Analysis of sustainability criteria applicable to Mexican industrial parks

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Mesa de trabajo: 
Ciudades sostenibles: ¿cómo impulsar la transición?
Analysis of sustainability criteria applicable to Mexican industrial parks

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Abstract:

The importance of the contribution of industrial parks to regional development has been long discussed and recognized. Governmental programs enhanced therefore the creation of industrial parks in the past. In face of the different economic crisis in the last years, the sustainability of the regions turn especially interesting not only in the developed countries but also in developing nations. The role of the industrial parks with focus on sustainable development is again discussed; processes and the definition of adequate indicators are looked for.

The present paper has a special focus on sustainability indicators. It is based on results reported by studies performed by Edgardo Bastida et al., 2011, who implemented inquiries to companies considered part of industrial parks, and the park administration entities in the central region of Mexico. This region was selected due to accessibility to respondents and because the central region of Mexico has representatives of at least of the two most relevant types of industrial parks for the purpose of this research which are: a) traditional industrial parks but innovative technology at the same time and; b) those already declared clean industrial parks. This exploratory work also aimed to define which indicators related to (National and International) certifications are already available at the company level and could be used to construct a framework to track sustainability development related to industrial parks in a context in which information is not easily accessible. As relevant existing factors to facilitate the implementation of our framework, researchers came across with terms associated to collaborative strategies (i.e. “industrial synergy”/ “industrial ecology”), “stakeholder management”, and others, which could be considered in the elaboration of an integrative approach towards sustainable industrial parks.

Introduction

Industrial parks have been in development in different regions of the world: sometimes triggered just by economic policy of a region (to attract more investments), sometimes with
the interest to share a common infrastructure and reduce costs, in such a way that industries can supply and distribute within their value chain in the nearest geographical possible way, which might build upon a “innovation ecosystem” strategy. Industrial Parks, currently, play an important role in the regional development, providing employment and economical welfare, as well as be integrated in the social context. Nevertheless critics’ extern that the impact on the region is far from being really in the sense of a sustainable development. Often it is found that industrial parks destroy productive and agricultural land, are binding local employment resources only marginally or using low value labor force or are remote from the employee pool. This is especially observed in industrial parks located in developing countries.

Numerous publications have been made on the reflections of sustainability; indicators and methodologies developed related to products, business cases or nations. But little information is found in the context of industrial parks, seen as detonators for regional development.

Classification of industrial parks has been done considering different aspects of the industrial park, one of them is the industry branch of the resident industries, e.g. chemical one; another is about the value chain approach such as “science park, innovation park, technology park, supplier park”; lately the kind of ecological orientation of the common infrastructure and the overall industrial policy, which regards the “green parks” or “eco industrial parks”. Internet searching showed that the term of “sustainable industrial park” is used mostly under the assumptions given by “green parks” with particular orientation towards the use of green architecture, or environmentally sound infrastructure, or in the widest sense -resource sharing among the companies installed in the same park, i.e. industrial synergy or industrial ecology practices. That internet searching gave prove of the existence of very few examples of sustainable parks. The latter mostly found in Great Britain, some in the Netherlands and USA. Until now, most of the initiatives focused on the terms of “green industrial parks”.

Understanding sustainable development as a complete and complex process, in order to be implemented as an overall policy it has to be broken down in sub processes, which usually starts with strategic planning, programs to reach the objectives set by the planning process, and indicators, which allow measuring the progress, obtained in reaching the objectives and targets.

There exist already several methodologies which can be used in this context, as e.g. methodologies used to determine the state of governance and others from the field of the business and industrial world, strategic environmental evaluation as well as the state of the art in sustainability indicators. The process focus described in the methodology developed by A. Chee Tahir, R.C. Darton (2010) and which was applied to an oil palm fruit production business could be a first approach. Other schemes regularly used are the Agenda 21 process, strategic planning used in companies, ISO 14001, and strategic environmental evaluation, Balanced Scorecard, Benchmark, among others.

The practice in the last years of using international frameworks to assess performance either individual or regional has been indeed used by both sectors, public and private ones. That is not the exception when it comes to measure the sustainability level of a company or the sustainable development of a region.
The challenge is how to transfer the sustainability indicators from a regional scale to a group of companies located in a region—so called industrial park. In other words, it can be formulated as follows: “how from individual company performance one can measure its regional impact (industrial park) through reliable indicators?”

Additionally, the private sector makes use of quality systems for certifications in which a set of indicators allow them to dynamically register how positively they influence the region where they are operating. Furthermore, the disclosure of certification reports about their performance enhance their public image, gaining consumers’ acceptance (Porter & Kramer, 2006).

