Project Guidelines

January 2002

Progetto Closed
Life
Sistema di gestione
a ciclo chiuso

About this Guide

This guide is a collection of fact sheets and helpful data about the Closed Project.

It has been realised by Arpat and Ecosistemi.

It is addressed to all those people that are interested in taking part to the Project or simply in following the current and future developments of the Closed method.

It cannot be considered an exhaustive description of all Project's aspects, but it represents a useful source of basic information.

It has to be considered as work in progress and it is opened to comments and suggestions from the readers.

This guide does not replace texts and materials released by the European Union.

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European environmental policy

The European Union Strategy for Sustainable Development focuses on the need of integrating ecological and economic considerations in the decision making process.

Over the past few years, the aim of European environmental policy has shifted from the improvement of standards and management criteria in the fields of waste, waters, soil and air emissions to the definition of methods for the overall assessment of future scenarios and for the integration of environmental policies of different sectors.

The reason behind that is very simple: the earlier the relevant environmental issues are taken into account in the decision making process, the more effective and the more economically efficient will be the actions aimed at protecting the environment.

The same recommendation applies to European enterprise policy: the environmental variable should be integrated with the other variables that affect the business decision making process.

Integrating environmental policy means looking at technological innovations, products, costs and the market also from an environmental point of view. The tendency to focus on a single industry or sector disregarding the importance of intersectorial connections could represent a dangerous obstacle.

Those connections, in fact, often result into economic and ecological dipendencies that are hardly reflected into the formulation of sector specific policies which thus risk to have countereffects on other sectors.

Environmental protection must thus be integrated in the definition and implementation of the other European policies not only for the sake of the environment, but also to guarantee that progress is made in all sectors. Enhancing the demand for clean technologies and products means creating new market opportunities as well, with particular advantages for the most innovative companies. The integration of environmental issues into business management practices enables also the achievement of advantages in terms of reduced energy and resource consumption and reduced waste processing costs.

Life

LIFE is a financial instrument for three major areas of action : Environment, Nature and Third Countries. While all three areas aim to improve the environment, each has its specific priorities.

LIFE dates back to 1992. The first phase was completed in 1992-1995 and the second phase is now continuing.

Actions eligible for LIFE funding are:

- Environment- innovative and demonstration actions for industry; demonstration, promotion and technical assistance actions for local authorities; and preparatory actions to support community legislation and policies.

- Nature- actions aiming at the conservation of natural habitats and of wild fauna and flora of EU interest.

- Third Countries- technical assistance in the establishment of environment administrative structures, nature conservation actions and demonstration actions to promote sustainable development.

In 1999, 152 Life environment projects were cofinanced , with a total amount of 65 millions Euro , about 125 millions of Italian currency. Among those 152 projects 59 are concerned with industry (recycling and clean technologies), 84 regard local authorities (regional and local policies for wastes) 9 refer to preliminary activities (water and wastes).

168 Italian projects have been introduced, 26 have been sponsored, in particular: 9 industrial projects and 17 projects proposed by local authorities.
Among them, Closed Project obtained a fund of about 500.000 Euro.

Among financed Italian projects we mention those introduced by:

- **Lipomo Printshop**, to lower inks environmental impact in textile printing;
- **Cavino Distillery**, to recycle and reuse waste waters;
- **Tre Effe Tannery**, to recycle and reuse waste waters;
- **Corona Arrubia Consortium**, for biological purification of waste waters;
- **CPR-System**, to reuse special containers for the transport of fruit and vegetables;
- **Salvatore Maugieri Foundation**, for air monitoring;
- **Ecotema**, to measure acoustic, electromagnetic and urban air pollution;
- **CNR-Materials Processing Institute**, to analyze asbestos presence in Italian industrial sites;
- **Techno-Biochip,** to develop a method of incineration for dangerous substances polluted soil;
- **Livorno Province**, to develop a real time measurement of heavy metals concentration in soil;
- **Cybernetics and Byophisics Institute,** to decontaminate polluted soils by a phyto-recovering method;
- **Milan's Province**, for a bio-recovering method suitable for areas contaminated by organic constituents;
- **Lao's Reclamation Consortium**, to experiment on the field an irrigation remote measuring method;
- **Genoa Municipality**, to monitor coastal erosion due to water treatment plants;
- **Veneto's Forest Regional Agency**, to examine nitrogen pollution in waters;
- **Umbria Region**, for copse running methods;
- **Ostini Municipality**, for the environmental protection of coastal areas;
- **Censis Foundation**, to develop practices of sustainable environmental tourism;
- **Codif**, for an integrated action plan for sustainable development in some Italian cities;
- **Monreale City**, to analyze the development of tourist flows through an eco-electric transport system and to create job opportunities.

