

The environmental activities of industrial park organisations in Hungary

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Abstract: Industrial Parks (IPs) and other forms of industrial agglomerations not only play an ever-increasing role in economic development, but may also contribute to the implementation of the principles of sustainable development. Modern-day IPs in Hungary face a number of environmental challenges, from the need to clean up historical pollution to compliance with European Union (EU) regulations. A survey conducted at the Corvinus University of Budapest shows that while many IP organisations – the coordinating umbrella organisations of IPs – are aware of these tasks, their activities often lag behind. This paper looks at the environmental practices and motives of these IP organisations and provides suggestions for their future development.

Keywords: industrial park; cluster development; environmental management; industrial ecology; Hungary.

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1 Introduction

Industrial Parks (IPs) and other forms of business agglomerations form an important part of the economy of modern societies, not only with regard to their value creation activities and their effects on employment, but also with regard to their impacts on the natural and artificial environment and society as a whole.

The recent years have witnessed a resurgence of the literature on the geographical location of business organisations, partly initiated by M.E. Porter's seminal book on business clusters and their effects on national and corporate competitiveness (Porter, 1990). More and more examples of industrial clusters are being described and analysed and cluster development plays an important part in the industrial and innovation policies of local, regional and national governments all around the world.

According to Porter (2000), clusters affect competition in three broad ways: by "(a) increasing the current (static) productivity of constituent firms or industries, (b) increasing the capacity of cluster participants for innovation and productivity growth, and (c) stimulating new business formation that supports innovation and expands the cluster" (p.20).

In the meantime, more traditional forms of business agglomerations survive and flourish in many parts of the world. IPs, business parks, industrial zones and, more recently, Eco-Industrial Parks (EIPs) provide an important contribution to the national economies in many regions.

One characteristic shared by these initiatives is geographic proximity, which, according to the literature, may provide many benefits to individual business organisations as well as contribute to local, regional and national development. With regard to IPs, Roberts (2004) listed their benefits as including better access to information and knowledge networks, supplier and distribution chains, markets and marketing intelligence, special competencies, resources and support institutions. IPs foster both cooperation and competition between the participating organisations which, when used in a balanced manner, can improve their economic and overall performance.

Economic performance and competitiveness aside, another recent impetus for the study of business agglomerations comes from a drive to implement the principles of sustainable development as laid down in the Brundtland Report (WCED, 1987) and, more specifically, the notion of Industrial Ecology (IE), which is an attempt to adopt the principles of natural ecosystems to industrial organisations and their networks (Frosch and Gallopoulos, 1989). Based on these principles, many industrial estates have started to incorporate environmental considerations into their daily operations and EIPs have been established both in Europe and in the USA with the particular objective of implementing clean industrial processes.

National and international policy institutions also acknowledge the benefits provided by business agglomerations and have a hand in designing and implementing policies aimed at fostering such development. The Europe INNOVA Cluster Mapping Project in the European Union (EU) identified and analysed the cluster policies, institutions and programmes in 31 European countries and found that all the countries surveyed have cluster policies on a national and/or regional level and have set up institutions to implement these. At the same time, there are huge variations between the studied countries and in some countries, cluster policy is still in its infancy (Oxford Research, 2008).

The EU's commitment is also demonstrated by the recently published European Cluster Memorandum launched at the *European Presidency Conference on Innovation and Clusters* in early 2008 in Stockholm, which is supported by national and regional agencies for innovation and economic development (Europe INNOVA, 2008). The Memorandum, which is aimed at policy makers at both European and national levels, highlights the benefits provided by industrial clusters and delineates such clusters as important tools for promoting innovation and economic development in Europe.

Taking these underlying concepts and tendencies as our vantage point, this paper aims to shed some light on the environmental performance of IPs in Hungary and, thus, uncover their potential for implementing state-of-the-art environmental management practices and the principles and tools of IE.

