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UNDERSTANDING THE LOW OCCURRENCE OF SYMBIOSIS INDUSTRIAL IN BRAZIL

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ABSTRACT

This paper contributes to the understanding of the low occurrence of Industrial Symbiosis in Brazil. The importance of public policies in Brazil, the development of public policies is confirmed by the institution of the National Solid Waste Policy (NSWP). Note that companies seek symbiosis in response to regulatory pressure or to increase the efficiency of resource use, emissions reduction, or wastes. Further the importance of including social, cultural and business approaches in planning synergies between companies. Identifies environmental and cooperation regarding the responsibilities and capabilities of each aspect environmental management. Methodologically the study can be regarded as descriptive and exploratory purposes and in relation to the literature regarding methods. Finally, there are barriers which are raised on the relationship to the Industrial Symbiosis practices.

Key words: Industrial Ecology, Industrial Symbiosis, Life Cycle Assessment, e Eco-Industrial Park

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1. INTRODUCTION

There is a growing trend for the market demand for innovative products and social processes and environmentally friendly as it seeks to optimize natural resources and minimize the cost of production and the effects of final waste. The organization innovation, as Barbieri (2007) is the introduction of new of any kind on a systematic basis and reaps the expected results. According Orsato (2009), such processes can be defined as investments whose purpose is to reduce or offset environmental and social impacts associated with direct or indirect activities of the organization as well as during the life of its products and services.

In this sense, innovation, and the search for new form of industrialization, Wu (2012) comments that it is a learning process to answer continuous but changing demands of stakeholders.

According to Portugal et al (2012) a study conducted by the Department of Environment of the Government of São Paulo of 2010 indicated some potential advantages of the Green Economy to the state that, if applied at the national level, could bring important benefits such as: i) the possibility of growth of the Industrial Transformation Value (ITV) through the green industry, given the high ITV products such as photovoltaic solar panels, turbines for wind power generation, new materials and products and restructuring of conventional industries; ii) increase the share of renewable energy modes combined with greater efficiency utilization; iii) greater efficiency in the construction industry through the use of recycled; iv) mineral inputs) incorporation of environmental issues in encouraging innovation programs; v) Improving the industry's access to recycled materials.

As Portugal et al (2012) while other emerging countries like China and India have demonstrated clearly its strategic goals, Brazil has not positioned himself clearly, which can lead to local industry to suffer serious competitive losses.

As Lehtoranta et al (2011), there is the importance of public policies for stimulating increased reuse of waste from a company other because these stimuli are also an incentive for the formation of clusters, and to strengthen existing .

According Chertow (2007) there are several issues that motivate companies to pursue industrial symbiosis, directly or indirectly, it is used to try to meet other goals. The most obvious are the motivations of business acumen, the sharing of

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resources, which can reduce costs and increase revenues or. However, its use can improve long-term security of resources, increasing the availability of critical resources such as water, energy, or particular raw materials through contracts.

The article is divided into four stages, the first introductory and methodological, in the second the literature review, the third deals with the discussion and in the last step the final considerations.

2. METHODOLOGY

This work is characterized as a qualitative descriptive theoretical study by means of literature. As to the purposes, this research is classified as descriptive research. In the view of Vergara (2000), the descriptive research exposes characteristics of a given population or particular phenomenon. You can also establish correlations between variables and set your natures'. Gil (1991) mentions that the descriptive theoretical study aims to go beyond simple identification of the existence of relationships between variables, objective determine the nature of this relationship and proposition.

Cites even the existence of research, though defined as descriptive from your goals, end up serving for research (GIL,1991).

About literature, Vergara (2000) mentions that the literature provides instrumental for any type of research, but also states that "may run out itself" requiring the researcher the possibility of the emergence of new theoretical constructs.

2.1. Search Question

What explains the low occurrence of Industrial Symbiosis in Brazil?

3. REVIEW OF LITERATURE

3.1. Industrial Ecology

According to Ayres (1997) ecology industrial analyze the industrial process as a metabolic system called industrial metabolism. This is the study of industrial flow from the inlet (raw materials and energy) passing through the processing to the output (Products and waste), by mass and energy balances that can identify inefficient processes and products that result in waste pollutants, as well as solutions to minimize waste.

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According Frosch and Gallopoulos (1989) Industrial Ecology (IE) is an industrial ecosystem is the transformation of the traditional model of industrial activities, in which each plant individually, requires raw materials and products to be sold generates and waste to be deposited, for a more integrated system in which the consumption of energy and materials is optimized and the effluent of a process serving as a raw material for another.