Closed Project, sponsored by **Arpat** and **Ecosistemi**, is added to the above projects.

Ecological Industrial Theory

Theories and applications in the field of "Industrial Ecology" represent the conceptual background of the Closed Project.
The scope of Industrial Ecology is to contribute to the construction of closed loop economies by defining, for example, networks of enterprises which exchange waste so that materials discharged by one firm can be used as raw material by another one. As a result, the overall quantity of waste produced is minimised.
With this purpose, material and energy flows are considered over the whole life cycle of a product/process, with the inclusion of the initial phase of raw material extraction, their consumption over the production process and their transformation in waste.

The Eco-Industrial Park (EIP) is one of the main tools of industrial ecology.
At present, two main experiences of EIP have been developed:

- The industrial system in Kalundborg (Denmark);
- The EIPs in the USA.

The EIP models are based on two different approaches:

- Kalundborg's one is a bottom-up approach, where the system evolves by itself and then it becomes a real management method;
- The USA's one is a top-down approach, where the application of a theoretical method leads to planning and implementation.

The idea behind Closed is to bring about a third way for the realisation of an EIP, through the creation of an Eco-Industrial District (EID). The Italian industrial districts are already characterised by the existence of strong connections among the different production processes, organizations and local institutions. Within those districts waste, materials, knowledge, experiences are transformed internally or by others in "local resources", but the environmental benefits of these relationships have been ignored so far. The aim of the EID is to maximise those environmental benefits by underlining also the economic advantages that accompany them.

Italian district analysis

The "Closed" project represents the first Italian attempt at creating an Ecological Industrial District (EID), using a "Closed-loop Environmental Management System" in the existing manufacturing areas of Prato, Lucca and Pistoia.
It is important to point out that the "Closed" project has been carried out in three of the richest and most competitive Italian industrial zones, of the textile (Prato), paper (Lucca) and plant flower growing (Pistoia) sectors.
"Closed" stands for ""Closed-loop System with Ecoindustrial Districts" and is a new model of greening existing and successful manufacturing areas (brownfield) optimising the material exchange between companies, in order to improve their environmental and economic performance.

Prato and Lucca belong to a group of industrial zones referred to in Italian law as *distretti industriali*.
This Italian "industrial district" is a local industrial system, consisting of small and medium enterprises (SME_s), which are closely linked to the local community.
Most of them, specialised in traditional sectors such as fashion, furniture and food, are located in the central and northern parts of Italy. Since 1991 these clusters of enterprises have been distinguished from other industrial zones under special legislation (lex n°317/91) that sets a statistics-based standard for classifying industrial districts, for example according to product concentration, number of companies of the same sector and level of turnover.
As this description hopefully explains, among the different types of industrial zones existing in Italy, the "distretti industriali"/"industrial district" would be the most ideal site for the application of Industrial Ecology principles, not last because of the fact that a network of enterprises can better meet the costs of the EMS, than a single industrial estate.