The focus of the research carried out at the Corvinus University of Budapest (introduced below) was on *IP organisations*, which we define to be any type of umbrella organisation (businesses, local governments, nonprofit organisations) responsible for the overall management of IPs, which extends to the sale/lease of land, the setting up of IP internal regulations, the external representation of the IPs and often also the provision of services to businesses within their confines. As a starting point, we assume that these organisations have a good overview of the activities within the IPs, are best placed to judge environmental problems within the sphere of the park and – to varying degrees – are in a position to promote environmental protection within IPs.

First, we review the literature relating to the environmental performance of industrial agglomerations, with a special emphasis on the principles and requirements of IE. Second, we present an overview of the situation in Hungary regarding both the general economic tendencies and the state-of-the-art of corporate environmental management practices in the country. Based on these observations, we formulate our research questions and introduce the research design. Finally, we demonstrate our results and provide suggestions for both IP organisations and policy makers.

2 Environmental considerations of industrial parks

A commonly used definition of IPs which is suitable for the purposes of this paper is provided by Peddle (1993): “a large tract of land, sub-divided, and developed for the use of several firms simultaneously, distinguished by its shareable infrastructure and close proximity of firms” (p.108).

The common types and synonyms of IPs include industrial estate, industrial district, industrial zone, export processing zone, business park, industrial estate and office park (among others), while ‘EIPs’ are more narrowly defined in the literature (Roberts, 2004; Gibbs and Deutz, 2007; Cote and Hall, 1995).

While this definition may also fit industrial clusters as defined by Porter (1990), clusters do not necessarily require very close geographical proximity and imply a closer fit between the activities of the participating organisations (*e.g.*, same industrial sector, supply chain, *etc.*). While we concentrate on more traditional IPs in the following discussion, many of our observations are valid for industrial clusters and other types of industrial agglomerations as well.

The proponents of IE, an approach to environmental protection first popularised by Frosch and Gallopoulos (1989), seek to examine and/or actualise the analogy between ecological and industrial systems. The principles of IE are grounded on the studies of

living systems: the analogy lies in the fact that ecological systems taken as a whole are extremely efficient at recycling the byproducts of natural processes and accumulations of toxic, persistent or bio-accumulative materials are rarely found in the natural environment. While counterexamples exist,¹ it is nevertheless obvious that there is still much to learn from the natural world around us.

While the concept of the reuse of byproducts in the industrial sphere may hardly be original in historical terms (see Desrochers, 2002; Gille, 2000, for some examples), what is novel in the current IE paradigm is the systematic application of an analytical framework, tools and policy initiatives designed to enhance the probability of IE-type occurrences. This systematic approach also includes the exploration and analysis of the current environmental practices and barriers to IE initiatives – mainly in industrial sectors – both from a scientific and practitioner point of view.

The reduction of amounts of waste and the cyclical transformation of wastes to resources in the industrial sphere has the potential to significantly decrease the environmental load at all levels of industrial operation.² Taking as a foundation what has been termed a ‘win-win-win’ solution (Gibbs and Deutz, 2007, p.1684) – the environmental, economic and societal desirability of a reduction in waste through ‘closed loop’ material cycling – its proponents claim that IE offers a tangible means of actualising environmental improvements and contributing to the stated goals of sustainable development as defined in the Brundtland Report (WCED, 1987).

Wallner (1999, p.51) stated that “in order to develop sustainable structures in industry we must [...] increase the complexity of the system” – a basic feature of which is “the aggregation of process units to form larger units”, while according to Roberts (2004), “IE is linked intrinsically to the concept of clusters” – notions that are often reiterated in the literature. Roberts (2004) explained that:

“Firms and organisations involved in clusters are able to achieve synergies and leverage economic advantage from shared access to information and knowledge networks, supplier and distribution chains, markets and marketing intelligence, special competencies, resources and support institutions available in a specific locality.” (p.999)

Such clusters have also been described as having the potential to be “islands of sustainability” (Wallner *et al.*, 1996).

