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INDUSTRIAL DEVELOPMENT ORGANIZATION

GLOBAL ASSESSMENT OF ECO-INDUSTRIAL PARKS IN DEVELOPING AND EMERGING COUNTRIES

Achievements, Good Practices and Lessons Learned from Thirty-three Industrial Parks in Twelve Selected Emerging and Developing Countries.

INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT

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ABBREVIATIONS

AC	Administrative Commission
APIIC	Andhra Pradesh Industrial Infrastructure Corporation
APSEZ	Andhra Pradesh Special Economic Zone
BEAP	Bizerte Economic Activities Park
CIP	Cartago Industrial Park
CP	Cleaner Production
DDA	Dalian Development Area
EID	Eco-Industrial Development
EIP	Eco-Industrial Park
GCPC	Gujarat Cleaner Production Center
GIDC	Gujarat Industrial Development Corporation
GZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IP	Industrial Park
IS	Industrial Symbiosis
MLD	million litres per day
MWC	Mahindra World City
NEPL	Naroda Enviro Projects Ltd.
PIEAG	Eco-efficient Industrial Park of Graphic Arts
PIESB	Eco-Efficient Industrial Park of San Benito
PPP	Private Public Partnership
PPSEZ	Phnom Penh Special Economic Zone
RECP	Resource Efficient and Cleaner Production
SCIP	Shanghai Chemical Industry Economic and Technology Development Park
SDA	Shenyang Development Area
SEZ	Special Economic Zone
SME	Small and Medium Enterprises
SSEZ	Sihanoukville Special Economic Zone
TEDA	Tianjin Economic Development Area
TLIP	Thang Long industrial park Corporation
TSDF	Treatment, Storage and Disposal Facility
VSIP I	Vietnam Singapore Industrial Park I
WISP	Western Cape Industrial Symbiosis Programme
ZNEIP	Zhenjiang New Energy Industrial Park

1. INTRODUCTION

This global comparative assessment, carried out in twelve countries, is undertaken by the United Nations Industrial Development Organization (UNIDO) within the framework of its joint global Resource Efficient and Cleaner Production (RECP) program with the United Nations Environment Programme (UNEP). The programme is aimed at scaling-up and mainstreaming the application of RECP policies, practices and techniques with the underlying objective to improve resource productivity and environmental performance of industries, in particular small and medium enterprises (SMEs).

Industrial Parks (IP) in emerging and developing countries provide an institutional framework, modern services and a physical and often social infrastructure, which might not be available in the rest of the country. The concentration of companies can foster innovation, technological learning and company growth. Economies of scale of the supply of services and facilities reduce the costs for companies, thus successful IPs contribute to high growth regions and national economic development. However the economic gains often come at a loss of environmental quality within and around industrial estates. Environmental issues have often not been fully considered and integrated into the planning and construction of IPs (UNEP/SEPA, 2001). For example in China, problems have arisen due to the rapid growth of IPs, despite regulations and awareness of environmental management (UNEP/SEPA, 2002). Important environmental issues include water, waste water and waste management, in addition to air emissions, odour and noise. In this regard, water shortages are becoming increasingly serious presenting a possible threat to the development of IPs and water security in general. Similarly with growing production and consumption there is an increase in waste, which needs to be handled properly.

There is a difference between creating green industries and the global process of the greening industries (UNIDO, 2011). The creation of green industries implies the achievement of the industrial supply of a diversified set of environmental goods and services, such as clusters of renewable energy developers or recycling and safe disposal of waste streams. The second category, the greening of industries, refers to all industrial activities. It entails the waste and emission reduction in individual plants, through a high level of coordination of their individual environmental initiatives. Another example is through waste (solid, liquid, gaseous) treatment in collective facilities for reuse by other enterprises. For RECP implementation the second category of greening industries is most important. IPs are very suitable because of their scale which leads to large scale achievement of plant level resource efficiency resulting in waste streams that can then further be collectively recovered.