Italian districts analysis

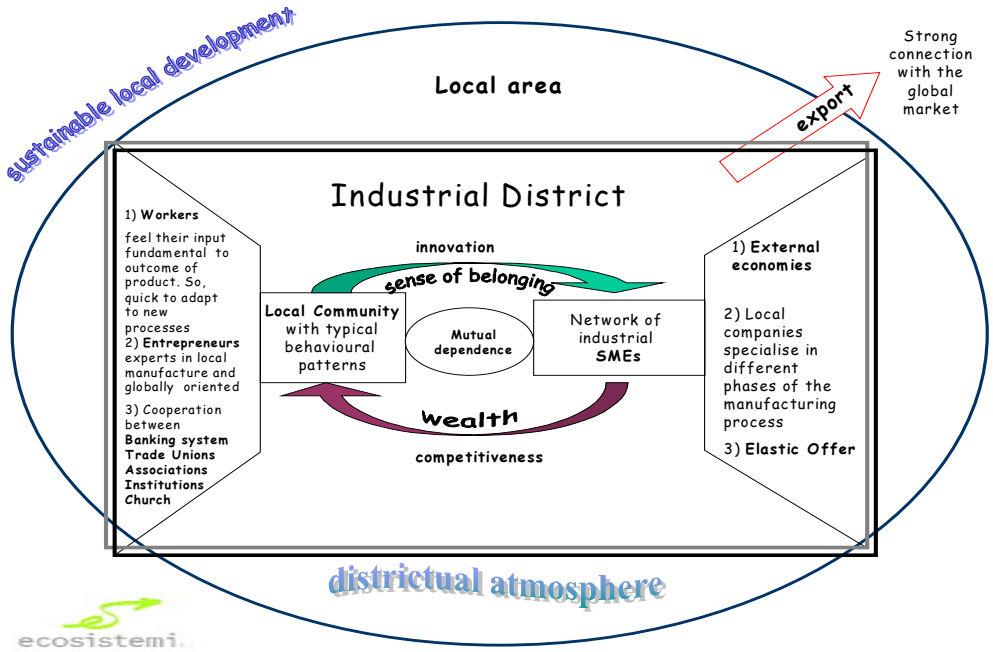


Fig.1

Background

Lucca's paper "distretto industriale" is a single product district, characterised by medium and large enterprises (150 workers), with a high level of competitiveness and expertise in paper production systems.
On the other hand, Prato (textile) and Pistoia (plants) are characterised by small and very small enterprises (5-20 workers) with a high level of co-operation that makes the local externalisation of manufacturing phases possible.
These features of competitiveness, co-operation and innovation make Prato, Lucca and Pistoia particularly suitable for the realisation of an Eco-Industrial Park in the form of an Eco-Industrial district (EID).

Lucca

With an estimated turnover of € 2,053,000,000 Lucca's paper industry is the primary manufacturing sector in the Province. The sector provides roughly 5,500 jobs and in terms of employment is the second biggest sector in the area. The Lucca paper industry accounts for approximately 80% and over 30% of Italian tissue paper and corrugated cardboard output, respectively. There are

approximately 200 companies in the paper industry and they are located primarily in the Medivalle Lucchese and Garfagnana. These firms can be broken down as follows:
4.5% produce corrugated cardboard,
42% manufacture paper
53.5% make paper and similar goods.
The marked rise in both domestic and industrial paper consumption in western countries has led to significant increases in exports from the province.