At present, the number of companies earning international certifications has increased importantly in the world and in some developed countries. Companies have even created some systems to collaborate among individual companies throughout their supply chain partners (Halldorsson and Kotzab, 2009) or through companies located physically in the same region (Heeres et al, 2004). This latter well known as “industrial ecology” practices. Whatever the case might be, during interaction among companies, some contextual conditions are required for guaranteeing real collaboration. Otherwise, there is a high risk that their interaction can be only one-time experience. Contextual conditions for collaboration among companies are based on: transparency, trust and win-win relationships for partners (Porter and Van Der Linde, 1995 and Bruijn and Norberg-Bohm, 2005).

In previous works, scholars have explained the relevance to manage the interrelationships among company’s groups of interest—stakeholders— for enhancing real collaboration. At company level, this has been led by the company itself with records of some level of success, especially when “stakeholder management” becomes an element of the business strategy. In the case of industrial parks, the stakeholder management as part of the collaboration strategy requires a leading entity which could be either an individual company, or an industrial association, a governmental unit (local, regional or National) or a certification organization. Collaboration among stakeholders within an industrial park demands a systematic approach to keep the initiatives from individual businesses accessible, updated with an innovative approach. Hence, the stakeholder management needs further attention while developing the integrative approach to implement sustainable industrial parks criteria.

Therefore, it is possible to conceptualize that under the principles of transparency, trust and cooperation throughout “stakeholder management”, a cluster of companies can be named as “green industrial park”, “ecological industrial park” or “sustainable industrial park”. Moreover, the sum of their individual performances represents the baseline for the inter-industrial cooperation. At that regard, the interactive phase among industries has been studied by several authors and used terms as “Ecological industry” (Frosh and Gallopoulos, 1989), “Industrial symbiosis”–Kalundborg project– (de Walle, 1996), among others. But the mechanisms to “adopt” the international best practices (guidelines and indicators) requires to analyze the local context in terms of policy, capacities and access to information. Therefore, the importance to have a coordinating entity which main role is to facilitate the information flow and capacity adaptation to the innovative approaches of reaching sustainability in the region.
The current challenge is to be able to distinguish traditional or green industrial parks from those already labeled –certified– as “sustainable” ones. The use of certifications, which includes a list of aspects –indicators- to be measured by the company, has taken the interest of this research with the purpose of having a set of those for categorizing industrial parks.

Therefore our research questions were: (1) Can “adopted” certifications to the Mexican context such as ISO’s, CSR, OHSAS and other locally designed and implemented reflect the level of sustainability performance of companies? In addition, (2) how sustainable individual performance can be extended to a group/cluster –industrial park– of companies through collaborative strategies? And (3) what other management concepts or systems could be used for sustainability purposes?

Those questions were analyzed by using secondary sources which includes some of the empirical data reported by Bastida et al (2013) which was obtained through semi-structured questionnaires for some of the stakeholders and survey with a list of indicators and local certifications.

1. Sustainability Indicators

Braat in 1991 defined “sustainable indicators as indicators which provide information, directly or indirectly about the future sustainability of specified levels of social objectives such as material welfare, environmental quality and natural system amenity”. While other authors state, that indicators are paths to measure or indicate in an easy clear mode, are used to demonstrate the conditions of a system, provide an added vision of a country, region, zone or state in environmental matter including social dominant interests that are useful in decision making (Bell, 2008).

The development of indicators must constitute a process with a clear scientific fundament also with a social politic content (Scerri, 2010). Both elements should mold the base of a statistic instrument that seeks to fulfill the information function that allows taking decisions of environmental matter.

Although the major impulse for developing indicators of sustainability resulted from the Earth Summit for controlling the advances of 21 Agenda, the conference of United Nations about Environment and Development where the Sustainable Development Commission was founded. This agency has launched three generations of indicators of sustainable development. The first generation in 1996 received the name of environmental indicators because they respond to the complex phenomenon of a productive sector with a singularity or reduced dimensions like the quality of air, the pollution of water, deforestation indicators among others.

The second generation in 2001 included indicators of environment, social, economic and institutional types, and are binding initiatives, monetized, communicational powerful but methodologically questionable as they conserve in its individual form their discipline or sectorial profile. These indicators are the most common used ones at a national level, they are very macro defined in terms as established by CDS-UNO (2001), i.e. air emissions of green-house gases per year; et cetera. The third and most recent generation (2006) are

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1 CDS-UNO ,2001, defines 134 indicators related to sustainable development.
binding indicators that in few figures permit a quick access to a world of bigger meanings that incorporate the economic, social and environmental aspects in a cross and systematic form. The list from 134 indicators was reduced to 96 indicators, 50 being the core ones used by the different countries 2007. Nevertheless, the indicators are still showing a bilateral dependence, as emissions per sector and GDP, investment per GDP, etcetera.

