

Eco-Industrial Parks – An Opportunity for the Developing Countries to Achieve Sustainable Development

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Abstract: Eco-industrial parks are a form of industrial parks that seems to gain more and more interest in the developed and emerging countries. In the introduction, the paper presents the reasons that justify the presence of an eco-industrial park on a territory and continues stressing their main characteristics and their diversity. The authors try to explain which are the problems that can put off the development of an eco-industrial park, presenting not only the advantages but also the risks of eco-industrial parks for their members and for the hosting community. The paper underlines the strengths of this type of parks that may contribute to a sustainable development of developing countries, especially now, when industrial parks are rising all over their territory without taking into account the environmental impacts. The authors' purpose is to emphasize the economic and environmental benefits for the community and for the firms located on their territory. As a final issue, the paper shows that for Romania the concept of eco-industrial park is new and almost unknown, a reason for the economists to approach it more often in their research.

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The Unsustainability of the Contemporary Society

Unsustainable development now compromises the ability of future generations to meet their needs. Global warming, destruction of the ozone shield, acidification of land and water, desertification and soil loss, deforestation and forest decline, diminishing productivity of land and waters, and extinction of species and populations, demonstrate that human demand is exceeding environmental support

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capacities. The populations of seventy-four countries are doubling every thirty years or less. Population growth increases poverty and deprived people are forced to undermine the productivity of the land on which they live. It is extremely difficult for people, or other species, to adjust to change at this rate.

Natural systems function with numerous built-in limits which, if transcended, result in resource exhaustion, environmental impact, and degradation of person and planet. Such outcomes are clearly not sustainable.

The abundance of natural resources used to be generally assumed, but questions are beginning to be raised on a many fronts, including the availability of fuel and of non-fuel minerals, the potential productivity of agriculture and the supply of forest products and of water.

Industrial and agricultural processes now are capable of generating so much pollution that the life-support systems of the planet may be threatened. Waste by-products could overload the interdependent systems of air, water, land and climate long before society is confronted with economic scarcities of other natural resources.

Specialists hope that the answer to this problem could be the regulation of the natural, human and technological resources to balance their use and conservation or any other actions that could result into a sustainable development of our society.

It is a fact that in the industrialized economies, technological innovations have already led to greater efficiency in energy and materials use, with many products being reduced in size and weight through the use of lighter materials such as aluminum in place of steel, and plastics in place of metals. Improved technologies mean that recycling rates for many key raw materials have also increased. In addition, demand has shifted away from heavy goods towards less material intensive products, consumer goods and service industries.

In this line of ideas lies the concept of industrial ecology, which is a framework for environmental management that seeks to model industrial systems on ecological principles.

Eco-Industrial Parks – Goals and Characteristics

The key concept in IE is that processes and industries are seen as interacting systems rather than comprising isolated components in a system of linear flows. This provides a basis for thinking about ways to connect different waste-producing processes, plants or industries into an operating web that minimizes the total amount of industrial material that goes to disposal sinks or is lost in intermediate processes. The key features of industrial ecology may be resumed as follows: the interacting

eco-systems, cycling of materials and energy, networking and cluster building and sustainable development (Gibbs, D., Deutz, P., 2007).

Eco-industrial parks (EIPs) are seen as an application of industrial ecology in practice. An EIP can be defined as a ‘community of manufacturing and service businesses seeking enhanced environmental and economic performance through collaborating in the management of environmental and resource issues. By working together, the community of businesses seeks a collective benefit that is greater than the sum of the individual benefits each company would realize if it optimized its individual performance only.’ (Gibbs, D., Deutz, P., 2007)

The goal of an EIP is to improve the economic performance of the participating companies through a systems approach to improved environmental performance. Using the principles of IE, the community of companies collaborates to become an industrial ecosystem.

One type of EIP, the virtual EIP, is a network of related regional companies that are not physically located in the same park. Companies in a virtual park can create economies of scale for cooperative buying or sharing employees’ services. Firms participating in waste exchanges may pay lower prices for secondary raw materials and may realize savings in hazardous waste disposal charges. Networked businesses that are located in the same region can enjoy reduced transportation costs, whether the firms are industrial, commercial or retail establishments.