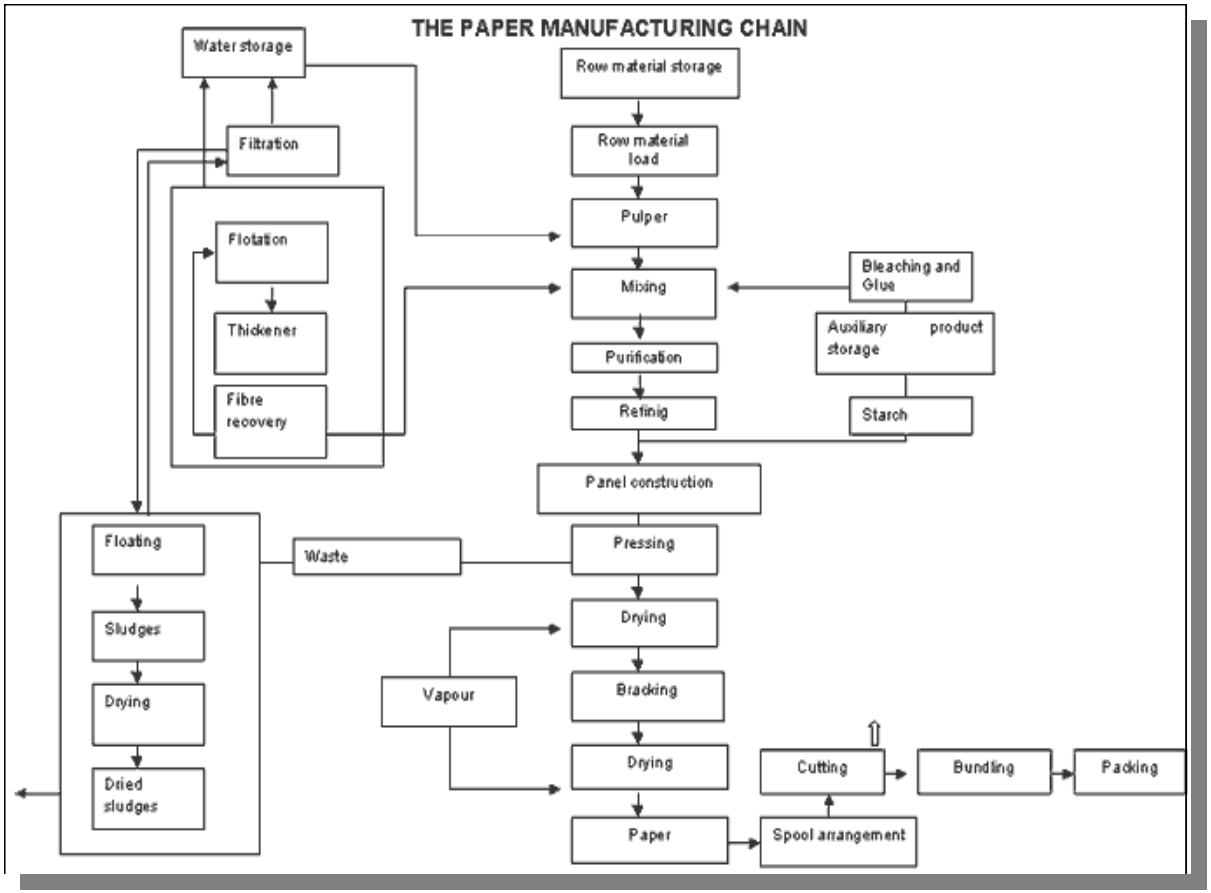


Fig. 2

Prato

The Prato district comprises approximately 8,000 medium-small firms that employ 44,000 people that account for:

- 15% of the population
- 30% of the total workforce;
- 60% of all the jobs.

The main manufacturing areas are: woollens (27.1% of the total output), yarns (18.6%) and cotton and linen textiles (16%). There has been a recent surge in synthetic textile production that now is roughly 7.2% of the area's output. The second industry in the area is textile machinery, with 200 firms that have annual turnover of US$210 million (40% of the products are exported). And finally a small number of firms are dedicated to packaging and auxiliary goods (oils, dyes, detergents, etc.) for the textile industry.

