.4 Possible Mechanisms for Financing

In each of the options outlined above, the centre is in a position to provide technical assistance to the financial institution, the enterprise itself, or to the technology provider.

The centre may assist the financial institution in the following ways:

- Modify the project appraisal process in order to incorporate into loan application forms the cleaner production approach and more generally evaluations of the risks related to environmental liabilities;

- Accompany the representatives of the financial institution on field visits during project implementation as a technical advisor (e.g., for de-bottlenecking);

- Conduct monitoring on behalf of the financial institution after the implementation of projects to assess the extent of benefits; and

- Advise on establishing and operating "special purpose" environmental funds; i.e. funds specifically designed to promote cleaner production investments.

Centres can thus serve as partners to financial institutions in the building of a pipeline of bankable cleaner production-related investments.

The centre may provide the following assistance to enterprises:

- Identify cleaner production investment projects for possible funding from financial institutions and / or technology providers;

- Identify the most promising financial institution and / or technology provider to approach;

- Prepare (or assist in the preparation of) the loan applications; and

- Assist in the implementation and evaluation of cleaner production investment projects.

Box 5.3 provides some dos and don'ts while interfacing with financial institutions.

Box 5.3 Dos and Don'ts for Interfacing with Financial Institutions

Before approaching the financial institution, ensure that the feasibility analysis of the cleaner production project indicates that the project is **bankable**

Ensure that the loan covenants and other conditions of the financial institution are **clearly understood** and **apply.** The centre **should not** enter into negotiations or be party to loan terms and conditions. This is to be kept between the stakeholders and the financial institution

Experience indicates that many enterprises, even if they have good, bankable, cleaner production investment proposals, find it very difficult to prepare loan applications that are acceptable to financial institutions.

The centre may assist technology providers by identifying, appraising and preparing cleaner production investment projects for possible funding.

In conclusion, interfacing with financial institutions is an important service that could assist the centres to earn significant sums of revenue. However, it is essential that the centre build a core expertise in financial analyses of projects and / or position itself to access such expertise through its network.

5.6 Policy Advice to National and Local Governments

Policies at all levels of government can potentially promote or dissuade cleaner production. Cleaner production is to be mainstreamed with policies at all levels of the government; from the national level all the way down to the regional / district levels. Thus, if the centre wants to be a key player in the field of cleaner production, it must get involved in a dialogue with the policy-makers. This task is best handled by the Director of the centre. This section gives guidance on how the Director can offer policy advice in a strategic manner.

5.6.1 Target Audience for Providing Policy Advice

Experience suggests that the following policy-making bodies will most likely be the targets for advocacy:

- *At the national and provincial levels:* Ministries of environment, ministries of industry, ministries of economy, ministries for trade, ministries of health, ministries of labor or equivalent, bodies setting standards for worker health and safety, ministries of energy or equivalent, ministries of finance, or equivalent, etc.

- *At the local level:* Environmental authorities, local trade promotion boards, industrial development authorities or equivalent, municipal bodies, etc.

The Director of the centre should focus primarily on the policy-making bodies covering the area of the centre's geographical focus (refer to **Section 3.2.1** of **Part 3** of this Manual). For instance, the Director of a centre at the municipal level should concentrate primarily on policy-making at the municipal level. However, one cannot afford to ignore the other levels (e.g., state level, provincial level, national level). To give an example, it is possible that barriers to cleaner production exist due to **interpretation** of national regulations at the local level. Therefore, the Director needs to work through networks of like-minded organizations to achieve representation at all levels of policy-making. In this context, networking and partnerships are important strategies that are much needed in the achievement of such objectives.

5.6.2 Ways to Extend Policy Advice across Different Stakeholders

There could be many ways to extend policy advice across different stakeholders. Some examples are given below:

- Governments often request centres to carry out studies on various aspects related to cleaner production and public policy. By conducting these studies, the centre can put forth recommendations with regard to changes in the policy regime to promote cleaner production to the government.

- Enterprises, institutions, or one of their supporting organizations could ask the centre to undertake studies to assess the impacts of new government policies (or the lack of such policies). For instance, with the increase in globalization, there could be an increasing demand for analysis in trade-related cleaner production issues.

- Financial institutions could ask the centre to prepare studies on their possible role in promoting cleaner production or on ways to reduce their exposure to environmental risks in lending. Such studies would include the element of a process guidance framework for financial institutions in the context of existing and / or amended environmental policies.

5.6.3 Possibilities to Usher Policy Changes

In **Part 1** of this Manual, we noted that cleaner production entails the following aspects:

- Increasing the efficiency of resource (materials and energy) utilization and / or;

- Changing consumption patterns of goods and services and / or;

- Decreasing reliance on materials hazardous or toxic to man and the environment and / or;

- Decreasing reliance on non-renewable sources of materials and energy.

These central aspects need to be considered while advocating cleaner production to the policy-makers.

Some of the potential areas where the concept of cleaner production can be introduced are listed below:

- *Standards and regulations* (e.g., moving from concentration based standards to load or mass based standards, levying pollution charges, using information on benchmarks while proposing load based regulations, extending process based regulations to product based regulation, banning harmful substances as administered through ministries of environment as well as commerce and industry, etc.);

- *Environmental impact assessment* (e.g., introducing cleaner production in the preparation and review of environmental impact assessments, especially in assessing the consumption of materials and energy, choice of technology and materials, etc.);

"The NCPC Programme came in at the right time. New investment policies were being decided by the government –most of which were end-of-pipe oriented. With UNIDO / UNEP, we have been able to help change the policy framework."