Almeida and Gianetti (2006), comments that Industrial Ecology (IE) is employed in the productive sector which reinforces the social and environmental responsibility vision, "considering that companies are organizations that participate in an industrial ecosystem, inserted in the biosphere, which demand and resources for which excrete waste, "invoking the perception that industrial systems are subsystems of nature, since they require resources (inputs), causing waste and dumping during and after the production process.

According Agner (2006), the Industrial Ecology (IE) proposes a change in the structure of industrial systems, leading to changes of these, starting from linear industrial systems for integrated open closed systems, interacting not only as a single component, however resembling the systems found in the natural environment.

The Industrial Ecology (IE) aims to see the industrial system as a whole, not limited to dealing with pollution issues and environment, as it also considers the full range of issues involved in business administration, ranging from technology, economies processes, interrelation ships between business and funding to the set of governmental policies. Thus, it provides a conceptual framework and a valuable tool for planning of economic development, especially at the regional level, and proposes means of optimization use of scarce resources and the environmental protection (ERKMAN, 2005).

Gertler (1995) contributes to a better understanding of Industrial Ecology (IE) taking the long view to the systemic process of analysis of interactions between production systems. As Garner (1995) , are also identified some tools of Industrial Ecology (IE) as green accounting , life cycle analysis and design for the environment. Below are the main concepts of Industrial Ecology (IE):

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a) Systemic view of the interactions between industrial systems and the environment;

b) Guidance for the future;

c) Multidisciplinary approach;

d) Flow Study and transformation of matter and energy;

e) Reorientation of industrial process;

f) Use of cyclic processes - reuse and recycling;

g) Maximization of industrial efficiency;

h) Minimization of impacts to the environment;

i) Perception of industrial activity as a participant harmonious ecological environment;

j) Considering the limits of carrying capacity of the planet and the region; and

k) Promotion of industrial symbiosis and eco- industrial parks.

According Chebebe (2002) the Industrial Ecology (IE) can be approached in three different ways, depending on the scale of operation:

a) Within the company, examples: pollution prevention and design for the environment;

b) Between companies, examples: industrial symbiosis and analysis of the product life cycle;

c) Regional, studies of the flows of materials and energy or industrial metabolism;

3.2. Life Cycle Assessment

Life Cycle Assessment is a technique for assessing the environmental aspects of the potential impacts associated with a product, comprising the steps ranging from the removal of the nature of the basic raw materials entering the production process to the disposal of the end product, addressing parameters such as energy production, flow chart of activities, transportation, non-renewable energy consumption, impacts related to the use or recovery of by-product reuse and issues related to disposal, recovery or recycling of waste and packaging (IBICT, 2006).

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According Chebebe (2002), according to the ISO 14040 standard, the evaluation of the product life cycle should include in their development and application, defining the purpose and scope of the study, an analysis of inventory, an assessment of environmental impact and the interpretation of results. The steps to perform an LCA can be classified according to ISO 14040 (1997) addresses the definition of the objectives and limits of the study, taking an inventory and assessment of the environmental impact of the life cycle, as detailed below:

Definition of goals and scope of the study: in this first stage, draws up a plan, setting out the reasons why the ACV will be performed, the definition of system boundaries, defining the purpose of the evaluation and the methodology to be adopted for the collection data. After defining the limits of the system and objective assessment, selecting a functional unit for calculation of system inputs and outputs is required. Functional unit should be understood as a reference to which it relates to the amounts described in the inventory. The functional unit is a unit of measurement of the function that the system performs.

The function of a given process is for production. Being this way, the process has two functions: one that generates the product and one that generates the byproduct. The functional unit must necessarily represent the impact of the evaluated product. It can also assign a different impact factors system functions, such as the mass of the product, the energy content, density and other physical properties (CHEBEBE, 2002).

3.3. Industrial Symbiosis

Industrial symbiosis involves traditionally separate industries in cooperation approaches to managing inflows of resources that improve their overall environmental performance, adopting an industry vision organized as an ecosystem model. It is also based on the concept of biological symbiotic relationships; independent bodies may find mutual benefit through the exchange of resources, which are generally, wastes (CHERTOW, 2000).

According Chertow (2000) industrial symbiosis involves traditionally separate industries in cooperation approaches to managing inflows of resources that improve their overall environmental performance, adopting an industry vision organized as an ecosystem model. Still based on the concept of biological symbiotic relationships,

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independent bodies may find mutual benefit through the exchange of resources, which are generally residues. Industrial symbiosis occurs in inter-company level, it includes exchange options between various organizations; examines the cooperative management and the exchange of resource flows, particularly materials, water and energy through clusters of enterprises.