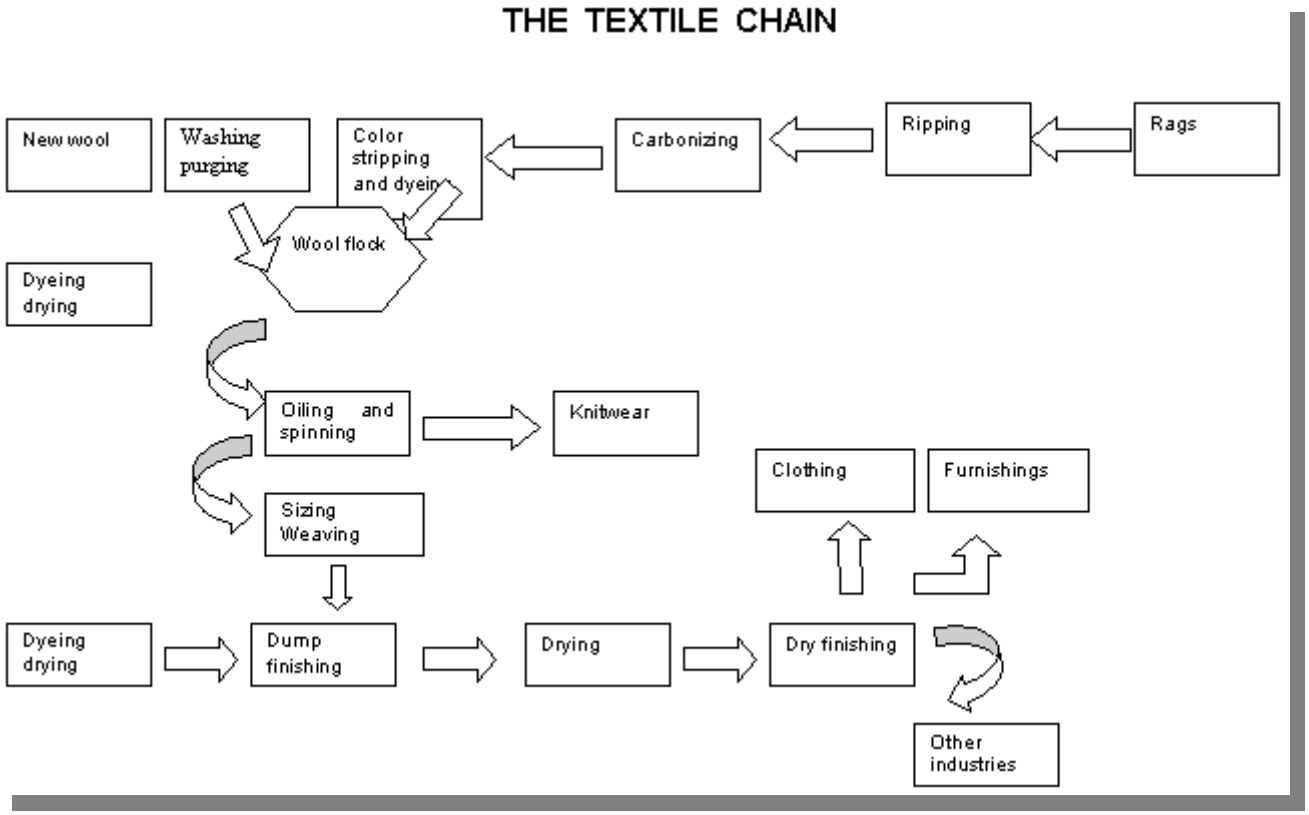

THE TEXTILE CHAIN
New wool
Washing purging
Color stripping and dyein
Carbonizing
Ripping
Rags
Wool flock
Dyeing drying
Oiling and spinning
Knitwear
Clothing
Furnishings
Sizing Weaving
Dyeing drying
Dump finishing
Drying
Dry finishing
Other industries