- The El Salvador Centre

- *Worker health and safety regulations* (e.g., recommending a ban on harmful processes and materials, promoting environmentally-friendly and safer substitutes, etc.);
- *Market-based instruments* (e.g., discouraging use of hazardous or toxic materials in the consumer products by promoting eco-labeling, providing more information to the consumer on better ways of manufacturing and designing of products, etc.);
- *Energy-related regulations* (e.g., wherever possible, promoting use of renewable sources of energy over non-renewable sources of energy, encouraging clean fuels, promoting energy efficiency through fiscal instruments, etc.);
- *Industry and commerce-related regulations* (e.g., removing subsidies on all materials and energy so that users feel the real cost of resources, encouraging growth of cleaner sectors through tax-based incentives or rebates; and
- *Finance and fiscal policy-making* (e.g., favoring cleaner production related investment by suitable tax structures, etc.).

5.7 How to Build Revenue from Basic and Strategic Services to Make the Centre Self-sufficient

Broadly speaking, the process of delivering basic services provides the centre with the foundation and confidence needed to ascend to the next stage; i.e. delivering strategic services. In one sense, the centre is building its own capacity. After all, if the basic services of awareness-raising, training and cleaner production assessments are not delivered properly, there will be no triggering of (demand for) other services occurring higher up the ladder.

However, not all services will follow the sequential order of basic-to-strategic. For instance, networking may be (and ideally should be) performed at all times. Note that such planning will be situation-specific.

Revenue generation from the delivery of services is a crucial aspect of steering the centre towards financial self-sustainability Therefore,

the Director of the centre should specially taken note of this aspect as he/she creates the varying mix of basic and strategic services the centre will offer. In deciding this mix, it is important for Directors to remember that services like awareness-raising and networking do not necessarily generate revenue as such, but they **may act as triggers for other revenue-generating services**. Therefore, it is highly recommended that the Director of the centre spearheads the delivery of the awareness-raising and networking services himself / herself. Also, it is essential that the centre attempt to cover the basic costs of services that do not raise revenue. This can be made possible through seeking sponsorships, soliciting the help from stakeholders / host institutions on resources (see **Section 3.4.1** of this Manual) and / or involving the centre's partners.

Table 5.1 provides some guidance as to how revenue may be generated through the delivery of services. Note that the delivery of one service may also lead to revenue generation for another service; for instance, trainees from a particular training session may be interested in the centre following up with them for a cleaner production assessment (CPA) at their enterprise / facility. Thus, a centre should use a multi- service based approach rather than focusing only on high revenue generating services.

It is evident that it takes time for the revenue generated from all these services to build up to a comfortable level, i.e. to the point at which the centre may call itself financially self-sustainable. Till such time, it is important for the centre to build up or have access to a store of reserve funds. These reserve funds must be managed prudently, e.g., by employing only core staff at the inception of the centre, and gradually expanding them in later years. Costs can be controlled by having short-term contracts with local consultants, and by sharing resources with partners to the maximum extent possible. It may be useful to remain on the alert through a regular monitoring and review process and seek incremental funds from external donors in time.

Establishing and operating a centre is no different from setting up a Strategic Business Unit in the private sector. However, the centre is not necessarily equivalent to a conventional private consulting company. Unlike a consulting company, the centre often has a "public" status, enjoying national recognition and international support, and operating in areas that include not just consulting but also project development and strategic advice. By doing so, it is expected that the centre "offer a public good".

As the centre matures, it may offer *an additional service – consulting*. The need for such consulting activities could possibly fructify as a result of the centre's involvement and acquired expertise in CPAs. Such consulting activities might include a number of different aspects, those related to cleaner production, as well as those bordering on cleaner production. Examples include detailed energy audits, quality control, product redesign, health and safety of the workplace, establishment of EMS, environmental cost accounting, trends in environmental regulations, environmental impact assessments (to some degree) and so on. It is important to remember to *perform progressively*; trying to influence all of the above aspects at one time is an imprudent strategy. Expanding such consulting services in stages will also help build the confidence of the centre over time. Revenues in such cases will also be progressive.

Operating a financially sustainable centre tests the concept of cleaner production in practice – i.e. whether the cleaner production works in the commercial world! We hope that this Guidance Manual equips the Director of the centre with the necessary tools to set forth in this direction.

Table 5.1: Guidance on Generating Revenue from Various Services

Avenues for revenue generation	Tips (other strategies to build revenue, points of caution and suggestions)
Awareness raising	
Awareness-raising often is not a revenue generating service per se. Awareness-raising should be considered as more of a continuous activity — an investment with returns over a longer term.	–
Training	
Fees from trainees is the main revenue source, but there are also fees from trainers seeking to build their expertise in a cleaner production-related issue, as well as fees from sponsoring agencies that are interested in promoting training in cleaner production.	It is prudent to minimize costs while maximizing income. Nowhere is this perhaps more possible than in training, e.g., the centre may make use of web-based distance-education and computer-based instruction programmes. The outreach of such techniques is high, being available on a 24 hours a day, 7 days a week basis. The sale of resource materials built for training sessions / programmes (CD ROMs, manuals, etc.) could form another strategy to build revenue. It may be prudent to develop a scheme of certification or a diploma programme to provide a greater acceptance or credence to the training courses. This can lead to more registration of the trainees, especially from the private sector. Note, of course (as a precautionary point), that developing such a scheme or programme entails a cost, which the centre will have to balance against the expected benefits.
Cleaner production assessments (CPAs) and demonstration projects	
Fees from the facility for which the CPA was conducted by the centre.	CPAs should ideally lead to cleaner production investments.
Networking	
Networking is **not** a revenue generating service per se although there are possibilities to raise funds (see tips). Like awareness-raising, networking should be considered as more of a continuous activity — an investment with returns over a longer term.	Revenue may be generated through certain networking events such as exhibitions and roundtables. While hosting networking exhibitions, the centre may earn revenue by renting exhibition stalls to participants and an entry fee for interested external parties / visitors to the exhibition. In the case of networking through the medium of roundtables, revenue may be generated through registration fees and delegate fees.