According to Lombardi and Laybourn (2012), Industrial a Symbiosis involves the union of several organizations, through a network, to promote eco-innovation and long-term cultural change. The creation and knowledge sharing across the network generate mutually profitable transactions for the supply of necessary inputs, final destinations that add value to by-products, business improvements and process. An in industrial symbiosis, involves the physical exchange of materials, energy, water and derivatives, byproducts sharing between enterprises.

According Chertow (2000), the term "symbiosis" is based on the notion of biological symbiotic relationships in nature, in which at least two independent species exchange materials, energy and information in a mutually beneficial way. Industrial symbiosis is the place based on exchange between different entities. By working together, companies strive for a collective benefit greater than the sum of individual benefits that could be achieved by acting alone. This type of collaboration can improve social relations among participants, which may also extend to the surrounding neighborhoods.

According Chertow (2007) presents two stylized models of industrial symbiosis: Model EIP (eco-industrial parks) planned, in which there is a conscious effort to identify companies from different industries and find them together so they can share resources. US characteristic, the planning of these systems has involved the formation of a group of diverse actors to guide the process and the participation of at least one government agency or quasi-government with some powers to encourage the development, such as planning of land use and / or zoning, and provide long-term financing. In the second type, the symbiosis model based on self-organization, an industrial ecosystem emerges decisions by private actors motivated by resources for foreign exchange to meet goals such as reducing costs, increasing income or business expansion.

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Doyle (1996) comments that practical way of applying to industrial symbiosis, an Industrial Ecopark (Eco-Industrial Park - EIP) is a community of suppliers of goods and services in a particular property, aiming to improve the economic performance of companies participants while minimizing environmental impacts and contributing to better environmental management and resources, which in turn implies principles of cleaner production, pollution prevention (EHRENFELD, 1997).

3.3.1. Eco-Industrial Park – EIP

According Chertow (2007) as community of suppliers of goods and services in a particular property and aims to improve the economic performance of the participating companies while minimizing environmental impacts and contributing to better environmental management and resources, which implies cleaner production practices, pollution prevention and energy efficiency. It is noteworthy that the symbioses not need to occur within the strict limits of a "park" despite the popular use of the term eco industrial park to describe the organizations involved in exchanges.

The United States Environmental Protection Agency - EPA being a community of industries and business services that aim to increase the environmental and economic performance, through collaborative management of the environment and resources. The business community, working in partnership seeks to produce a collective benefit greater than the sum of individual benefits of each company if they perfect their performances alone. Using the principles of industrial ecology, the business community works together to become an industrial ecosystem.

The Indigo Development define Eco-Industrial Park Institute - EIP as a community of companies (industry, trade and services) located together in the same property, in order to increase the environmental, economic and social performance through integrated collaboration in the management of resources and environment. The business community seeks a collective benefit greater than the sum of individual benefits each company would reach only improving individual performance (LOWE, 2001).

An Eco-Industrial Park - EIP should be characterized by a set of actions and not only by:

• A simple network-product exchange?

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• A productive arrangement of recycling business;

• A pole of environmental technology companies;

• A pole of green products companies;

• An industrial park designed around a single environmental theme (solar energy, for example)? ;

• A park with environmentally friendly infrastructure;

• A multi-purpose park (industrial, commercial and residential).

Figure 1: shows the technologies that support the EIP:

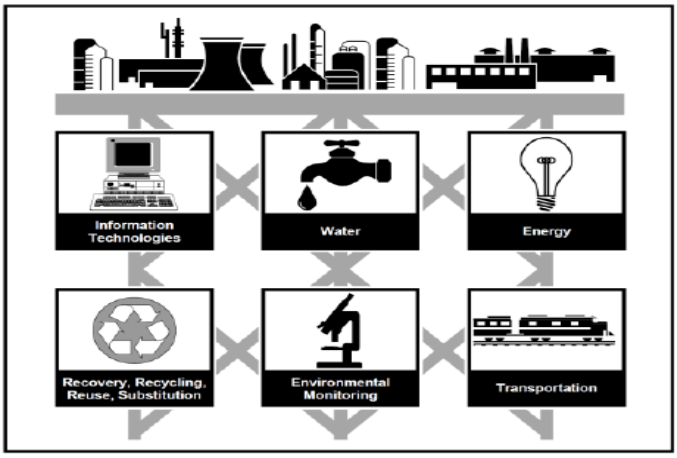

Figure 1: Tecnologias que suportam o EIP
Source: Doyle, (1996).

The concept of Eco Industrial Park is based on the synergy between different productive activities that have greater resource efficiency combined with environmental and economic benefits, and seeking mutual interest of stakeholders in general. So the theme environment will not always be the only reference that set up an industrial district is or is not an eco-park.