An industrial park in which companies cooperate with each other and with the local community trying to reduce waste and pollution, efficiently share resources and help to achieve sustainable development, with the intention to augment economic gains and improve environmental quality, can be called an Eco-Industrial Park (EIP). (e.g. Lowe, 1997)

The reported potential advantages of environmental management at the level or industrial parks include (UNEP/SEPA, 2001a):

- IPs are export oriented and therefore the environmental management practices of IP companies become gradually in line with international standards
- Environmental management should rely on measurements to achieve high efficiency.
- Environment affects investment; eco-industrial parks put more effort in controlling environmental quality than normal areas.
- EIPs can serve as special designated areas to test new environmental management practices and advanced instruments.

A positive net economic effect is made by many environmental investments and services because they make manufacturing more efficient, i.e. decrease in

waste, energy efficiency and loss of materials. They also lower the costs of environmental compliance. Where benefits are properly shared between the park management and its tenant companies, all parties can benefit. The park manager can recover some of the costs made for environmental management services by charging fees to tenant companies. Some environmental services can also be provided by private contractors which can charge a fee which is lower than the costs saving (Europe and Central Asia Regional Conference on industrial parks, 2012).

An overall challenge for the global RECP programme is to develop, trial and promote approaches to scale-up and mainstream the application of RECP, through: reaching out to many individual enterprises in a region or sector; collective application of RECP e.g. in resource conservation facilities through economies of scale; and finally through industrial ecology or industrial symbiosis. Industrial symbiosis is the exchange of by-products of one company (or sector) by other companies (or sectors) in close geographic proximity (Chertow, 2000). More broadly, industrial ecology can be described as the design of industrial infrastructures as if they were a series of interlocking ecosystems with interfaces with the natural global ecosystem.

An industrial zone, sector or park can turn into an eco-industrial park through the combination of the following factors:

1. Plant level efficiency: resulting in minimization of waste and emission generation from individual enterprises
2. Collective synergies: resulting in optimized resource exchanges between companies.
3. Environmental and utility systems
4. Proper zoning and planning
5. Environmental management of park operations

The ultimate aim is to almost zero the net generation of waste, effluents and emissions. The term Eco-Industrial Park (EIP) has become the umbrella term for parks practicing collective environmental initiatives in their design, construction and/or ongoing operation and management (UNIDO, 2014). Environmental and utility systems and the impact of zoning are discussed in the following chapter.

The stakeholders involved in establishment of or conversion into an eco-industrial park are:

- Developers and investors, private or governmental, who are often mainly concerned with economic return from land conversion into industrial park and may be concerned that good environmental practices are costly
- Government decision makers and managers, responsible for setting environment and industrial standards, providing policy and investment incentives and thereby enabling industry creation in industrial parks
- Company decision makers including future and present tenants
- Environmental managers employed by present and future tenants and providing services to tenants and park managers
- Consultants for environmental planning of EIP
- Involved public, in particular communities directly affected by the industrial park
- International community, including bilateral and multilateral aid agencies and international financial institutions
- Customers whose pressure and awareness may influence the decision makers and the private sector

Their impact depends on their environmental awareness and scope of their responsibility.

Eco-Industrial Parks have been assessed in various comparative studies, mostly in developed countries (Geng et all, 2008; Massard et all, 2014; Van Berkel, 2006). A key lesson is that EIPs simultaneously require innovations in business relations, between companies, and resource flows (Van Berkel in UNIDO, 2012). The benefits for all involved enterprises include reduced net waste generation and/or resource consumption; the adoption of new technologies towards resource conservation; the creation of new products and the provision of environmental services to urbanized areas. The identification, evaluation and eventual realization of such innovations involve both the assessment of industrial processes and their resource consumption and by-product generation, as well as synergies and networking among enterprises. Third party facilitation is critical for such eco-innovation and can contribute to embedding environmental awareness and action at the level of enterprises and their staff.