Table 5.1: Guidance on Generating Revenue from Various Services

Avenues for revenue generation	Tips (other strategies to build revenue, points of caution and suggestions)
Matchmaking	
Fees from all parties (buyers and sellers) which the centre helped to make a match, fees from all concerned parties if the intended outcome of the matchmaking was a success. There could be additional revenues from membership fees (e.g., fees charged in order to get listed in buyer-seller guides). If web-based matchmaking is offered, a small annual fee may also be charged to members of the website.	Fees from the delivery of a matchmaking service could be two-tiered. As an extension of the matchmaking service, the centre may confer accreditation to relevant parties (e.g., manufacturers of eco-friendly products), and charge these parties for the accreditation service, which would be performed by the centre. The centre could then host and circulate lists of such useful product-providers / parties, which in turn could help the latter maintain a certain image for themselves or expand their presence in the market. It could charge these parties for the annual / biennial re-accreditation.
Knowledge management	
Fees from sale of products created by the centre or in conjunction with other parties. Such products could include cleaner production-related CD ROMs, guidance manuals and other publications, technology fact sheets, etc.	The centre may also generate revenue from the sale of market intelligence reports and buyer-seller guides. The centre could also extend its knowledge management service to the World Wide Web; i.e. it may generate revenue by collecting a small annual membership fee for access to a carefully devised and well-maintained database. Constant, specialized and useful updates to such a database would help in increasing the number of subscribers. As a precautionary point, such activities, while undoubtedly useful, imply a cost that must be covered by the centre.

Table 5.1: Guidance on Generating Revenue from Various Services

Avenues for revenue generation	Tips (other strategies to build revenue, points of caution and suggestions)
Interfacing with financial institutions	
Fees from the concerned enterprise / facility for making a proposal to financial institutions for a bankable project (after a CPA / demonstration project has been completed successfully), fees from the enterprise / facility for adding the dimension of cleaner production to an existing proposal (thus making it more attractive), fees from the financial institution and enterprise / facility for brokering a financial deal between the two.	The centre could also generate revenue by conducting oversight of a cleaner production project at the enterprise / facility, on behalf of the financial institution. In a similar context, the centre may also generate revenue from the enterprise / facility as well as the financial institution for conducting a cleaner production appraisal for the project in question.
Providing policy advice	
Grants from government institutions in order to conduct studies related to certain aspects of cleaner production (e.g., making a detailed study on the pros and cons of a policy change in cleaner production-related areas), fees from government institutions to host consultative workshops which seek to gather such information, and also fees for post-study-workshop consultations.	International donors with an interest in supporting policy-development work (perceived as the key in ensuring the long-term sustainability of development efforts) may also provide an avenue for revenue generation.

Part 6

How to Monitor and Review the Progress of a Cleaner Production Centre

What will we learn from Part 6?

6 How to Monitor and Review the Progress of a Cleaner Production Centre

6.1 The Need for Monitoring and Reviewing the Progress of the Centre

In **Part 3,** we noted that once the strategy of the centre is formulated, the stakeholders decide on the targets to be achieved in line with the objectives and the mission of the centre. These targets will bring about the accomplishment of the objectives of the centre.

Another important realization made from the discussions in **Part 3** and **Part 5** was the prospect of *revisiting and revitalizing* the *conceptual plan* of the centre *after its establishment*, depending on the achievements of targets and the changing economic and environmental situations. Therefore, the requirements for measuring the progress of a centre are two-fold:

- Firstly, in terms of **monitoring**: This involves ascertaining and measuring the achievement of the set targets; and
- Secondly, in terms of **reviewing**: This involves revisiting and revitalizing the business plan of the centre after its establishment.

Against this backdrop, **Part 6** is intended to provide the centre's Director, oversight bodies (Advisory Committee and Executive Board), staff and external sponsors (if any), with a general guideline on monitoring and reviewing the progress of the centre.

The Director of the centre will need to know whether the tasks of the centre are occurring at the planned levels and whether they are attaining the desired effect. It is only with this feedback that the Director can ensure that the centre is achieving its targets, and in turn meeting its objectives, in conformity with its mission (see **Level 1** of **Figure 6.1**). If deficiencies are identified through the feedback, then it is necessary to ascertain the actions required to bring the focus and resources back on track. In this light, the Director needs to apply the basic concept of continuous improvement; i.e. the **Plan-Do-Check-Act** or **PDCA cycle** (see **Section 1.4.2** of **Part 1** of this Manual). These actions will help the

Director to utilize the available resources optimally, improve the effectiveness of it's the centre's services and fetch more business. These actions are also crucial to establish and maintain the credibility of the centre and increase confidence amongst its stakeholders.

The centre's oversight bodies need to be aware of the progress made by the centre, as they provide *strategic directions* to it. Decisions concerning the strategic directions that the centre should take will be influenced primarily by the "marketing intelligence" available to the oversight bodies. Such marketing intelligence should ideally include information for **review** with respect to the following:

- The performance of the centre in the market with respect to its competitors in cleaner production-related activities, areas for improvement, and the necessity for repositioning its services (see **Level 2** of **Figure 6.1**); and
- Changes in the environmental and / or economic factors and sectoral focus of the centre: This may give rise to an expansion in the initial / present scope of the centre in terms of revising its geographical coverage and focus (see **Level 3** of **Figure 6.1**).