Another type of park, the zero-emissions or closed-loop manufacturing EIP, has as its goal the total elimination of wastes. Companies are co-located in the EIP so that water, heat and energy sharing, and recycling of low-value byproducts, become physically and economically feasible. Participating firms need to closely coordinate their production processes and infrastructure to maximize efficiency. Most eco-industrial parks under development can be placed somewhere in between these two extremes.

Specialists (Martin, A., S., Weitz, K., A., Cushman, R., A., Sharma, A., Lindrooth, R.C., Moran, S.R., 1996) consider that some developers and communities have used the term EIP in a relatively loose fashion. They encourage applying this term to developments that are more than:

- a single byproduct exchange pattern or network of exchanges;
- a recycling business cluster (e.g., resource recovery, recycling companies);
- a collection of environmental technology companies;
- a collection of companies making ‘green’ products;
- an industrial park designed around a single environmental theme (a solar energy driven park);
- a park with environmentally friendly infrastructure or construction;
- a mixed use development (industrial, commercial, and residential).

The most problematic element of EIPs is the development of symbiotic exchange relations between the members. The barriers to the establishment of exchanges could be numerous and they classified them as: technical, when exchanges are technically not feasible; economic, where they are economically unsound or risky; informational, where the appropriate people do not have the relevant information at the right time; organizational, where exchanges may not fit with corporate structures; and regulatory or legal, where exchanges are not allowed to occur. (Heeres, R.R., Vermeulen, W.J.V., de Walle, F.B., 2004)

EIPs have the potential to affect the companies that participate in them, the managers of EIPs, the members of the communities that host them, and the wider community. Their capacity to positively affect a large range of actors should encourage central and local authorities to promote them, especially in the case of developing countries which are known to be confronted with more social, economic and environmental difficulties than developed ones.

Each of the stakeholders identified above can potentially benefit from the EIP as an alternative form of business organization, as explained below. (Martin, A., S., Weitz, K., A., Cushman, R., A., Sharma, A., Lindrooth, R.C., Moran, S.R., 1996)

Membership in an EIP can potentially bring economic benefits to companies by improving their efficiency, reducing their infrastructure requirements, providing access to better information about their customers and suppliers, and reducing their costs for regulatory compliance. More specific, the EIPs may improve the economic efficiency of member firms by improving the utilization of resources among the members, taking advantage of economies of scale and scope, improving the flow of information between customers and suppliers.

EIPs have the potential to bring economic and environmental benefits to the communities in which they locate. The EIP can provide a basis for industrial recruitment, bringing new jobs and income to a community. In addition, an EIP can bring new industries that diversify the industrial base and insulate it from downturns in economic activity that may affect specific industries. An EIP may lead to the development of industries that add value to the products leaving a community, increasing local income. Finally, an EIP arrangement may improve the competitiveness of existing companies, preventing plant closures and the accompanying job losses. The EIP can also reduce the environmental burden of existing industrial activities and mitigate the environmental impact of new firms. As members of the EIP begin to use each other's byproducts in their production activities, they may reduce their production of solid waste. As the EIP reduces the cost of activities such as solvent recycling, EIP companies may generate less hazardous waste. The application of water cascading techniques may reduce pollutant discharges to water and reduce the use of fresh water. The collocation of EIP companies can reduce air emissions from combustion of fossil fuels.

The EIPs encourage sustainable design and architecture, innovation, original technologies and knowledge sharing. They can also be applied both to new developments as well as to the redevelopment of existing or obsolete sites. Examining the various actors and their interdependences better enables the environmental burden of the entire system to be reduced, rather than simply focusing on an individual waste flows.

At the wider macro or regional level, there is more value in utilizing a systems approach rather than focusing on specific issues. The use of such as approach would allow for more holistic and coordinated planning and implementation strategies to be attained. Greater co-ordination seem to produce a number of benefits including: increased opportunities for networking between the businesses in the EIP, as well as between the EIP and its community, greater economies of scale as a result of a wider network of stakeholders, enhanced connectivity amongst stakeholders, and increased capacity with respect to the resources and skills base that could be tapped into. In this way, use of a systems approach at the macro-level should bring a range of benefits to the EIP. (Tudor, T., Adam, E., Bates, M, 2007)

Despite their potential for improving efficiency and profitability, few companies have actually participated in an EIP, in part, because of the risks associated with EIP membership. Sources of risk are considered to be: supplier/customer relationships with EIP members, environmental liability, regulatory uncertainty and technological uncertainty.