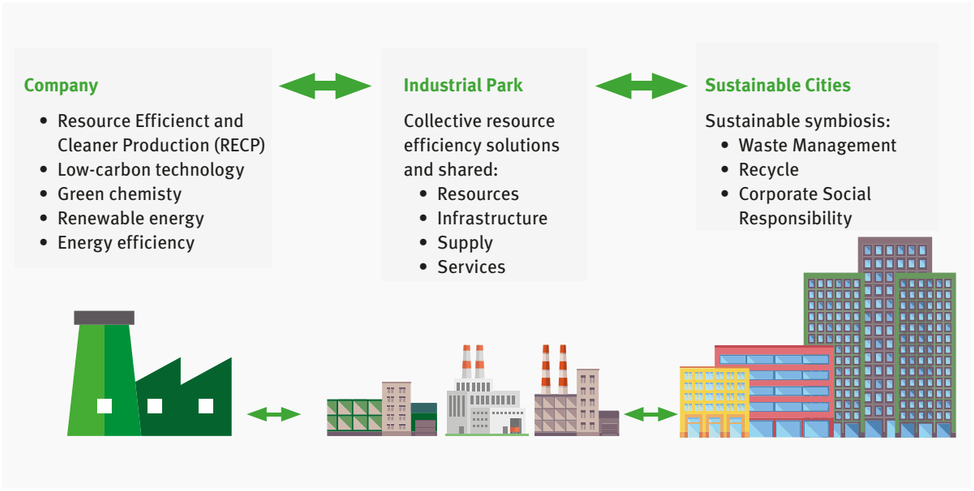
So far the following drivers for EIPs in developing and emerging countries have been promoted:

- Environmental and resource conservation benefits
- Operational costs saving
- Technology learning and adaptation.

However an in-depth analysis of the driving factors behind EIP developments, specifically in developing and emerging economics, is still lacking.

UNIDO therefore sets out to document in comparable manner 33 examples of EIPs in 12 developing and emerging economies, including their policy context (Cambodia, China, Colombia, Costa Rica, Egypt, El Salvador, India, Morocco, Peru, South Africa, Tunisia and Vietnam). This report provides an in-depth comparative analysis of the results of the country case studies, to understand the environmental, social and economic benefits. This allows the extracting of good practices and success factors and the subsequent formulation of future recommendations. This study contributes to the understanding and scaling-up of the environmental and economic benefits to a larger number of industrial parks and their occupant companies. The full details of each case can be found in separate on-line publications on www.recpnet.org.

Industrial-urban symbiosis fosters inclusive and sustainable development through outward integration



2. CHARACTERISTICS OF THE CASES

This chapter covers key characteristics of the assessed case studies. The results show a high variety among the cases, related to the country of origin, location, industry mix, ownership and various other factors. This variety reflects the boundary conditions in which eco-industrial park development takes place. Thirty three cases in over twelve countries have been analysed in total. The countries are as follows: China, India, Vietnam, Cambodia, Egypt, Morocco, Costa Rica, Colombia, El Salvador, Peru, South Africa, Tunisia (see Table 2.1). The common features of these countries is that they all have developing or emerging economies with a GDP per capita ranging from $2600 (Cambodia) to $12900 (Costa Rica).

Members of the RECPnet in the respective countries have identified and reviewed several cases of eco-industrial park developments in their home country. For each case the following information was collected: history or eco-industrial story; achievements and practices implemented; economic, environmental and social benefits; monitoring and evaluation; best practices, drivers and success factors; needs, difficulties and lessons learned, and perspectives and outlook. The reviewers collected information from various sources, including planning and policy documents, technical reports and direct data collection from park managers and tenant companies.

This chapter describes some of the cases and discusses briefly the stage of development, characteristics, sectors, EIP locations, ownership, number of SMEs in IPs and physical infrastructure.

Stage of development

Table 1 shows the development stage of the IPs and EIPs and whether each is in full operation or not. The stage of development is indicated by the parks themselves.