In 1997, the United Nations Environmental Programme (UNEP) published a technical report entitled *The Environmental Management of Industrial Estates* (UNEP, 1997), in which it is noted that the rapidly growing number of IPs worldwide play “a significant role in the production and use of goods and services” while “many of them also pose a substantial threat to the environment”. The document noted that “the growing body of knowledge on IE [is not] yet sufficiently field oriented to provide practical management options for most estates” (UNEP, 1997, p.vi), although the document also stated that IPs have clear potential advantages over individual enterprises when it comes to adopting sustainable business practices (many of them due to economies of scale).

Based on a review of the literature (UNEP, 1997; Roberts, 2004; Tudor *et al.*, 2007; Cote and Cohen-Rosenthal, 1998), industrial clustering may:

- permit a sufficient quantity of waste to accumulate to be economically viable for use as raw materials (which also encourages the settlement of more companies able to use waste as a byproduct resource)

- encourage knowledge sharing (*e.g.*, technological, managerial, environmental)
- promote the sharing of utilities (*e.g.*, water provision and waste and sewage disposal) and other infrastructure costs, thus potentially increasing the efficiency of such systems and freeing up capital for technological investment
- stimulate the shared development of novel technologies, design, architecture and construction
- foster the joint development of a more holistic and coordinated management system (which Small- and Medium-sized Enterprises or SMEs, in particular, may benefit from but not be able to afford individually in time or cost)
- attract increasing levels of investment capital, which will help promote industrialisation and technology uptake
- enhance connectivity between stakeholders.

But under what conditions may these expectations be fulfilled? Or, to reframe the question, what are the barriers to the implementation of state-of-the-art environmental management tools, such as the principles of IE in IPs?

A growing literature seeks to address this question (see, *e.g.*, Lowe, 1997; Sterr and Ott, 2004; Tudor *et al.*, 2007). The barriers may be economic: *e.g.*, access to start-up finance, geographically-based economic factors which inhibit tenant recruitment and retention (such as poor local infrastructure or distance from markets), the relatively minor costs of waste treatment and disposal, the low cost of procuring resources in comparison to labour costs – especially for some high-tech and service companies – or the perceived or real additional costs generated by being ‘green’, such as the necessary investments, the additional cost of ‘green resource’ procurement, *etc.* They may also be technological, legislative (*e.g.*, the classification of wastes as hazardous materials, making them unsuitable for use as byproduct) or logistical barriers. Tudor *et al.* (2007) highlighted the importance of sociocultural and political barriers to the greater success of EIPs – examples of such impediments may be the lack of concise definitions of the nature, function and role of EIPs to adequately promote them to public bodies and investors, the absence of a ‘value-added’ perception of EIPs from the industry, public and policy makers or the disinterest and lack of support from local government. At the company or park level, the managerial-level barriers may include the reluctance of company leaders to become dependent on potentially restricted and localised sources of byproducts and a lack of motivation and leadership to engage in a change to industrial symbiosis due to a preoccupation with traditional economic indicators or management inertia.

There is debate over whether, in fact, successful and long-lasting EIPs can be planned at all (Desrochers, 2004; Desrochers and Ikeda, 2003; Gibbs and Deutz, 2005) and if so, whether they can be replicated under a variety of perpetually changing conditions. It is evident from an overview of the potential hurdles to successful EIP operation that a reductive ‘cookie cutter’ approach to promoting IE in clusters, which takes the forms of analysis of byproduct exchanges or wholesale attempts to replicate examples of partial successes across national or even regional borders, will fail: the obstacles to the successful integration of IE into the industry are predicated on micro, meso and macro-scale social, political, legislative and economic factors.

Gibbs and Duetz (2007, p.1690) even claimed that "...there is an issue as to whether the park element of [E]IPs is an essential feature, or whether an emphasis on co-location is actually a hindrance", *i.e.*, more benefits may be realised by identifying and promoting the possibilities for a network of waste exchange on a meso or macro level than through a focus on the geographical clustering of industrial entities.