There exist also Industrial branch specific indicators: The indicators defined in this standard are also two-dimensional ones: i.e. CO\textsubscript{2} emissions per million hours worked; tons of hazardous wastes in terms of sales unit.

The two dimensional definition of these indicators makes difficult to see the impact on in the “map of sustainability”. There is for example the discussion on the relationship with the traditional GDP: higher GDP does not mean better health or a higher security in the nation or more happiness of the people. There is the need to define balanced indicators or indexes reflecting relationships between different parameters, towards the integration of the three pillars of sustainability (social, economic and environmental). In addition to that, state indicators and impact indicators are considered in the accounting, as well. Even further, according to Bartelmus and Douglas (2008), sustainability indicators also require including the institutional dimension. Institutional innovation has been one of the successful factors while enforcing sustainable policy within organizations either public, private and public-private interaction (Heeres et al, 2004). Bartelmus described the “indicators of sustainable development” as those more “in the nature of indices that reflect the state of overall concepts or social goals such as human development, sustainable development, the quality of life or socioeconomic welfare”.

Applying “sustainable projects” within local contexts in developing countries, some other difficulties have been faced in terms of information scarcity and/or information widely dispersed. Therefore, the information gathered and used to measure the sustainability indicators are raptly reliable just because of the quality of the local data. The analysis of tendencies becomes a complete challenge for the same reasons.

In order to provide a more realistic (measurable) set of sustainability indicators for the Mexican context and more specifically for Mexican industrial parks located in the central region, Bastida et al carried out an analysis of secondary information sources for matching sustainability indicators with available related data, which are reported by companies along their certification processes. This indicators framework was explored empirically with the intention to validate it by applying a list of selected UN indicators, priory obtained from perceptions of Mexican business administrators (Kreiner, et al, 2011).

As a first approach the assessment of individual companies on sustainability matters was studied by Bastida et al. (2013). In this study the international widely used list of criteria/indicators form the Global Reporting Initiative (GRI) guidelines was used (Table 1.)

Table 1: List of sustainability indicators taken from GRI (Bastida et al., 2013)

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3 http://www.sd-m.de/files/SD-KPI_Standard_2010-2014_V12d.pdf; consulted on the 21\textsuperscript{st} of September 2010.
| ECONOMIC       | Economic performance |
|               | Market presence      |
|               | Indirect economic impacts |
| ENVIRONMENTAL | Materials            |
|               | Energy               |
|               | Water                |
|               | Biodiversity         |
|               | Emissions, effluents and waste |
|               | Products and services |
|               | Compliance           |
|               | Transport            |
| SOCIAL: LABOR PRACTICES AND DECENT WORK | Employment |
|               | Labor/management relations |
|               | Occupational health and safety |
|               | Training and education |
|               | Diversity and equal opportunity |
| SOCIAL: HUMAN RIGHTS | Diversity and equal opportunity |
|               | Non-discrimination   |
|               | Freedom of association and collective bargaining |
|               | Child labor          |
|               | Forced and compulsory labor |
| SOCIAL: SOCIETY | Community |
|               | Corruption           |
|               | Public policy        |
| SOCIAL: PRODUCT RESPONSIBILITY | Customer health and safety |
|               | Product and service labelling |
|               | Marketing communications |
|               | Compliance           |

The list nevertheless shows a minimum of indicators perceived by the companies as important to consider them in the sustainable development tracking. One precondition is that companies have framed their performance under international certifications such as ISO’s, CSR, among others.

Their performance as individual company might even take them one-step further when that company has created operational synergies with other companies installed in the same industrial park. In other words international –also national- certifications can be seen as the baseline for developing the inter-companies indicators, which can help to measure the level of agreement towards sustainability of an industrial park. Although, the limitation of this approach is that small size companies are mostly unable to pay expensive certification costs. In consequence, additional measures might need to be implemented for reducing the
risk of seen small companies as barrier along the sustainability accounting of the all-whole industrial park performance. (Bastida et al., 2013)

2. Management concepts, certifications and tools

Currently, Mexican companies can be awarded with certifications associated to product quality, safety, employee’s health, environmental protection, labor rights, and social guarantees for the community, among others. Most of the aspects assessed and reported for obtaining the certifications have association to various or few aspects listed on the UN sustainability indicators (see table 2). But many of the Mexican companies, especially SMEs, still do not count with certifications or have only simple tools. An opportunity is seen in the extension of the supply chain initiatives of the large and/or international firms to their local suppliers.