Table 1: Development stage of EIP cases

COUNTRY	CASE	DEVELOPMENT STAGE	YEAR OF ESTABLISHMENT
Cambodia	PPSEZ	Not fully operational	2008
	SSEZ	Not fully operational	2008
China	SCIP	SCIP became a National Demonstrative Eco-industrial Park in 2012	1996 (start EID 2008)
	Guangxi Xianggui Sugar Group	In development	planned, construction period is 2010-2025 in two phases
	ZNEIP	Fully operational	2009
	DDA	Fully operational	1984 (start EID 2000)
	TEDA	Fully operational	1984 (start EID 2000)
	SDA	Fully operational	1988 (start EID 2009)
Colombia	PIEAG	Being in the park more costly than outside, reduces competitiveness	2003
	PIESB	Planned, not realised	1990 (start EID 2007)
Costa Rica	CIP	Pilot with GIZ	1985 (start EID 2012)
Egypt	6th of October City	Fully operation IP, EIP not implemented yet	1979
	10th of Ramadan City	Fully operation IP, EIP not implemented yet	1977
El Salvador	El Pedegral	Operational, unclear what is EIP exactly	1994
	Miramar	Not fully operational	2001
India	IP Nacharam and IP Mallapur	Pilot	1967 (start EID 2004)
	APSEZ	Greenfield project, still under development	2007
	Mahindra World City	Fully operational	inaugurated in 2002
	Vapi Industrial Estate	Fully operational	1967-1968
	Naroda Industrial Estate	Fully operational	1964
	Satchin Industrial Estate	Fully operational	1984
Morocco	Sidi Bernoussi	Fully operational	1960s
	Tangier Industrial Park	data missing	1975
Peru	EcoPYMES Pantanos de Villa	Fully operational	1989
	EcoPark Callao	Fully operational	2008
	EcoPark Pucallapa	In development	2009
South Africa	Western Cape Industrial Symbiosis Programme (WISP)	Virtual, inception phase	virtual
	Capricorn Park	Not fully operational	1998
	Rustenburg Platinum Mines Limited (Ltd)	Fully operational	1931/restructuring in 1994
Tunisia	Bizerte Economic Activities Park (BEAP)	Fully operational IP, but not implemented EIP yet	1993 in operation since 1996
	Industrial Area of Djebel Oust and Bir M'Cherga	Pilot	1981
Vietnam	Thang Long industrial park (TLIP) Corporation	Fully operational	1997
	Vietnam Singapore Industrial Park I (VSIP I)	Fully operational	1996

Some IPs are planning to implement EIP practices (the two Egyptian IPs and SSEZ Cambodia), some are pilots (IP Nacharam and IP Mallapur India and CIP, Costa Rica) and others are demonstration parks (TEDA and SCIP, China). APSEZ, in India, is a greenfield project, still under development.

Other industrial parks call themselves EIP or "eco-park" but are still rather premature with respect to eco-industrial development. It appears that governments have different approaches and different standards for EIP. Not all IPs designated as EIP indeed display EIP features. For example the three Peruvian IPs are all called "eco-park", but are not yet EIPs, considering the lacking experience in implementing resource efficiency at enterprise level and collaboration for waste and by-product exchanges.

Some IPs, such as the two Cambodian cases, are not yet fully operational. In some countries the creation of an EIP is risky because of the investments needed and the uncertainty of companies coming to actually establish themselves in the IP. On the list several IPs are not fully operational, meaning that some land or even factory units are not utilized, giving rise to inefficiencies in land use. This is a serious issue for planners of EIP and IP, see Box 2.1.

Box 2.1 APSEZ (India): A GREENFIELD ECO-INDUSTRIAL DEVELOPMENT PROJECT

In 2004 Andhra Pradesh Government started to foster Eco-Industrial Development (EID) in IPs. The case of Nacharam and Mallapur was the first pilot. The results were used for conversion of other IPs and for establishment of new IPs. APSEZ was identified as ideal case for a planned EIP. The measures included Green SEZ (policy level) guidelines, Environmental Management Cell (park level), Eco-club and Eco-Profit (unit level) and Skill Development Centre and Eco-Drive (society level).