Communities face a number of challenges in developing and supporting an EIP, too. Finding a source of development funding, determining what organization should manage the EIP, attracting a viable combination of companies, and gaining the cooperation of regulatory agencies all pose significant challenges to making EIPs viable and successful. Perhaps the most significant challenge is building into the EIP design the flexibility required for longevity.

EIPs can serve a significant role in realizing economic, environmental and social benefits both to individual companies as well as to a network of firms. The emphasis for the EIP should be, however, on a systems approach, rather than focusing on specific streams. There are a number of issues to be taken into account, but the significance of each of the driving and limiting factors identified will vary depending on the geographical, social, political, environmental, economic and institutional context within which the EIPs are being developed. (Tudor, T., Adam, E., Bates, M., 2007)

EIPs Issues for the Developing Countries

The literature regarding industrial ecology and EIPs underlines mostly the motifs that should make us accept and encourage the application of those concepts and produce very little proof that they actually work on practice. Nevertheless, there are a few examples of real success and the fact that EIPs are rising continuously both in developed and developing countries is meant to encourage our countries to try it too. The experience of developing EIPs in countries like Japan, USA, Great Britain and Norway but mostly in developing countries like Korea, China, Singapore proved that there are some factors that condition the success of such projects (www.indigodev.com). Those critical factors are generally applicable, but they present a greater importance for developing countries, where the legislative, technical, financial restrictions and the mentality are stronger than elsewhere. As presented above, there are also a number of barriers to eco-industrial development that should be taken into account when deciding to plan such a project (technical, economical, informational, organizational, legal barriers), that are also stronger in developing countries than in developed ones.

One of the critical success factors for the developing of an EIP (including the situation when the EIP is the result of the transformation of an existing industrial park) is the cooperation between the national agencies responsible for EIPs or standard industrial parks development (governmental and non-governmental). The cooperation is necessary because of the multidisciplinary approach that should be conducted (economic, environmental, social, cultural, legislative).

A second factor is the implementation of an adequate management structure in charge with the development. The goals of an EIP are unlikely to be obtained spontaneously, though not impossible, and the major task of such a structure is to create strong channels of communication between all the actors susceptible to be involved. Web sites, conferences, an open door policy and even a door-to-door promotion, nothing should be left aside.

But in practice, not even the best intension get to be accomplished without the appropriate information, so that it is absolutely impossible to develop such a complex project without an effort of education and know-how acquiring. Workshops focused on specific project, programs linking international and local experts, study tours, conferences – all are appropriate ways of obtaining the capacity development.

When the first lines of the project are designed, it is high time to approach all the future members of the EIP in order to involve them in the planning process. The earlier this moment is, the best the project will be developed, because early involvement of company management assures that the project is guided by their perceptions of issues, needs, resources and opportunities. Each company should have

one staff person able to follow each step of the developing process and to assure an interface between his company and the project's management structure.

The complexity of an EIP supposes a detailed and accurate plan. The planning process should be conducted both bottom up and bottom down, which implies a continuous and an almost perfect dialogue between all the actors. Academic researchers may provide valuable assistance, but the lead needs to be from the implementation structure.

Not a phase of the developing process should be conducted without an evolving long-term vision of the whole system. The idea of one company using another's by-products could be more or less feasible and it is one of the many strategies suitable to be applied, but not the only one. A full vision is required because of the many possible future scenarios in which the project could evolve. A strong resource recovery industrial system needs to be planned, linked to a in-plant application of cleaner production or to other strategies, because an EIP is more than a system of exchange of by-products between companies. Technical feasibility is only an aspect that affects the functioning of an EIP, but it doesn't assure its long-term success.

Community support consisting in advanced environmental technologies and services is a factor that could make the difference between fail and success. Unfortunately, financial issues often make it impossible to be realized.