Table 2: List of available certifications and tools in Mexico overlapping some of the UN sustainability indicators (Bastida et al., 2013)

<table>
<thead>
<tr>
<th>CERTIFICATION</th>
<th>ACRONYM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical environmental performance (not certifiable)</td>
<td>HEP</td>
</tr>
<tr>
<td>Certificate of Clean Industry</td>
<td>PNAA</td>
</tr>
<tr>
<td>Environmental self-regulation (not certifiable)</td>
<td>ESR</td>
</tr>
<tr>
<td>Environmental Management System (documented) (not certifiable)</td>
<td>EMS</td>
</tr>
<tr>
<td>Certificate for Environmental Excellence</td>
<td>CEE</td>
</tr>
<tr>
<td>Certificate of ISO 9001 (management system)</td>
<td>ISO 9001</td>
</tr>
<tr>
<td>Certificate of ISO 14001 (environmental management system)</td>
<td>ISO 14001</td>
</tr>
<tr>
<td>Certificate of OHSAS 18001 (Security and employees health management systems)</td>
<td>OHSAS 18001</td>
</tr>
<tr>
<td>Enterprise social responsible (CSR)</td>
<td>CSR</td>
</tr>
<tr>
<td>ISO 26000 (Social Responsibility)</td>
<td>ISO 26000</td>
</tr>
<tr>
<td>AA1000 (AccountAbility)</td>
<td>AA1000</td>
</tr>
<tr>
<td>SA8000 (Social Accountability)</td>
<td>SA8000</td>
</tr>
<tr>
<td>Global Compact</td>
<td>GC</td>
</tr>
<tr>
<td>Global Reporting Initiative (GRI)</td>
<td>GRI</td>
</tr>
</tbody>
</table>

Note* the definitions of these schemes are given in Bastida et al. 2013. Not all of these schemes are not certifiable.

Statistics are only available for some of the mentioned schemes, and are presented in table 3.
Table 3: Statistics of Certifications hold in Mexico (own elaboration based on information available on internet of the respective certification bodies)

<table>
<thead>
<tr>
<th>Mexican Environmental (PNAA), Environmental management or Quality, and Touristic environmental quality</th>
<th>Participating companies</th>
<th>3,904</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid certificates in 2013</td>
<td>2,469</td>
<td></td>
</tr>
<tr>
<td>Clean Industry</td>
<td>1,638</td>
<td></td>
</tr>
<tr>
<td>Environmental quality</td>
<td>781</td>
<td></td>
</tr>
<tr>
<td>Touristic environmental quality</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Number of certificates emitted during 2013</td>
<td>631</td>
<td></td>
</tr>
<tr>
<td>Submitted requests for certificates during 2013</td>
<td>711</td>
<td></td>
</tr>
</tbody>
</table>

**Certificate of ISO 9001 (management system)**

| companies in Mexico hold an ISO 9001 certificate in 2011 | 4611 |

**Certificate of ISO 14001 (environmental management system)**

| Valid certificates in 2011 | 871 |

**Certificate of OHSAS 18001 (Safety and employees health management systems)**

| Not available |

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5 Accessed at [www.profepa.gob](http://www.profepa.gob), on 8\textsuperscript{th} of Sept 2013.
7 [http://www.iso.org/iso/home/standards/certification/iso-survey.htm](http://www.iso.org/iso/home/standards/certification/iso-survey.htm) accessed on 8\textsuperscript{th} of Sept 2013.
<table>
<thead>
<tr>
<th>Corporate social responsibility (CSR)(^8)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid certifications in 2013.(^9)</td>
<td>768</td>
</tr>
<tr>
<td>ISO 26000 (Social responsibility)</td>
<td>Not certifiable, therefor no statistics available</td>
</tr>
<tr>
<td>AA1000 (Accountability)(^10)</td>
<td>Not certifiable, therefor no statistics available</td>
</tr>
<tr>
<td>SA 8000 (Social accountability)(^11)</td>
<td></td>
</tr>
<tr>
<td>Registered companies</td>
<td>4</td>
</tr>
</tbody>
</table>

\(^8\) For obtaining the award, companies start an self-assessement process, that later is validated by a group of specialists from AliaRSE, an alliance of 7 organizations promoted by CEMEFI (Mexican Centre for Philantropy). Nowadays, the award has 120 indicators based mostly on the UN Global Compact and the aspirants need to accomplish to at least the 75% of them. The indicators evaluate the companies with "yes or no, and how" typed questions in terms of four main pillars: life quality in the company, ethics and business governance, involvement with the community and environmental sustainability. Regarding the last pillar, it is divided in ten sub topics, including the following: environmental operations; environmental policies; investment; training and environmental programs; information and communication; external relations; facilities; in and out of resources; transportation and environmental impact.