Figure 6.1: Monitoring and Reviewing the Progress of the Centre

The targets of the centre are typically short-term and hence *constantly evolving* (see **Section 3.3.1** of this Manual). This leads to a need for constant refinement of the targets, thus making the need for *review* even more significant.

Additionally, the centre may be the recipient of funds from external sponsors. These sponsors will probably have requirements concerning the monitoring of the progress of the centre, so as to assess the success of their funding programme(s).

It is possible that the centre may want to approach other institutions or entities in order to facilitate twinning arrangements. In such cases, measuring and communicating the performance of the centre becomes an important requirement.

The progress of a centre is judged by its performance. Monitoring and reviewing its progress entails the design and use of "performance indicators". In the next section, we shall consider some fundamentals of performance indicators.

6.2 The Fundamentals of Performance Indicators

An indicator is defined as "something that provides a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable"[1].

Performance indicators have been used extensively in a number of fields. Examples can be found in economics, where indicators such as the Gross Domestic Product (GDP), national debt, unemployment rate etc., are used. Environmental indicators are becoming increasingly popular in the evaluation of policies at the country level, the state of the environment and inter-country comparisons.

The main characteristics of performance indicators are that they quantify and simplify information in a manner that promotes the understanding by interested parties of the problems associated with achieving a target / targets.

Other special features of performance indicators are that although they are implicitly understood as having a quantitative basis, they can also be communicated in qualitative formats[2].

A performance indicator carries with it information of the various parameters from which it was evolved. *A performance indicator is thus not merely a statement of the existing status, but also provokes the need to diagnose the cause and effect.* Such diagnosis is possible with the application of the **PDCA cycle**. The performance indicator provides us with the relevant information at the "**Check**" stage of this cycle. Based on this information (which may be

[1] Hammond, Allen, A. Adriaanse, E. Rodenburg, D. Bryant, and R. Woodward. 1995. *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development.* A Report from the World Resources Institute, Washington, DC.

[2] This facet will be further expanded on in later sections of this Part of the Manual.

positive or negative in nature), we may then decide on the necessary corrective actions to be taken (i.e. at the "**Act**" stage of the cycle).

Note that corrective actions need not be taken *only* when a performance indicator indicates a negative response. They may *also* be taken when the performance indicator indicates a positive response. Such actions would tend to be situation-specific, but in general they may involve modifying that particular target qualitatively or quantitatively.

Remember that indicators are *always* to be compared against a *benchmark.* A stand-alone number generally fails to provide any concrete information, thus defeating the very purpose of devising a performance indicator in the first place. A very simple example can illustrate this point. Let us say that the Director of a centre wishes to examine the number of training sessions conducted during a year, and he / she has the information that the number of such sessions was 15. The number "15" by itself has no meaning, unless the Director *compares* this number with the number of training sessions targeted for that year (through the Training Needs Assessment or TNA). It follows naturally that if the TNA targeted a number higher than 15, then the Centre's target has not been met. In this way, the number of training sessions targeted for that year in the TNA becomes the benchmark for the centre.

Choosing an appropriate performance indicator is a not always an easy task. No universal set of performance indicators which would be equally applicable in all cases exists. Thus, the choice of a particular performance indicator is dependent on the context, and consequently the objectives and mission of the centre.

6.3 Criteria for Monitoring and Reviewing the Progress of the Centre

If we were to re-examine a centre's mission, right down to the tasks that it has assigned itself, we would realize that its basic aim is to deliver cleaner production-related services to its clients. These services have been already outlined and discussed in **Parts 4 and 5** of this Manual. It then follows that the centre would be interested in tracking its performance in relation to the delivery of services.

The centre's services could be assessed against four criteria, namely:

- The input expended in delivering a service;
- The efficiency (output) with which the delivery was performed;
- The effectiveness (outcome) of the delivery; and
- The impact of the delivery.

This hierarchy will give rise to four types of indicators - namely, "input indicators", "output indicators", "outcome indicators" and "impact indicators" respectively[3].

As mentioned earlier, the choice of a particular performance indicator is dependent on the context, and consequently the objectives and mission of the centre. It is also possible that in the case of certain services (e.g., policy advice), it may not be possible to calculate or arrive at an agreed definition for the input indicator. Therefore, it is possible that not all services may contain all four performance indicators in the hierarchy mentioned above.

Performance indicators are implicitly understood as having a quantitative basis. However, it may not be possible to quantify impact indicators for certain services, such as networking. In a similar vein, the impact indicator (or perhaps even the outcome indicator) of a service such as an awareness session could be that it *triggered* a cleaner production demonstration project. Such a performance indicator would be qualitative in nature.

Further, there could be difficulties in apportioning contributions made by two or more services to the observed outcome or impact. For example, a policy change can occur due to contributions made by awareness campaigns, training, networking, interfacing with financing institutions etc. The outcomes and impacts of different services *may overlap*, as the performance of one service could depend on the

[3] More information on performance indicators may be had from: World Bank, September, 1997 "*Pollution Prevention and Abatement Handbook: Towards Cleaner Production*."

outcome(s) of one or more other services. These limitations must also be kept in mind while using performance indicators.

In keeping with the idea of *running a smart business centre*, it is possible to use *planned triggers* as qualitative performance indicators for a particular service. For instance, the Director and the oversight bodies of the centre may plan to conduct 10 awareness-raising sessions in a year. Of these, 60% may be specifically targeted as planned triggers for the next service (i.e. training). Traveling further up the chain, 30% of the training sessions may be targeted as planned triggers for cleaner production assessments, and so on.