EID at APSEZ included site selection, environmental impact assessment, site and land use planning, green belts creation, establishing management structure for environmental management, monitoring of performance of the zone and industries, improving waste and water handling, supporting industries in RECP measures, strengthening the environment, utility and related industrial infrastructures and more.

Resettlement of villagers took place in a considered way on mutually agreed terms and their living conditions improved at the new site. Because APSEZ was newly planned, Site Master Planning was important. It helps a park to attract investment and create a competitive industrial environment. Zoning of the site was done to explore synergies between the units and reducing the stress on environment. Industries with significant environmental impact were restricted from the park. APSEZ contains a one stop service centre of $2.2 million to ease administrative difficulties. So overall APSEZ is attractive as it is relatively new, the location was carefully selected, Andra Pradesh Industrial Infrastructure Corporation (APIIC) is an experienced planner with land use planning. However because the park is new it is not fully operational and many facilities have not been installed yet, for example hotels and restaurants and technical facilities lack wastewater plants. Being the first planned EIP in India, the state has invested heavily as it saw potential to reduce the environmental and social impacts of industrialisation while increasing the economic benefits. As a result, there are currently only 13 units operating at APSEZ.

Table 2: Characteristics of the cases

COUNTRY	CASE	AREA (HA)	NO. OF COMPANIES	NO. OF EMPLOYEES
Cambodia	PPSEZ	360	38	10000
	SSEZ	528	27	11000
China	SCIP	2940	71	17000
	Guangxi Xianggui Sugar Group	266	4	1350
	ZNEIP	900	30	2000
	DDA	104000	4000	256000
	TEDA	34000	10000	484800
	SDA	44800	1300	300000
Colombia	PIEAG	0.4	88	400
	PIESB	Not available	78	Not available
Costa Rica	CIP	45	33	9000
Egypt	6th of October City	3600	1400	140000
	10th of Ramadan City	5847	1300	129000
El Salvador	El Pedegral	10.4	12	6500
	Miramar	8000	11	493
India	IP Nacharam and IP Mallapur	364.2	681	17000
	APSEZ	2264	13	2738
	Mahindra World City	630	62	35000
	Vapi Industrial Estate	1140	1696	247000
	Naroda Industrial Estate	363	1100	30000
	Satchin Industrial Estate	749	600	45000
Morocco	Sidi Bernoussi Industrial Park, Casablanca	1000	600	50000
	Tangier Industrial Park	138	107	25000
Peru	Industrial Park «EcoPYMES Pantanos de Villa»	13.7	300	3670
	Industrial Park «EcoPark Callao»	4600	3180	25000
	Industrial Park «EcoPark Pucallapa»	44	80	0
South Africa	Western Cape Industrial Symbiosis Programme	virtual	virtual	virtual
	Capricorn Park	70	180	Not available
	Rustenburg Platinum Mines Limited (Ltd)	16000	1	20706
Tunisia	Bizerte Economic Activities Park	81	62	5470
	Industrial Area of Djebel Oust and Bir M'Cherga	228	105	23000
Vietnam	Thang Long industrial park Corporation	274	78	63600
	Vietnam Singapore Industrial Park I	500	240	96367

Case characteristics

Table 2 shows the area (ha), number of companies and number of employees in all the cases. The cases show large variations in numbers. There are a few very large parks: Chinese TEDA with some 10,000 companies, Chinese DDA with some 4,000 companies and Peruvian Industrial Park «EcoPark Callao» with 3,180 companies. Furthermore, there are a few IPs with 1,000 to 1,700 companies: Chinese SDA, Egyptian 6th of October City and 10th of Ramadan City and Indian Vapi and Naroda industrial estates. Very small number of companies in the IPs include the mine Rustenbrug (1 company with multiple mines and processing units)), Guangxi Xianggui Sugar Group (4), El Salvadorian El Pedegral (12) and Miramar (11) and Indian APSEZ (13).