\(^10\) These series of standards was first published 2003 and revised 2008. Their nature is more principle-based and they are used in support to sustainability reporting addressing especially stakeholder engagement, especially in the context of GRI based reports.

\(^11\) http://www.saasaccreditation.org/certfacilitieslist.htm, accessed on 28th of Sept. 2013. The standard is based on the human right norms and labor laws. Criteria named are: Child labor, forced and compulsory labor, health and safety, freedom of association and to collective bargaining, discrimination, remuneration working hours, disciplinary practices. Companies must fulfill the requirements based on these criteria. SA 8000 certifies the fulfillment of these through an efficient management system. Interesting is that the enhancement of labor work conditions is especially named.
From table 3, it is clear that the most “popular” voluntary certification scheme in 2013 corresponded to the “Clean industry” program, with 1638 out of 3904 companies. The main grasp of such program privileges the environmental aspects within companies, which unfortunately approaches partially the sustainability principles. Global compact and GRI reporting schemes represent a more inclusive, socially and environmentally, certification for individual companies, which counted only with 304 and respective 15 Mexican industries in 2012. One can wonder whether a certification as a “sustainable industrial park” could promote a more sustainable individual company behavior on one hand, and facilitate the collaboration among companies for environmental, social practices while increasing their competitiveness regional value on the other hand. In any case, these numbers showed some tendencies that could be exploited to define a more suitable implementation strategy for this type of multi-company certification.

### 3. Stakeholder management and collaborative strategies

The analysis of the certification schemes used in Mexico leads to the conclusion, that stakeholder management is still not very commonly used. Only the GRI certified reports reflect that a process of stakeholder management is in place in the respective 15 Mexican companies. Stakeholder management is one of the crucial processes used in the management schemes related to sustainable development.

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12 The UN Global Compact is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with ten universally accepted principles in the areas of human rights, labor, environment and anti-corruption. By doing so, business, as a primary driver of globalization, can help ensure that markets, commerce, technology and finance advance in ways that benefit economies and societies everywhere.


Industrial parks have a management dimension that handles its operations as a whole, but there exists no evidence that the aspect related to stakeholders is considered; understanding stakeholder as parties, which are affected by or influence on the operations or performance of the industrial park.\textsuperscript{14}

The first step in the management process is the identification of the stakeholders of the industrial parks, the different roles and interests that are involved in the daily operation of it. Five types of stakeholders are identified whose interaction and interests with the industrial parks are determinant for the successful operation of them. The first stakeholder is the industrial park management whose primary responsibilities are the attraction of investments, the cooperation with authorities, the infrastructure development and provision, and the power and decision authority over park development. The second one are the resident companies of the park who are responsible of the codetermination of the park development, the creation of synergies, the quality and adequate prices of the products that are manufactured by them, the park’s image, and support the approval of any project proposed by the park’s management. The third stakeholder related to an industrial park are the employees of the resident companies whose performance impacts in the park’s profits and turnover, and demands security and proper income conditions. The fourth stakeholder identified is the local government who is responsible of the regulation of environmental, labor and taxes issues. In addition, this entity is directly linked with the park’s management, and overall is in charge of the investment attraction and the cooperation in infrastructure development and provision. Ultimately, the fifth stakeholders of the industrial parks are the local communities that expect creation of jobs, corporate citizenship, social responsibility, and environmentally sound operations. This entity may be represented by an NGO that pursue some wider social aim that has political aspects. (Bastida, master thesis, 2012)

The analysis of the interests of each of these stakeholders leads to the conclusion that it is not easy to trace the boundaries of this system; the supply chain of each of the companies residents in the industrial park can be affected, through pressures executed by the other stakeholders which can have impacts in other regions (national and international) far from the industrial park. On the other hand, the environmental impact, direct and indirect, caused by the activities of the industrial park has to be seen on different geographical limits depending on the kind of environmental aspect studied (waste and water management, air emissions, energy use, resource management etc.). These impacts, as for example global warming, acid rain or water scarcity, lead the industries to develop sustainable ways to operate in the last decades with the target to reduce the negative impacts on the environment of the industrial activities in the entire world or even prevent the impacts of being created.

Pollution prevention initiatives including the minimization resources use are the most applied concepts in the Mexican industry. The principle of eco-efficiency is still not

\textsuperscript{14} The definition of the stakeholder of an industrial park can be narrowed to “actor who can affect the achievement of the objectives of an industrial park due to his material or immaterial stake in the industrial park and also directly or indirectly affected by the operation of the park today or in the future” (Salonen, 2010)
commonly used with exception of some of the participating companies in the Mexican program of “Environmental Leadership for Competitiveness”, which promotes the use of eco-efficiency along with other best practices in environmental protection and management. Eco-efficiency is focused towards the attainment of a sustainable balance between economic objectives and environmental outcomes. It can briefly be described as the optimal use of material, water and energy in order to generate profits, and create added value in an environmentally responsible manner (Bryer Murray, 2009).