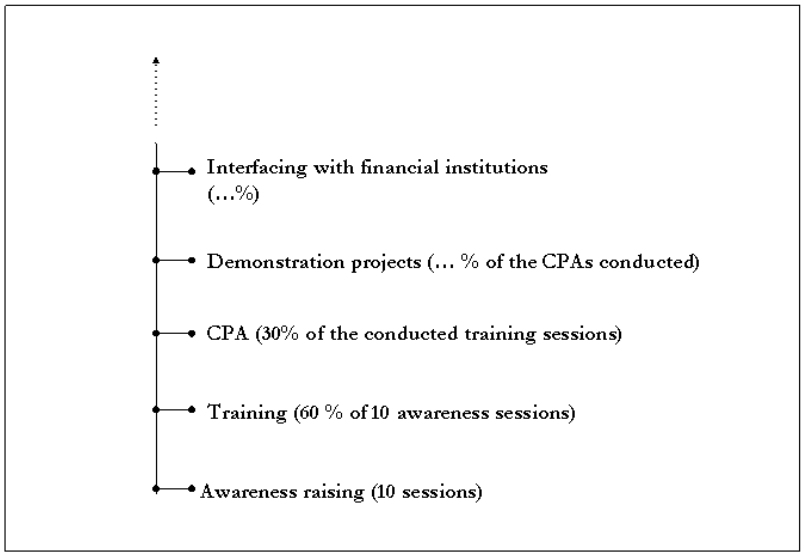


Figure 6.2: Possible Triggers and Overlaps in the Delivery and Performance of Services

The following example of delivering training as a service will be useful to explain the hierarchy of performance indicators in more detail.

Evaluation of a training session and its documentation is perhaps one of the most important, and one of the least understood parts of the training cycle. Many sessions tend to concentrate on the output indicators and neglect the outcome and impact indicators.

It is common for Directors to plan that their centre gives a certain number of training sessions during the year, based on its TNA. Let us say that the centre has organized a particular training session. Calculation of the input indicator could entail gathering data on the number of person-days spent in preparing for that particular session, rental charges for the space hired to host the session[4], advertising costs to market the session, the cost of material (stationery) and refreshments served during the session, and so on. The input indicator in this case would take the form of funds spent for that particular training session. Since the provision of training sessions is a revenue-generating activity, the information from the input performance indicator will assist the centre in comparing the costs incurred for the session against the revenue earned from it.

The output indicator can be sourced from an inventory of the invitations sent for the training session versus the actual number of registered trainees for that particular session, specially designed feedback forms (see **Annex 1**), etc. In keeping with the **PDCA cycle**, any negative revelations and responses must be examined in further detail (e.g., why was the audience number below par? Was the session poorly advertised?). Adequate steps would need to be taken to ascertain the reason for less attendance and ensure to the maximum extent possible that such instances do not recur.

The revenue earned from the training session could also form an input to this performance indicator. Feedback from the specially designed feedback forms could also provide leads to the centre's staff as to which trainers may be more effective than others. We have seen that building the capacity of the partner is also crucial and it reflects directly on the performance of the centre. Therefore, one of the output indicators for the training session may measure the extent of capacity-building achieved for each identified partner.

Another possible set of outputs from the training session could be the identification of positive ("plus") aspects of the session, accompanied by

[4] Assuming that the host institution may not absorb all or part of the costs for the training session.

suggested changes ("delta") for the benefit of future sessions. Such an identification is normally termed as a "Plus / Delta reflection"[5]. Once again, in keeping with the **PDCA** cycle, all negative revelations (deltas) must be examined in further detail. Further, subject to their relevance, all positive revelations (plusses) must be replicated across all future training sessions.

The outcomes of the training session will investigate its effectiveness, and will require the centre to follow-up with the audience *concerning the usefulness of the training after its application to their work*. The latter may require a time lag of a few weeks to a few months, in order to accurately gauge the outcomes of the training session. Once again, in keeping with the **PDCA** cycle, any negative revelations and responses must be examined in further detail.

The impacts of the training session may be ascertained by obtaining information on the number of trainees functioning as cleaner production trainers to date. However, a negative answer in this context **does not imply a negative impact** through the training session. Instead, it provides an important **trigger** for the Director to continue "hand-holding", or restructure future training sessions to ensure that a network of cleaner production trainers is created.

Figure 6.3 provides an illustration of the above example at a generic level.

[5] Refer to http://www.pekin.net/pekin108/quality_tools/plus_delta/ for more information on plus/delta