On a similar note, Roberts described three levels at which IE can be applied to eco-industry development, thereby providing a broader framework within which to examine the subject: he described "the micro level (firms), the meso level (eco-industrial parks) and the macro level (regional and wider global networks of manufacturing activity centres)" (Roberts, 2004, p.1000). The micro level concerns intrafirm activities such as internal recycling, which may provide operational cost savings and contribute to decreasing the environmental load, while also at this level, byproduct reuse will be restricted to the intrafirm level. The macro level may involve the coordination of more than one industry, clusters of companies or a spread of companies on the regional or national scale (UNEP, 1997). At the meso level, most of the attention has been focused on the study and practice of the establishment of IPs, where the most obvious example of clustering occurs.

The variability at each scale is evident and confounds attempts to provide a prescriptive approach to implementing IE in the industry. Micro-scale factors may include the differing functions and/or products of companies (*e.g.*, service company, manufacturing plant or power generation utility), managerial motivation, priorities and competencies. Meso-scale variability includes such factors as regional support, the availability of investment capital, geographical factors, planning, park management and regulatory oversight and the mix of resident companies, while macro-scale factors include the consideration of the stage of a country's economic development, its national development strategy, level of integration and the cooperation of trade and industry ministries with environmental policy making bodies, master planning and, again, the availability of investment capital. An important factor adding to the complexity of effective environmental management is broader sociocultural attitudes towards the environment and industry – such as attitudes towards consumption (Hertwich, 2005).

A raft of options exists for increasing environmental performance in IPs and is covered well in Lowe's Handbook for developing EIPs (Lowe, 2001). According to Lowe, such avenues include the use of targeted regulation, voluntary programmes (*e.g.*, information and expertise sharing), market-based instruments (taxes, tariffs, subsidies, *etc.*), increasing transparency (public awareness of the dangers of pollutants and requirements for firm-level reporting may increase the pressure for action) and increasing the provision of information and education. Working closely with local community leaders and Nongovernmental Organisations (NGOs) as members of public-private partnerships that support the goals of greener local business development may bear fruit. The dramatic increase in the number of environment-focused NGOs in Hungary and the Central European region over the last decade indicates potential in this area.

According to Lowe, the creation of the following elements may be required for EIP development (Lowe, 2001):

- an integrated resource recovery system
- a system for encouraging and managing the exchange of byproducts between companies

- training and services in all aspects of eco-industrial development
- a network management/coordinating unit and working groups
- a community enhancement office to manage projects with neighbouring communities
- one or more business incubators (for SMEs)
- public sector support in Research and Development (R&D), policy development, access to investment and information management.

At the park level, the deliberate recruitment of a more diverse set of firms into the park and the creation of an environmental performance-minded business incubator (as a park tenant) – and/or cleaner production centre – that helps new or expanding companies succeed within the park can stimulate greener practices. A recruitment focus on the companies and industries (and markets) that are engaged in the field of environmental protection (*e.g.*, renewable technologies, energy efficiency or waste treatment, *etc.*) will be helpful in achieving an increase in overall environmental performance and may provide spin-off benefits (Lowe, 2001).

3 The special case of Hungary

In Hungary, the transition process to a market economy started almost 20 years ago, resulting in a present-day economic environment similar to that of the developed states of the EU. Corporations were created according to newly established corporate laws and regulated in line with EU legislation, which included the significant body of environmental regulation implemented in the country before its accession to the EU in 2004.

One of the most important changes in the Hungarian manufacturing industry during this period was the closing of outdated, inefficient heavy industries: the legacy of Soviet-type industrialisation, predominantly as a result of vanishing markets and the emergence of new industries such as car assembly, high-tech industries and the service sector. These developments also prompted new ways of organising industrial activities. Just-in-time systems and complex networks of supply chains came into existence and local authorities all around the country attracted new industries to supplement their shrinking operational budgets with the promise of higher tax revenues. Former industrial zones burdened with inadequate infrastructure and gloomy environmental records lost their importance, while new greenfield developments sprouted up, especially in the developed Western regions of the country and around the capital city, Budapest.

These tendencies were recognised in environmental and economic development policy early during the transition process, but actions beyond those necessitated by the immediate requirements of the EU often failed to follow suit. As a result, although regulatory compliance has improved, old industrial sites still pose a long-standing worry in some of the regions of the country and additional efforts towards the implementation of pollution prevention and IE have been weak or non-existent.