Other newer schemes developed in the last years to show that joint initiatives of several companies would have a stronger reduction impact on the green gas emissions, combined emissions, waste generation, energy use, or water treatment. It is important to point out that industrial systems combine two complementary visions: the classic one focused on economic flows and in economic life cycle of industrial activities, and the new one focused on physical exchanges and physical life cycle of industrial activities (Capuz Rizo & Gómez Navarro, 2004).

In this way, there are several good examples of joint initiatives of “green industrial parks” framed under the principle of “Ecology industry” and Industrial Estates. The eco-industrial parks15 are based on “Industrial Ecology (IE)” that emphasizes that industrial development should be similar to the natural ecosystems because in them, energy and resources are used optimally and wastes are absent (Heeres, Vermeulen, & Walle, 2004).

“Industrial Ecology” goes beyond the traditional “control of contamination” also called “end-of-pipe approach”, which was a classical approach of Environmental Engineering in the 70ties and 80ties. This approach is limited because it did not improve the environment situation and did not guarantee the acquisition of Sustainable Development. Looking at “Industrial Ecology” which considers that the output of some industry might be the input for another industry, it could mislead to promote the waste generation in one industry to be used as an input in another industry. Or it could result in a lesser damage to release certain substances to the atmosphere if this action guarantees that the manufactured product will be recyclable.

A direct application in Industrial Ecology is to design industrial zones, industrial parks in which in global terms, the input flows of matter and energy and the output flows of matter and energy are drastically optimized by applying eco-efficiency. The collaboration among companies is in this context the key success factor. Cooperation is presented as a challenge and at the same time as an opportunity for enterprises to re-engineer their production processes and improve their networks in order to eliminate or recycle their wastes to make best use of returns per unit of resource consumed, share or reduce their costs over limited natural resources and supporting infrastructure, and increase their business opportunities

15 the U.S. Environmental Protection Agency defines them: “An EIP is a community of manufacturing and service businesses seeking enhanced environmental and economic performance by 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” (Martin, Weitz, Cushman, Sharma, & Lindrooth, 1996).
and profit by establishing long and short-term strategic alliances to develop new competitive advantages without compromising critical resources for the future (Romero & Molina, 2010).

The experience acquired on the development of eco-industrial parks allows a series of advantages and inconveniences. Positive are the overall output reductions, less waste generated, less energy consumed than the sum of each company separately; higher resource efficiency among other aspects. But there exist still inconveniences which hinder a broader use of industrial ecology: the available technology for an effective and cheap waste integration on productive processes; the conditions or quality of waste streams are still not effectively controlled to facilitate an easy integration into production processes; processes mostly are not prepared to integrate waste or recycled materials; there is still a lack of business networks which facilitate the creation of a perfect balanced system; the influence of driving companies (e.g. as seen in the automotive sector) on their supply chain.

In summary, the above mentioned schemes are still weak in sustainability matters, and are focused on technological fixes for improved eco-efficiency, managing business risk within the existing market structure, not considering social aspects. The aim should be in a further step to develop strong sustainability, which transforms both product and process toward innovative green growth (Lombardi & Laybourn, Redefining Industrial Symbiosis, 2012), and later on includes social aspects on a same level as economical or environmental issues.

In this regard, industrial symbiosis (IS) is a strand of industrial ecology, which includes such things as life-cycle analysis, green accounting and green production, and could be considered to form the basis to develop the social components asked for by sustainable development. Industrial symbiosis brings together companies from all business sectors with the aim of improving cross industry resource efficiency through the commercial trading of materials, energy and water and sharing assets, logistics and expertise. It engages traditionally separate industries and other organizations in a collective approach to competitive advantage involving physical exchange of materials, energy, water and/or by-products together with the shared use of assets, logistics and expertise (Laybourn, Working together to boost industrial sustainability, 2011). The principal elements of a successful industrial symbiosis are: industrial engagement, regional delivery but national coordination (including Innovation, Research and Development), and economical attractive investments. In addition, this ecosystem of industrial symbiosis stimulates new business start-ups and new products in order to fill the gaps in the process, e.g. the waste stream from one company is not quite right as a feedstock for another. (Laybourn, Working together to boost industrial sustainability, 2011).