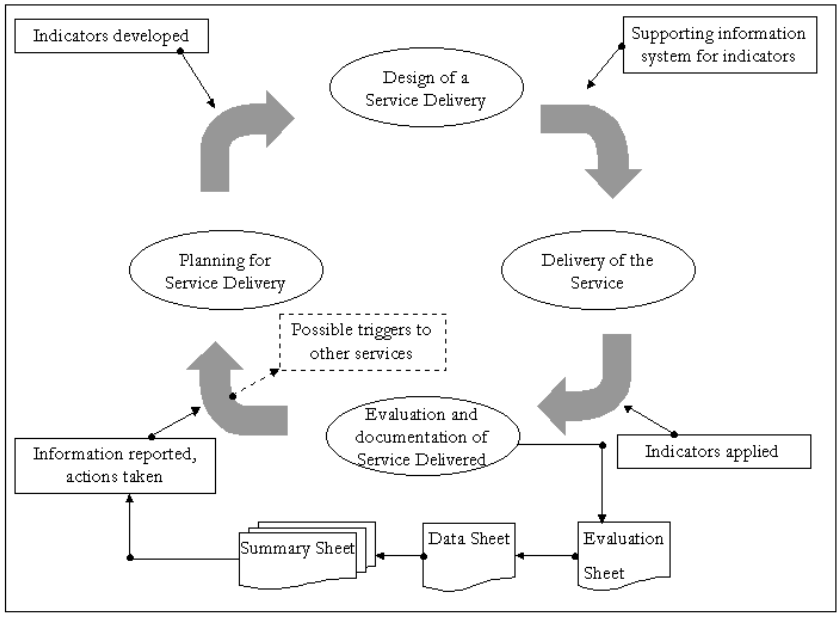


Figure 6.3: A Generic Approach to Assess the Performance of Services Delivered by the Centre

So far, we have noted the power that a properly designed and applied performance indicator wields. We have also noted that it may not be possible to calculate or arrive at an agreed definition for quantitative input and / or impact indicator(s) for all services. Further (as seen from the illustration on training and the annexes), **output and outcome** performance indicators tend to ally for operations at the level of **individual services**, while **input and impact** performance indicators tend to ally for operations at the level of the **entire centre**.

Thus, while performance indicators are elegant, their transformation in realistic terms can be quite difficult. There is thus a need to arrive at a compromise, so that the issues related to complexities in calculation and impracticalities of associated information overload may be addressed adequately.

Having said that, **Table 6.1** provides us with some leads about setting performance indicators for specific services of the centre.

In the next section, we shall examine the importance of documentation in the process of monitoring and reviewing the progress of the centre.

Table 6.1: Suggested Performance Indicators for Certain Services

Services delivered	Output indicator	Outcome indicator
Awareness raising	Percentage of awareness sessions conducted against those planned, Percentage of participants in attendance against those invited to the session, Percent coverage in terms of the geographic region and focal sectors, Any innovative structure of the awareness session that should be noted (e.g., across supply chain).	Percentage of participants in attendance that approached the Centre for additional information after the session (e.g., to seek other services), The number of partners created with the capability of sustaining future awareness sessions.
Training	Percentage of training sessions completed against the number targeted in the TNA, Percentage of participants in attendance against those invited to the session, Percent coverage in terms of the geographic region and focal sectors, Any innovative structure of the training session that should be noted (e.g., field-based, distance education mode).	Percentage of participants in attendance that approached the Centre for additional information after the session (e.g., to seek other services), The number of partners created with the capability of sustaining future training sessions, The number of faculty trained who now regularly offer cleaner production courses or courses including cleaner production units
Cleaner production assessments (CPAs)	Percentage of CPAs carried out against the number targeted, Percent coverage in terms of the geographic region and focal sectors, Any innovative aspect of the CPA that should be noted (e.g., product focused, to support EMS, etc.).	Percentage of cleaner production options implemented against those identified, Information on total resources conserved, wastes reduced, production increased, investments made and savings achieved for each facility.
Demonstration projects	Percentage of demonstration projects completed against the number targeted, Percentage of demonstration projects completed against the number proposed, Percent coverage in terms of the geographic region and focal sectors, Any innovative structure of the demonstration project that should be noted (for e.g., involving private sector, triggering technology	Number of demonstration projects that got multiplied, Number of technology / methods patents filed as a result of the demonstration project, Number of technology transfers (national and international), Information on total resources conserved, wastes reduced, production increased, investments made and savings achieved for each

Table 6.1: Suggested Performance Indicators for Certain Services

Services delivered	Output indicator	Outcome indicator
	transfer, etc.).	facility.
Matchmaking	Percentage of contacts enabled against the number targeted, Percent coverage in terms of the geographic region and focal sectors, Any innovative tool used that should be noted (e.g., web based match making, or revenue sharing with the technology / information provider).	Number of transactions that actually fructified, Information on total resources conserved, wastes reduced, production increased, investments made and savings achieved for each transaction.
Knowledge management	Percentage of knowledge-based products completed as against the number targeted, Number of knowledge-based products sold, Revenue made as a percent of the Centre's total revenue, Percentage of sectors covered, Any innovative tool used that should be noted (e.g., computer based instructions, CD-ROM based database on technology fact sheets, or revenue sharing with the information- provider, etc.).	_
Interfacing with financial institutions	Percentage of proposals submitted for financing as against the number targeted, Number of proposals reviewed for a financing institution, Percent coverage in terms of the geographic region and focal sectors, Any innovative structure used that should be noted (e.g., joint venture, venture capital funding route, etc.).	Information on total resources conserved, wastes reduced, production increased, investments made and savings achieved for each transaction.
Providing policy advice	Number of studies undertaken to catalyze a policy change, Any innovative policy modifications / recommendations that should be noted.	Any evidence of impacts due to changed regulations or policy regime.

6.4 Establishing a Data Collection System

Having understood what a particular performance indicator may or may not entail (given the specifics of each situation), we should pay equal attention to its documentation. Continuing from our example of training in the previous section, documenting the outputs and outcomes of training sessions will help the centre understand and map out what works or does not work given a particular scenario.

The centre could then capitalize on the strengths of that particular session, learn from its weaknesses, and resolve ways and means to improve future training sessions within the same scenario, and possibly even across varying scenarios. The results of this documentation would not only have to be fed into the centre's TNA for its updating, but also forwarded to and discussed with the centre's partners, as part of their capacity building efforts. In essence, the centre would be **monitoring** its performance. Such documentation could be in the form of a **Data Sheet** (see **Annex 2**).