Fig. 3

Pistoia

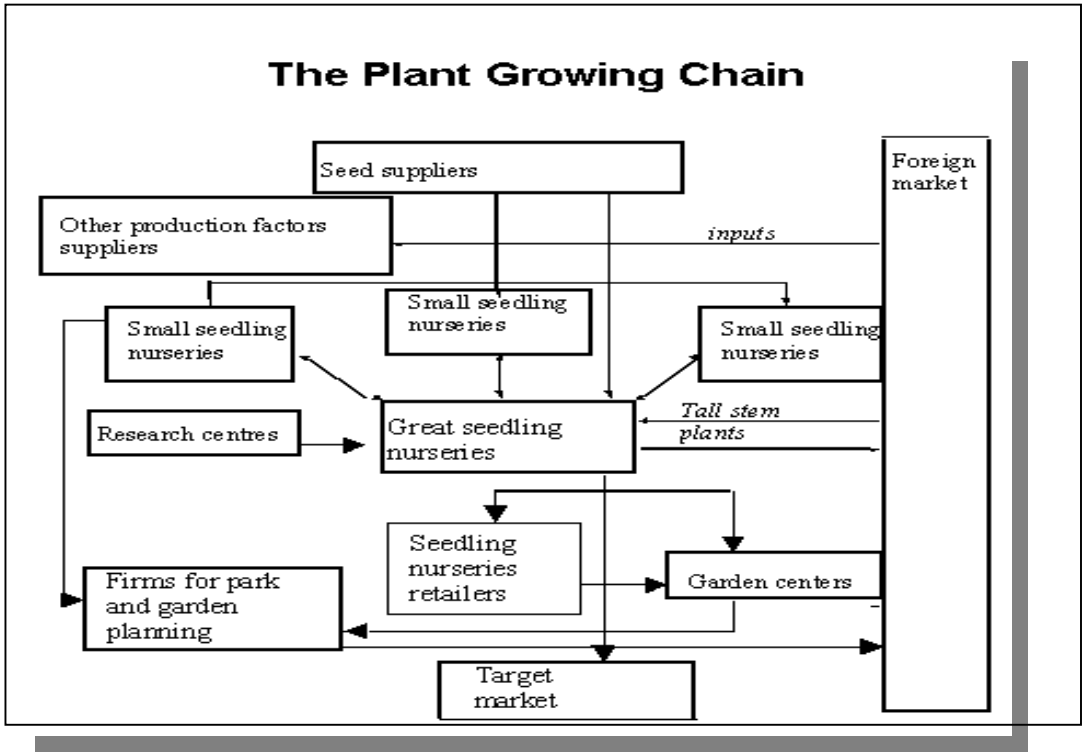
The plant-flower sector in Pistoia accounts for 80% of total agricultural output with a turnover of € 211,750,000 broken down into € 129,115,000 from plants and € 82,635,000 from flowers. The plant-flower growing sector in Pistoia dates from the middle of the last century and it developed gradually thanks to the qualities of the soil and the increasing expertise of the people. It began on the Ombrone Plain (where approximately 90% of the firms are located today) and has expanded to the Valdinievole (near Pescia) that is also the world's major olive-growing area, and the mountain areas where "Christmas tree" production is thriving along with other forest products. Currently the plant-flower growing district extends over an area of roughly 5,000 hectares located primarily in the municipalities of Pistoia, Serravalle P.se, Agliana, Quarrata and Montale. There are approximately 1250 nurseries and flower growers that provide steady employment for 5,000 people. The mean size of the companies is around 1.5 hectares.

The reference market brought changes to the sectors. Until a few years ago the reference market was the private sector, today plant-flower growing has a public sector market in purchases of greenery for urban areas, public places, and areas of community interest, with a consequent increase in output of products for parks.

The area covered with nurseries is approximately 5,000 hectares of which about 80 are dedicated to potted plants. In recent years gross saleable output was over € 181 million of which € 77,5 million was exported. There are over 1,000 firms employing about 5,000 people involved in this business. On the national scale, Pistoia accounts for 1/4 of Italian plant-flower growing, with a focus on plants for gardens and parks.

Pistoia is Europe's major centre for landscaping and outdoor ornamental plants. Pistoia produces a wide variety of ready-to-plant trees that can satisfy all needs as regards shape, size and colour for constructing parks and gardens. The products from this area can be grouped in three categories:

- plants grown in the ground
- potted plants
- young plants, both potted and in the ground



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Closed Project

CLOSED stands for "*Closed Loop Management System*". In Italian: "Sistema di gestione a ciclo chiuso"

Mission and task

The main task of the Project is to open a new way for the application of industrial ecology-related theories by means of an Eco-Industrial District (EID), hence by giving an environmental shape to the existing mutual relations among production activities, organisations and local institutions. With this purpose, the cost reductions that arise from those connections will also be emphasised.
In the end, we hope to set up a community of local authorities and citizens that cooperate to achieve economic and environmental objectives simultaneously.
The Closed Project will allow to focus on the specific environmental concerns of the areas and the

sectors involved in the initiative.