As already mentioned, for some synergies geographical proximity depends upon the nature of the resource. Recent work has shown that the distance traveled by a resource in a synergy does not statistically correlate with the resource value or mass which raises the question of exactly what is meant by geographic proximity. The traditional perception that the industrial symbiosis relationship between the participants is somehow more collaborative or altruistic is also being questioned (Lombardi, Lyons, Shi, & Agarwal, 2012).
Revising the different schemes which could provide a starting point for the development of specific, regional adapted management systems related to sustainable industrial parks, some other tools have to be mentioned, as it is the sustainability balanced scorecard as a promising starting point for the development of integrated sustainability performance measurement and management approaches. Nevertheless it has to be stressed, that a strategic planning process for the region and industrial park with the consideration of the different stakeholders has to be the input process for this tool. This turns us back to initial question- the definition of adequate indicators.

4. Methodology

Mainly secondary sources of information were analyzed to answer the research questions, including own contributions to this topic. An exploratory approach was considered as the most appropriate research type in this phase of the study for evaluating the match of sustainability indicators taken from an international framework with local certifications that Mexican organizations may obtain in order to be more sustainable. Findings previously gathered by authors of this paper through a pre-designed survey which was applied to employees of companies in order to find out information about (1) their knowledge of local certifications, (2) the level of agreement on key success factors for implementing certifications in an industrial park, and (3) the relations among local certifications and sustainability. And additionally a series of interviews with expert groups from different sectors was carried out by using a semi-structured questionnaire.

The structure of the survey was fully described by Bastida et al (2013). Its main purpose was to relate sustainability indicators taken from international frameworks as the one of GRI and the local certifications listed in section two of this paper in order to match each concept to analyze which certifications contain the international indicators in its parameters to obtain them. One of the author’s assumption was that one of the best ways to measure sustainability within an organization was by applying the GRI indicators.

Basically, authors adapted the indicators construction model developed by Lazarsfed (Boulanger, 2008) which is shown in figure 1 where Kreiner and collaborators explored in 2011 the first level (conceptual analysis) in connection with United Nations indicators of sustainability. The “dimensions” level in our case was related to the “locally available certifications” under the assumption that each certification comprises a number of variables to be accomplished by company. The indicators for the sustainable industrial parks are displayed in section 1 which are extracted from the crossing matrix among certifications and GRI indicators.
In the survey there was also some emphasis on the contextual conditions for facilitating the collaboration among industries. Therefore, a deeper literature revision was carried out to identify from the good practices of green industrial parks those with some replicable elements to the Mexican reality, in particular those practices oriented to enhance collaborative attitudes.

5. Relevant findings and discussion

As indicated by Bastida and collaborators (2013), a survey was sent to 54 companies located in industrial parks in the central region in Mexico, with a low responding rate (only 6). Even though, those answers allowed to explore the level of managers’ knowledge of “sustainability” related certifications, the perception about key success factors (Franco and Bressers, 2010) for implementing certifications at industrial parks, and the relations between local available certifications and sustainability indicators (mostly from international frameworks).

As one of the outstanding analyzed points, there was totally agreed that the public image of the industrial park, where respondents worked for, truly represents a sensitive key success factor for implementing certifications schemes at industrial parks when public image is related to the industry environmental behavior. The other three success factors during the implementation of certification schemes were: “trust between members of the industrial park”; “representative of the industrial park who could negotiate on behalf of the cluster of industries”; “authorities recognize voluntary certifications as a realistic and complementary alternative to legal instruments”. They were favored with 75% of agreement among respondents (Bastida et al, 2013).
Authors observed that among the voluntary certifications and tools that are available in Mexico, the respondents fully agreed that the Certificate of Clean Industry requires to be considered in a sustainability certification for an industrial park. This latter is confirmed with the statistics (2011) about certifications included in table 3. The historical environmental performance records, an environmental management system, and the certificate of ISO 14001 are in second level with the 75% of agreement. It is important to point out that the AA1000 standards are not important about sustainability for the respondents.

![Voluntary Certifications and Sustainability](image)

**Figure 2: Voluntary Certifications and Sustainability (Bastida et al, 2013)**

Regarding the indicators, the industrial representatives (survey respondents) thought that the most important ones that should be considered in a sustainability certification for an industrial park are: economic performance, indirect economy impacts; materials, energy and water use; emissions, effluents and waste, environmental compliance, transport, labor/management relations, occupational health and safety, training and education, non-discrimination, forced and compulsory labor, community, customer’s health and safety, and the product responsibility compliance. This shows that the 57% of the 28 proposed indicators to measure sustainability in an industrial park are significant to the respondents.

Some of the less relevant for sustainability accounting, accordantly to respondents, were those related to “market presence”, “products and services”; “diversity and equal opportunities”; “public policy”; “product and service labeling”. The least relevant indicator was the one of “marketing communications”. It was to some extend a bit contradictory to see how marketing indicators were not agreed to have connection to sustainability matters.
while at the same time, the same respondents think that “company image” is important to apply for certifications. This implies that there might exist a lack of cognitive interconnections between the competitiveness advantages of sustainability certifications and the market preferences.