The **sustained** collation of such documentation over the long term, in the form of a **Summary Sheet** (see **Annex 3**), will eventually help the centre plan for its future. This repository of information would provide the centre with the information it needs to **review** its performance.

In sum, **Annex 1** provides certain guidelines on the documentation that would be required after the completion of a training session. In essence, this is the feedback form that trainees would fill in and pass on to the staff of the centre. **Annex 2** provides a guideline for the Data Sheet for an individual training session. A member of the centre staff who has had a close association with that particular training session would complete this Data Sheet. **Annex 3** provides a guideline for the Summary Sheet, which would be a result of the collation of summaries of all training sessions held during that year. The information for the Summary Sheet will be compiled by centre staff in charge of delivering the service of training, and presented to the Director and oversight bodies of the centre for their review, comments, and follow-up actions.

In this context, it is also important for the Director and the oversight bodies to give thought to the **data collection time and effort required by each performance indicator under consideration.** However, this requirement should be balanced evenly with the significance and ultimate consequences of the data collection exercise. Having said that, the

energies expended towards the data collection exercise should be reviewed as an investment, instead of a barrier or drain on resources.

The task of documentation is not as daunting as it sounds. In fact, the numerous data management software available in the market could make this task significantly easier for the centre.

6.5 Establishing a Reporting System

The Director and the oversight bodies of the centre will also have to decide on the nature of information to be reported, to whom, and how. It will also be useful (if not necessary) to report such information to external donors (if any) and other external parties (e.g., prospective clients). The Director will need to ensure that performance data are collected in sufficient time so as to meet reporting deadlines, and that they are reported in a manner which is easy-to-understand and well-structured. There may be required formats for reporting, such as in the form of an Annual Report. Where the reporting of performance indicators is mandated by external donors, the Directors and staff need to arrive at an understanding with the donor as to the required format for reporting, so as not to waste precious time reformatting data at a later stage.

6.6 Obtaining Information on Changing Scenarios and Updating the Business Plan of the Centre

The state of affairs in the real world is never static. A smart business is always on the lookout for information on changing scenarios, so as to continually review and reposition its Business Plan as and when the need arises. So too must any Cleaner Production Centre. The marketing intelligence of the centre may reveal changing situations such as:

- Transitions in the economy;
- The need to revise the sectoral focus of the centre;
- The need to revise the geographical coverage of the centre;
- Induction of new stakeholders;
- Mentoring newer centres;

- Addressing new trade impositions;
- Unpacking of new and useful technologies, and so on.

While it would be quite rare for a centre to revise its mission, there would undoubtedly be room for it to envision new priorities, and thereafter revise its targets (up scaling and downscaling alike), devise new tasks and reallocate financial resources. This would require the centre to revisit its original Business Plan and tweak it accordingly, based on the inputs received from the marketing intelligence, as well as its own performance indicators (see **Figure 6.4**).

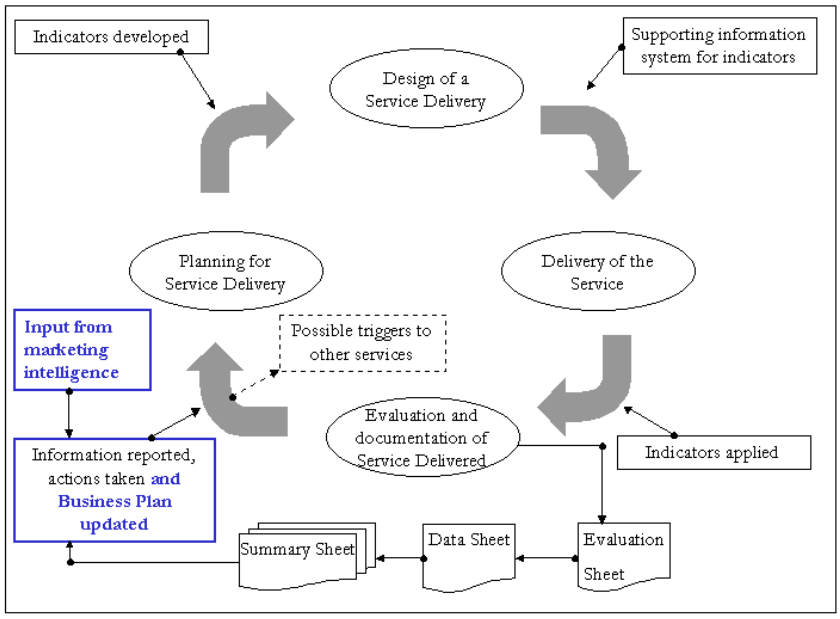


Figure 6.4: Updating the Business Plan of the Centre Based on its Performance

Updating the Business Plan also mandates updating the relevant documentation, as it will chart a history of lessons learnt during the conception, establishment and operation of the centre. Such historical records will help to establish transparency among stakeholders of the centre, as well as aid in the setting up of new centres.

Annex 1

Sample Evaluation Sheet for a Training Session[6]

Date: _____

Kindly take a few moments to fill in this Evaluation Sheet. It will help us greatly in assessing the usefulness of our training session. Do feel free to ask for any assistance if the need arises. Additional sheets will be provided to you if required. Thank you!

I. General information[7]

Name of the trainee: _____

Name of the trainee's employer: _____

Contact details of the trainee (at the place of work): _____

Designation of the trainee: _____

Title of the training session attended: _____

Name of the trainer[8]: _____

---

[6] This Evaluation Sheet will be filled in by the trainees. There could be some additions / deletions to the Evaluation Sheet depending on centre-specificity.