Some IPs offer fewer space for rather large companies, whereas other IPs host numerous companies yet mostly SMEs. IPs with a particularly high employment (more than 100,000) are as follows: the Chinese DDA, TEDA and SDA, Indian Vapi, the two Egyptian IPs and Vietnamese VISP I. These high numbers are indicative of the economic and social importance of the respective IPs.

Many of the parks have a relatively high number of people living in the vicinity of the park. Almost 4 million live near MWC (and within MWC 100,000 see Box 4.2), more than a million inhabitants for DDA, TEDA and SDA and more than 100,000 for SCIP, the Egyptian cases, El Pedregal, Sidi Bernoussi, Eco PYMES and Callao.

The year of establishment (see also Table 1) varies greatly. Some Indian, Moroccan, Egyptian and Chinese parks are rather old. The mine Rustenburg even originates back to 1931 yet has been modernized multiple times since its first establishment. It was found that the IPs that are older are more likely to have highly deficient environmental infrastructure (lacking effluent treatment, etc.), use of old technologies as well as poor zoning. All the industrial parks have started with EID from the year 2000 or later.

Sectors

Most IPs are home to multiple sectors of industry. Most common are (petro) chemicals, manufacturing, textile, pharmaceutics, (agro) food, dyes and automotive. A few IPs consist of only one sector: ZNEIP China (photovoltaic), PIEAG Colombia (graphic arts industry), PIESB Colombia (tannery), and Peruvian EcoPark Pucallapa (especially wood based industry). Mahindra World City contains only non- and low environmental impact industries as it is also a green city. The same holds for Capricorn, see Box 2.2.

EIP located in ecological areas

One observation is that some IPs have been purposely created in the vicinity of natural reserves to provide a home for industrial development. For example EcoPYMES Pantanos de Villa is located adjacent to a wildlife refuge wetland, and EcoPark Pucallapa is in the Amazon forest. Capricorn Park (Box 2.2) in South Africa is located on environmentally sensitive land with high biodiversity. The Chinese Dalian Development Area (DDA) is located in the Dalian Municipality. Dalian is a famous tourist city on an ecologically sensitive peninsula. Planning an industrial zone next to a natural reserve should only be considered where no suitable location alternatives are available and with strong environmental safeguards.

Box 2.2: CAPRICORN PARK

Capricorn Park South Africa is located next to an environmentally sensitive zone with high biodiversity. All tenant companies are therefore subjected to a strict environmental screening process, prior to receiving approval to locate and operate in the park. The fact that the development site was located within such a biodiverse landscape meant that Capricorn Park was required to sign an Environmental Agreement with the Cape Town City Council. Only commercial and light manufacturing companies are allowed.

Box 2.3: BUSINESS MODEL OF VISP I

Vietnam-Singapore Industrial Park I is a symbol of Vietnam-Singapore cooperation, and has been considered one of, if not, the most successful industrial park in Vietnam from a sustainable development perspective. VSIP I has contributed to the socio-economic growth of the region and the country with a total investment capital of US$ 2.62 billion from 240 projects of 22 countries all over the world.

It is developed as a joint venture between Becamex IDC Corporation, Vietnam and Sembcorp Development Ltd (SDL), Singapore. Becamex IDC Corporation, one of the most successful state-owned enterprises in Vietnam belonging to the Binh Duong Province People's Committee, holds 49% of the legal capital. The remaining 51% is held by Sembcorp Development Ltd, a 100% owned subsidiary of Sembcorp Industries which is a trusted provider of essential energy and water solutions as well as developer of integrated townships and industrial parks in the region.