Targets

The Closed project represents an attempt of meeting SMEs requirements of economic development and environmental protection in the plant flower growing, textile and paper sectors, which have been identified by the European Commission as sectors with a significant environmental impact.
Main targets of the Project are therefore the reduction of environmental impacts and the better management of a territory, such as the Italian one, which is characterised by a strong concentration of productive activities and by the presence of "district economies".

Solutions

Closed Project intends to:

- Design an original model of connecting systems to set up closed loop economies;
- Promote an Eco-Industrial District (EID), that is a territorial connecting system in which firms, institutions and local partners work together to achieve economic and environmental objectives through natural resource management.

Proponents

- Arpat, who assures know-how and territorial presence;

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- Ecosistemi, that provides the expertise for the definition of eco-industrial symbiosis processes.

Basic Assumptions

Redesigning connections among SMEs will be possible only if:

- They will show a good attitude towards cooperation;
- They will be willing to provide data on material and energy flows;
- They will be willing to redesign products so as to substitute production inputs with outputs deriving from waste materials of the districts.

Expected results

Expected outcomes of the project are:

- the maximisation of reusable waste exchange flows;
- the increase in the amount of recyclable materials;
- the reduction of harmful emissions and of the consumption of environmental resources;
- the reduction of environmental management costs;
- the identification of "green market's niches";
- the definition of environmental criteria useful to set up a district's EMAS;
- the introduction of the environmental variable as a factor of technological innovation.

Expected products

At the end of the project the Working team will produce:

- a manual collecting project's history and methodologies so as to enhance the EID's implementation and to encourage its replication elsewhere;
- a territorial map to indicate where the initiative could be repeated;
- a set of territorial economic-environmental indicators.

Working Team

Arpat is the beneficiary of the project and Ecosistemi is its partner.
- Arpat – Regional Agency for Environment's Protection, Tuscany
It is the regional agency supervising all environmental controls of the Region.
- Ecosistemi, - initiative partner – Environmental Consulting Company, member of the international Eco-Industrial Parks network.

Contributions to the Working Team will also come from:
- Ecobilan;
- Isis;
- Antonucci & Associates;
- Irpet (Regional Institute for Economical Program)
- ARRR (Regional Agency for Resources Reuse)
- Ambi.NET

Methodology

"Closed" has attempted to combine two different approaches to setting up an Eco-industrial Park:
- the spontaneous symbiotic system developed in Kalundborg (bottom up)
- the demonstration sites designated by the US President's Council on Sustainable Development (PCDS) in order to investigate the practical applications of the Industrial Ecology's theoretical concept (top down).
"Closed Method" would open a third way for EIP realisation, adapting the previous experiences and theories to the Italian district context by greening the natural symbiotic relationship between companies.

Our first task was *to educate local entrepreneurs* about the main aspects of Industrial Ecology through workshops and seminars, in order to adapt the theoretical model to their reality.
As a result we arrived at a reconstruction of the manufactory chain of each "distretto industriale" as shown above (fig. 2-3-4)
This was a difficult process in which we strove to achieve the best possible compromise between the IE models and the realities of the industry coupled with the manufacturers extent of co-operation.

The analysis phase, our second task, started with a Local Environmental Analysis (LEA) aimed at quantifying the potential amount of waste which could be re-used as secondary material in production, according to economic convenience and environmental sustainability criteria. "Closed Software" has been designed to manage the information on quantities and types of waste from each production process, its potential reuse, treatment and disposal costs, waste transformation costs and substituted raw material costs.
These data are drawn from special questionnaires on input-output materials and the companies' environmental declarations on waste production.