The government policy in the field of resource use is decisive for the evolution of the economy. The government, in team with business associations should set resource optimization targets for all sectors of the economy, not just industry.

A final aspect that needs to be presented is that national policy should support the management of the EIP initiative and individual industrial parks. Without appropriate organizational management, the most promising technical solutions have the tendency to fail. Therefore, policy should support adequate staffing, capacity development, management reward systems and other measures important to the agencies involved and to the EIPs themselves.

The Future of the EIPs in Romania

The history of common industrial parks in Romania is very recent. The first initiatives of this kind appeared in the late 90's and they behaved (and still do) like simple logistic facilities. The members search only the basic facilities (roads, gas, electricity, buildings, phone, internet etc,) and ignore the advantages of networking between the members. The owners of Romanian industrial parks are interested mostly in collecting the rent and less in contributing to the increase of the tenants' efficiency. Currently, in Romania exist over fifty entirely or partially functional traditional industrial parks and there are lots of projects in the initial phases.

Considering all the above, we can put ourselves a question: in the present, do the EIPs have any chance of success in Romania?

This question raises many others: Does Romania has the legal frame for the development of EIPs? Can it create the adequate structures able to support such initiatives? Are the local communities ready to host and to support EIPs? Are the firms interested and prepared to work together in order to achieve the environmental aims? Is there or can be created on short term any structure able to manage an EIP project?

Unfortunately, the answers are not very encouraging. The legislation regarding industrial parks is very restraint and it stipulates only the basic conditions necessary in order to receive the title of industrial park and a list of exemptions and privileges for the parks and their members. Although the beginning was made in the late ninety's, there was little change until 2007. From this point of view, the EIPs are like inexistent for Romania and on short term there is no progress to be foreseen.

The local authorities from Romania are barely conscious of the benefits that an industrial park can bring for the hosting community and they are still reluctant or indifferent to such initiatives. They are focused mostly on short-term objectives and lose sight of the global picture: sustainable development cannot be achieved unless a long-term vision in progressively put into practice. EIPs are a sample of long-term project that requires long term planning and the evolution of the traditional industrial parks in Romania does not indicate a constant and stable concern for the sustainable development.

Not even the firms realize the benefits that can be obtained when participating to an industrial park project, mostly because of the nature of those projects in our country: like mentioned before, they are mostly logistic parks and very few behave like genuine industrial parks. Therefore, EIPs might have little success because of two different factors: on one hand, participating to such a project suppose effort of adaptation and a high level of opening from the part of the firms, and on the other hand, the previous experience regarding the benefits resulting from such a membership is not a sufficiently powerful motif to support such an initiative.

The answer to the last question raised above is probably the most encouraging because industrial parks gain more and more interest every day from the part of specialist, practitioners or not. Therefore industrial ecology and particularly the EIPs might become major points of interest in a very short period of time. But things should be taken one at a time: the success of projects like EIPs depend on the collaboration of all the factors concerned and in order to obtain such participation, measures should be taken on all the levels (central authorities, local factors, development agencies, firms and population).

Conclusion

The development of ‘sustainable’ sites is a complicated process, involving a range of stakeholders and economic, social and environmental considerations. As time progresses and more research is undertaken some important factors should be implemented to improve the success of EIPs. It is evident that it is difficult to magically manufacture EIPs to work from scratch; however, their development should be facilitated. There should first be the basic ingredients in place, namely the willingness of firms to actively cooperate and the correct mix and structure of firms. These basic ingredients can then be enhanced and improved upon, with the correct support structure in place.

The issue of sustainability is present more and more in the concerns of specialists, politicians and population but measures are expected more urgently. Therefore, all the attempts to achieve sustainable development should be welcomed and supported. EIPs are such attempts with effects on a large scale and on a long term, but they must reckon on all the attention we can provide: technical support, financial contribution, information and positive mentality. Developing countries should be not only beneficiaries of developed countries experience, but pioneers in this field, capable actors in the battle for the survival of the planet. EIPs advantages should prevail over their risks and previous experience should be the foundation for the development of new projects. Central authorities play a crucial role in the support of EIPs and they should take their chances because global gains are larger than individual losses.

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