Ownership

Among the case studies there exists a difference in ownership of land, companies and park (its collective infrastructures and built environment, e.g. roads, water and energy supply and waste and effluent treatment). In addition there is a difference between involvement of public or private sector in the development phase of the EIP and the operation of the EIP. Most common is public investment or a private public partnership (PPP) for development stage with private ownership for companies. Many IPs are also home to state-owned companies. In addition, some parks have more foreign investment than others, a situation that is often resulting directly from special investment incentives and economic policies that apply to such special economic zones.

For example, SSEZ is a PPP founded by a Cambodian and Chinese company. Another example is the Vietnamese IP VISP I (see Box 2.3). Another IP with foreign investment is TLIP, which is jointly established between Sumitomo Corporation, a world's leading integrated trading house of Japan and Dong Anh Mechanical Company, one of the most successful Vietnamese companies under the Vietnam Ministry of Construction. The companies are Japanese or Vietnam/Japanese joint stock.

The land in many cases is owned by the government (like all Chinese IPs except Guangxi Xianggui Sugar Group). Privately owned land applies to CIP, Costa Rica, PIEAG Colombia, El Pedegral, El Salvador, two cases in South Africa and the two Moroccan IPs.

Number of SMEs in IP

Another key factor is the number of small and medium enterprises (SMEs) within the reviewed IPs. SMEs are often labour intensive and can play an important role in providing jobs and incomes at the regional and also local level around the IP. Some IPs mention the high number of SMEs as a cause for the higher level of pollution, as is the situation with Vapi Industrial Estate, India (Box 2.4). SMEs at DDA, TEDA and SDA do not receive adequate support for their EIP efforts. This is due to the fact that under national regulations, such as the Chinese legislation, medium- and small-scale projects, unlike larger companies, can easily bypass the compulsory cleaner production audit requirements. Additionally, managers of SMEs have relatively lower environmental awareness and often regard environmental protection as a burden. Thus, the growing number of SMEs has caused significant negative environmental impacts. This is why TEDA decided to support SMEs in obtaining the ISO 14001 certification, which is costly in China. The Administration Commission (AC) at TEDA provided a subsidy of 30,000 RMB consulting and certification fees. 240 companies at TEDA passed the certification. At DDA the AC compensated up to 50% of the consulting and certification fees, resulting in 119 companies passing the certification. SDA does not provide any financial subsidy to its tenant companies for ISO 14001 certification due to its lower public budget. Until August 2013, only 55 tenant companies had passed the ISO 14001 certifications.

Box 2.4: VAPI

This particular cluster was chosen for a RECP case study as Vapi is a core industrial cluster of Gujarat. According to the Indian Institute of Foreign Trade, SMEs contribute to about 6% of the country's GDP. The Vapi SMEs are facing a lot of challenges, such as rising energy costs, poor effluent treatment plant performance, sludge generation, potential pollution load, use of old technologies and lack of proven technologies. As such SMEs have been facing the problem of compliance with environmental standards and are facing challenges in operation and mainte-

Physical infrastructure

Below is a table listing the physical infrastructure possibilities as mentioned by the cases. The infrastructure is either provided by the local, provincial or national authorities, as well as by private companies (subcontracted by the IP) or by the IP as collective service. Companies of an IP may have to pay for some of these products and services.

For example Mahindra World City has contractors for security, waste management, water supply and sewage treatment.

For some IPs the creation of physical infrastructure is essential as there is a lack of infrastructure in the rest of the country. As such an IP with good infrastructure is more likely to attract investments from more companies, which is a major concern in developing and emerging countries.

Table 3: Physical infrastructure provided to tenant companies in the case studies

PHYSICAL INFRASTRUCTURE			
Collective road network	External power supply	Railway	Sanitation
Collective solid waste	Telecommunication	Port	Private well water
Collective water supply	Security	Airport	Rain water harvesting
Water supply from outside IP	Health clinic	Greening landscape	Storm water drainage
Power supply from IP	Bank	Recycling	Lights
cogeneration	Bus station