The Cape Sustainable Technology Park Charles, for example, designed the common use of solar energy for the first office building, a recycling system for water containment and reuse of rainwater, however there is an exchange system by-product, which can be effected later. An eco-park does not have a single shape or pattern, and will depend on the speed of deployment, investment capital available; profile of enterprises, in addition to the cultural aspects of the region members is installed. CHERTOW (2000)

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According to Orsato (2009) after all, natural parks are shown as positive in theory, why not much more initiatives of its kind in practice? Two main reasons are identified, the first is focused on the flows of materials and energy - typical of the expected symbiosis in industrial parks - implies greater difficulty of organization.

This as the exchanges of by-products require synergy between activities and specific companies, and various technical studies and construction of adequate infrastructure and the second is that draws attention to the need for alignment between the parties throughout the development of the initiative mainly in the implementation, not only in the process of attraction of companies. ORSATO (2013)

4. DISCUSSION

This study reports on aspects related to Industrial Symbiosis, it provides an analytical treatment that allows companies to understand how groups work together in the search for competitive advantage. Research on Industrial Symbiosis, according Bain et al. (2010) examine the cooperative management of resources among industries, to identify and understand the economic, environmental and social benefits related to the interaction and its significance practices for business networks.

According to Sopha et al. (2009), for Industrial Symbiosis happen, relations should be aligned with the areas Technical, Economic, Political, Informational, and Organizational. Again, it is important to emphasize the need for state action in the integration of environmental policies in the context of economic policies and how to restructure the legal framework for better implementation of industrial ecology model. (PORTUGAL et al, 2012).

As Tanimoto (2004) the main barriers for Industrial Symbiosis in Brazil reside in the legislation that can help or hinder the symbiotic relationships of companies, for example, when sets high environmental licensing costs and co-product transport. You can also identify barriers in the economy and business, as corporate cultures do not see any economic benefits in synergies and exchanges of co-products and environmental improvements, especially if there is participation of competitors, do not use environmental accounting tools, quantification of environmental impacts, lack of funding to cover consulting costs or early research companies (TANIMOTO, 2004).

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According Tanimoto (2004) attributed to barrier concerning the public perception regarding the use of co-products as raw material, in the fact that the product is produced or reprocessed with reused materials may suffer rejection by consumers. Finally, management techniques offer barrier due to lack of incentives for the board's collective gains, lack of research and lack of qualified professionals and holistic view of the product life cycle and the chain as a whole (TANIMOTO, 2004).

The literature discusses the principles for making industrial processes more sustainable, but there is a lack of guidance on how to apply these principles. Therefore, there is a perceived lack of a methodology able to provide detailed guidance according with each industrial process (SMITH, 2012).

Zhang et al. (2008) emphasize the importance of including social, cultural and business factors in planning approaches and the development of policies to promote the development of Industrial Symbiosis.

As Sopha et al (2009) Industrial Symbiosis is commonly characterized by physical exchange between collaborating companies. However, it can be considered an important aspect of Industrial Symbiosis establishing agreements between unrelated companies because it leads to resource efficiency (MATTILA et al, 2010;. JENSEN et al, 2011.).

According to Lehtoranta et al. (2011), there is the importance of public policies for stimulating increased reuse of waste from a company other because these stimuli are also an incentive for the formation of clusters, and to strengthen existing ones.

The success of the Industrial Symbiosis depends on cooperation and integration between industries, the industries mix, the availability of waste, the demand for these residues, process management, institutional relations and willingness of stakeholders to cooperate, and the legislation / regulation in force (CHERTOW, 2000; VEIGA; MAGRINI, 2012).

As Portugal et al (2012), Brazil has potential opportunities especially in areas related to: i) use of renewable energy as energy cogeneration from biomass, operating small rivers and basins and wind energy, ii) waste management industrial through industrial symbiosis, iii) increasing energy efficiency among others. Added to also the possibility of sustainable exploitation of the Amazon flora for the production

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of drugs, opportunity still little used in Brazil; tax incentives for electric and hybrid vehicles; infrastructure plan that contributes to reducing the emission of greenhouse gases; encouraging textile production from recycled raw material.

5. CONCLUSION

Several instruments seek to insert the principles of Industrial Ecology in industrial systems such as the Prevention of Pollution, Industrial Symbiosis, Industrial Parks Ecological, Analysis of Material Flow and Energy, Life Cycle Assessment.

Especially occurring an evolution of an industrial complex towards the Industrial Ecology relations successful, it is important that government environmental policy is also aimed companies to develop the Symbiosis Industrial. Finally practices, there is a public politics importance, stimulating increased reuse of waste from a company other because these stimuli are also an incentive for the formation of clusters, and to strengthen existing ones are also an incentive for the formation of clusters, and to strengthen existing ones.

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