[7] Some centres may want to consider excluding the fields concerning the name and contact details of the trainee, so as to encourage "more frankness" in their opinions / evaluation.

PART 6

Has the trainee had any previous exposure to cleaner production? Yes / No

If "Yes", how so?

II. Please provide a rating on a scale of 1 to 5 for the following items by placing a tick mark in the relevant column. A rating of "1" denotes the lowest level of achievement while a rating of "5" denotes the highest level of achievement.

Item	1	2	3	4	5
(a) Venue					
(b) Travel arrangements to the venue					
(c) Audio-visual equipment					
(d) Refreshments					
(e) Resources (reading material and CD-ROM)					
(f) Ability of the trainer to communicate with the audience					
(g) Content of the training					
(h) Technical skills of the trainer					

[8] If the training session is being conducted by more than one trainer, the relevant fields will need to be modified accordingly.

III. Please feel free to provide any suggestions that would improve future training sessions (e.g., ways to make them more effective and relevant to your work, coverage of the training content, improving the training content, etc.)

Annex 2

Sample Evaluation Sheet for a Training Session[9]

Date: _____

Name and date of the training session for which this Data Sheet

is being filled: _____

Name of the centre staff completing this Data Sheet: _____

1.1 Calculation of the input indicator for the training session (assign a monetary value; add all costs associated in conducting this session - rental charges for space, cost of stationery, cost of refreshments, cost of travel, charges paid to local consultants, monetary value of staff person-hours spent towards preparing for and conducting the session, etc.)
... Input indicator = _____

[9] This Data Sheet will be filled in and analyzed by a member of the Centre's staff, who was directly involved in planning and / or conducting that particular training session. The source of the information needed by this member of staff will be the evaluation sheets from all the trainees of that training session. There could be some additions / deletions to the Data Sheet depending on Centre-specificity.

1.2 Calculation of the output indicators for the training session (showing the calculations for the ratios)
Ratio (Number of people trained in the session / number of people targeted for training in that particular session) = _____ Percentage of trainees who felt that the trainer was a good communicator = _____ Percentage of trainees who felt that the trainer was technically skilled = _____ Revenue earned from the training session = _____ Ratio of revenue earned from the training session / cost of the training session = _____

1.3 Calculation of the outcome indicator(s) for the training session
Percentage of trainees contacted by Centre Staff for follow-up: _____ Percentage of contacted trainees who used the training they received in their work = _____

1.4 Assessment of positive outcomes: Identify and list all positive outcomes collated from Boxes 1.2 and 1.3, as well as any other information from the evaluation sheets (e.g. identification of good trainers, identification of good partners, etc.)
….

1.5 Assessment of negative outcomes: Identify and list the causes of negative outcomes collated from Boxes 1.2 and 1.3 (e.g. some contacted trainees might not have used the training they received in their work if an incorrect TNA was made)
….

1.6 Actions taken to alleviate the cause of <u>each</u> negative outcome identified in Box 1.5 (for <u>each</u>

action, mention by whom and when)
…

1.7 Identification of the impacts of the training session
Did this training session trigger the need for the centre to deliver further services? If Yes, which? … Did the training service lead to any positive environmental impacts at the enterprise level? (e.g. quantity of energy saved, quantity of water saved, quantity of solid waste reduced at source, toxics use reduction, etc.[10]) … Were the overall impacts positive / negative / indeterminate? _____

[10] The extent of such environmental impacts may be gauged through a comparison of before-after scenarios; e.g. the quantity of water saved may be computed by calculating the difference between the quantities of water used (per capita per month or per capita per year) before and after the evaluation.

Annex 3

Sample Summary Evaluation Sheet for Training Sessions Conducted Throughout the Year[11]

Date: _____

Financial year for which this Summary Sheet is being filled: _____

Name of the centre staff filling in this Summary Sheet: _____

1.1 Assessing whether targets for training have been met
Number of training sessions conducted throughout the year = _____ Number of training sessions targeted in the TNA for this year = _____ Have the targets for training been met: Yes / No

1.2 Assessment of the inputs expended on all training sessions throughout the year, versus the revenue earned from them

[11] This Summary Sheet will be filled in by a member of the centre's staff who is familiar with delivering training as a service. The source of the information needed by this member of staff will be the data sheets from all training sessions held during the year. The completed Summary Sheet will then be analyzed by the Director of the centre. There could be some additions / deletions to the Summary Sheet depending on centre-specificity.

Training session identification code

Input indicator

Revenue earned

...

...

...

Total

US $_____

US $_____

1.3 Assessment of the progress in capacity-building initiatives of partners (i.e. trainers of the training sessions)

Name of the trainers / partners identified as good communicators: _____

Name of the trainers / partners identified as technically skilled: _____

Percentage increase in the number of trainers / partners identified as good communicators (over the previous financial year) = _____

Percentage increase in the number of trainers / partners identified as technically skilled = _____

1.4 Summary of positive outcomes from all training sessions given in this financial year
…

1.5 Summary of negative outcomes from all training sessions given in this financial year and the actions taken to alleviate each negative outcome
Training session identification code Negative outcome Description of the action taken By whom and when? Was the action taken effective? … … …

1.6 Summary of identified impacts from all training sessions given in this financial year
Training session identification code Description of the identified impact Nature of the impact (positive / negative / indeterminate)

…

…

…

1.7 Comments from the Director (including but not necessarily restricted to follow-up actions for all positive and negative indicators)

…

1.8 Comments from the oversight bodies (including but not necessarily restricted to follow-up actions for all positive and negative indicators)

…