The Life Cycle Assessment (LCA) followed and integrated this first analysis.
The LCA consists of posting all raw material and energy consumption and all the emissions into the air and water and solids from the chain, through the entire life cycle from raw material extraction to final disposal (cradle-to-grave).
The LCA aimed at obtaining a quantitative evaluation of the environmental and energetic benefits associated with waste recovering potential options.
The LCA we used in this study is internationally recognised through the ISO 14040 standards series. They make it possible to:
- quantify the environmental impact of complex industrial chains using a rigorous and scientific approach; - take into account

the environmental and energetic aspects relative to raw material production and the use of co-products of the industrial sites; - compare alternative industrial systems in a coherent manner.
Because of its features the Commission has also adopted the LCA for Ecolabels (or product eco-compatibility marks/labels) of the European Community as an appropriate tool for developing the criteria for granting ecolabels.
The following scenarios are the main results suggested by LCA:
PISTOIA
Reutilization of soil removed from sold plants as soil for new crops
Reutilization of waste plants as compost for new crops
LUCCA
Energetic recovery of pulper waste
PRATO
Reutilization of the waste flock (i.e. textile waste that is less than a few millimetres long) as fuel through burning with a cogeneration energy recovery
The aim of the Environmental Cost Accounting (ECA) was

a) to calculate the costs of the measures implemented by the companies to prevent, reduce or repair environmental damage caused by their operations (environmental costs);

b) to identify those areas - in qualitative terms - that would be modified through the creation of the eco-industrial metabolism project;

c) to identify those phases of the process in which the reduction of environmental impact coincides with the reduction of business costs thus constructing a win-lose diagram.
the quantification of costs incurred by enterprises in order to prevent, reduce or repair environmental damages, followed by the qualitative identification of costs, which would be modified, with the implementation of the eco-industrial symbiosis project.

The environmental cost analysis phase of the CLOSED Project fits into the context of the European environmental cost accounting project. Environmental cost accounting is the representation of the economic and financial effort made by a company to protect the environment.

Material Flow Accounting (MFA) aimed at the creation of material flow diagrams for each enterprise and for each district, which show the amount of materials needed for the production, distribution, use, recycling and disposal of a given product and allow to calculate the environmental pressure indicators for each area. These indicators represent the starting point for the realisation of eco-industrial symbiosis within the districts.

MFA of LUCCA Industrial District

MFA of PRATO industrial district

MFA of PISTOIA industrial district

In order to complete the information background from an economic and social point of view Irpet elaborated a study to analyse the economic and social aspects of the paper, textile and plant-flower growing districts. The starting point is a general outline of the industrial district paradigm, which is a local context, characterised by a concentration of small and medium size businesses.

Future developments

The third phase for the Ecological Industrial District realisation has just started.
Analysis results have been communicated to entrepreneurs and to local authorities through public meetings.
The aim of these public meetings was to validate our analysis so as to begin the EID construction through a *bottom up* process.
The instruments identified for this purpose is:

The Laboratory for "waterfall-like planning"'
"Waterfall-like planning" represents in practice the intersection point between the *top down* and *bottom up* approaches.
13 project files have been compiled to collect the ideas and proposals that resulted from the combined work of local entrepreneurs and ARPAT staff.
Local entrepreneurs are now able to individuate best waste exchange options from an economic and environmental point of view.

The "Closed" help-desk
The Closed help-desk would act as a promoter of industrial symbiosis and as a support system for all companies based inside the industrial zones.
Its main tasks should be:
To promote an Environmental Management System for the whole d*istretto industriale*
To inform local entrepreneurs on market green opportunities and trends
To promote new waste exchange projects by filling the existing gap between the nature of the waste produced by one enterprise (output) and the nature of the raw material required by another one (input)
To encourage students and professors to collaborate on applied research projects.

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Further information on the «CLOSED» project is available at:
http://www.arpat.toscana.it/progetti