In general and in connection to reporting, respondents said that their companies report periodically their environmental performance to PROFEPA (Federal Attorney for Environmental Protection), their labor performance to STPS (Ministry of Labor) and IMSS (Mexican Social Security Institute); and the economic performance is reported confidentially only to their headquarters.

In addition to the survey respondents, researchers interviewed some experts from the industry sector who said that they currently report in their organizations indicators such as: economic performance, market presence, indirect economic impacts; materials, energy and water use; emissions, effluents and waste; transport, employment, labor/management relations, occupational health and safety, training and education, diversity and equal opportunity, freedom of association and collective bargaining, and community. This shows that there are different level of knowledge about the type of reporting done within companies. Obviously the experts’ opinion is expected to be more elaborated than for regular managers who might have an overview on the company operation. In any case, the number of indicators mentioned by the expert group represents the 53% of the 28 proposed indicators (see figure 3) to measure sustainability within an industry which could be explored at industrial park level.
On the other hand, the match of the voluntary certifications and the proposed indicators showed that the Global Reporting Initiative is the best mechanism to measure sustainability in an industrial park as it was suggested by Bastida et al., 2013. The tendency of using this tool for reporting on sustainability is indeed growing in the last years. A construction of the indicator framework based on it will support the comparability on an international level, which is especially interesting as most of the already reporting companies are large and international companies. A benchmark between plants could be facilitated.

The other certifications and tools that are important for the group of experts are: environmental self-regulation, environmental management system, and CSR. It is important to point out that the SA8000 and the AA1000 are still mostly unknown certifications for the respondents.
5. Conclusions

This study investigated if voluntary certifications in Mexican Industrial Parks can reflect the level of sustainability performance of companies by asking experts their opinion about the relevance of certain certifications and tools that are used voluntary in Mexican companies in order to measure sustainability in an industrial park.

The investigation showed the environmental self-regulation, environmental management system, and CSR certifications and tools should cover the main indicators about sustainability in an industrial park, but as it was assumed, the GRI reports are the most complete in this sense. It can be suggested to use this framework as a starting point for constructing the indicator framework for sustainable industrial parks. Additionally to the certifications hold by the companies, the industrial parks should themselves contribute with additional certifications, like counting with a certification for the buildings, like LEED, and creating synergies in the terms of sharing infrastructure and resource management, e.g. in energy, water and waste water, resource management, and fostering collaborative strategies.

In this regard, the study showed that the industrial parks are aware of the relevance of the environment and they are sensible to its issues. In the same line, most of the companies in the industrial parks consider that there is trust among the members of the cluster, and that the representative of the park is able to negotiate on behalf of all the members in order to obtain a sustainability certificate as a whole entity. In this sense, the perception of most of the companies about the authorities’ acceptance of voluntary certifications, as a realistic and complementary alternative to legal instruments in the sustainability field is positive.

On the other side, industrial parks still face the challenge to facilitate through establishing adequate policies, leading efficient negotiations and the respective management the sustainable development of regions. It still remains to be studied how the impact of these parks in the region could be measured and the kind of schemes which could be developed, independent of certifications. A few international companies already are looking to identify their environmental footprint, establishing hydric balances and developing strategies and programs which allow them to neutralize their balance in water use limited to the water shed where they are established. Additional the corporate culture can be extended to the supply chain. Some initiatives already started in Mexico led by the environmental authority “Procuraduría Federal de la Protección Ambiental, PROFEPA” being the most known one “Environmental Leadership for the Competitivity”. This program with an orientation to environmental aspects and resource efficiency could in future present an opportunity to be used in the context of sustainability.

An additional opportunity is seen in the linking of innovation and sustainability. Local or national markets development are getting important for authorities as for companies. The corporate culture whose systems promote innovation are getting more and more common. Leading companies are starting to integrate the agendas of sustainability and innovation. Lessons from the more developed countries where technological developments such as
mobile technology, social media and collaborative consumption transform the way consumers interact with companies, could be adapted to the requirements of the less developed countries. Trends toward green economy and the circular economy will provoke major requirements for innovation. New business models, process and product development with desirable characteristics will have to include as a standard considerations of societal expectations and, not least, providing a meaningful purpose in favor of wellbeing and not at least the happiness of the society.

Moreover, as part of the companies’ strategies, it is crucial to add the collaborative approach which can accelerate the achievement of environmental and social goals in a region in which an important promoter of the economy are without a doubt the industrial parks based in the region. Integrative approaches and interconnector entities are meant to support the individual actions of those industries willing to be proactive towards the sustainability current and future demands.

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