3.1 Environmental performance of the Hungarian industry

To date, no comprehensive surveys relating to the environmental performance of Hungarian IPs exist. Legal environmental information provision requirements are limited to individual business organisations, while IP organisations are only required to report a basic set of (mainly economic) data.

On the other hand, there is an extensive literature regarding the environmental management practices of business organisations operating in the country. Corporate environmental practices have been surveyed on several occasions since the transition to a market economy in 1989. Many attempts used international methodologies and tried to compare Hungarian data with relevant European experiences.

Harkai *et al.* reviewed this literature and concluded that Hungarian companies took a technical perspective on environmental issues at the turn of the century and prefer end-of-pipe measures over more efficient cleaner production and IE-type measures. They also pointed out that one of the most important deficiencies of the corporate environmental management activity in the country is the lack of appropriate environmental communication. For this reason, the authors suggested that regulatory authorities should require some form of public reporting from the companies, as well as require the implementation of the principles of green procurement in order to motivate the industrial sector. One of the conclusions of many surveys is that Hungarian financial institutions do not have any environmental requirements regarding lending decisions. The authors also emphasised the lack of initiatives at the IP level and suggested that the remedy lies partly with government intervention (Harkai *et al.*, 2003).

A more recent study concentrated on the motivation factors, decision-making practices and organisational arrangements of Hungarian enterprises with regard to their environmental performance and environmental management activities (Kerekes *et al.*, 2004; see also Csutora, 2008). The report, which is based on a questionnaire survey of more than 450 individual companies that are medium to large in size, analyses the most important environmental management tools used by the Hungarian corporate sector and describes a marked increase in such activities. More than 50% of the interviewed corporations report the existence of a written environmental policy – an increase of 28% compared to 1999. A similar amount of companies carry out internal environmental audits. Around 40% of the companies define environmental performance indicators and goals, prepare environmental audits and provide environmental training for their employees. Considerably fewer companies use environmental criteria when compensating employees and also, only a few companies employ environmental accounting. The chemicals sector turned out to be the champion in all the management tools analysed, while machinery and equipment production came in second.

In the year of research, 93% of the corporations monitor the solid wastes generated by their operations, while 87% claim to track the use of natural resources. Somewhat less than 80% of the organisations monitor their wastewater effluents and air pollutant emissions and analyse their risks relating to industrial accidents. Even fewer of the surveyed organisations consider soil pollution and global pollutants when planning and implementing their environmental activities (Kerekes *et al.*, 2004).

In comparison with other Organization for Economic Cooperation and Development (OECD) countries, the survey found that Hungarian enterprises are less motivated by potential efficiency gains, even though the replacement of outdated technological

solutions could well result in higher returns on their investments than in more developed regions. On the other hand, Hungarian companies believe more in the potential to increase their corporate image by implementing environmental measures.

A high level of export orientation explains the importance of the corporate headquarters in making environmental decisions, while the strong supplier-orientation of Hungarian companies results from the importance of supply chains in the country (Kerekes *et al.*, 2004).

Regarding the most important stakeholders of the companies involved in the survey and in line with previous experiences, public authorities proved to be the most important, followed by the corporate headquarters, management and commercial customers. Environmental organisations and the final consumers turned out to be less important to these organisations. Accordingly, the most important motivation factors for action were regulatory compliance, prevention/control of environmental accidents and corporate image, followed by cost savings from new technology/product development. According to the authors, there has been little change in this regard over the last few years.

The study concludes that there has been a significant improvement in the environmental practices of Hungarian enterprises in recent years, but little has changed with regard to their motivation factors and the most important stakeholders considered by these organisations.

These results demonstrate that Hungarian business organisations have approached their counterparts in more developed regions of the world and many use an extensive array of environmental management tools. But does this relatively high level of environmental management at individual companies imply that the more complex IPs are also engaged in extensive environmental practices? The following sections will provide some answers to this question.

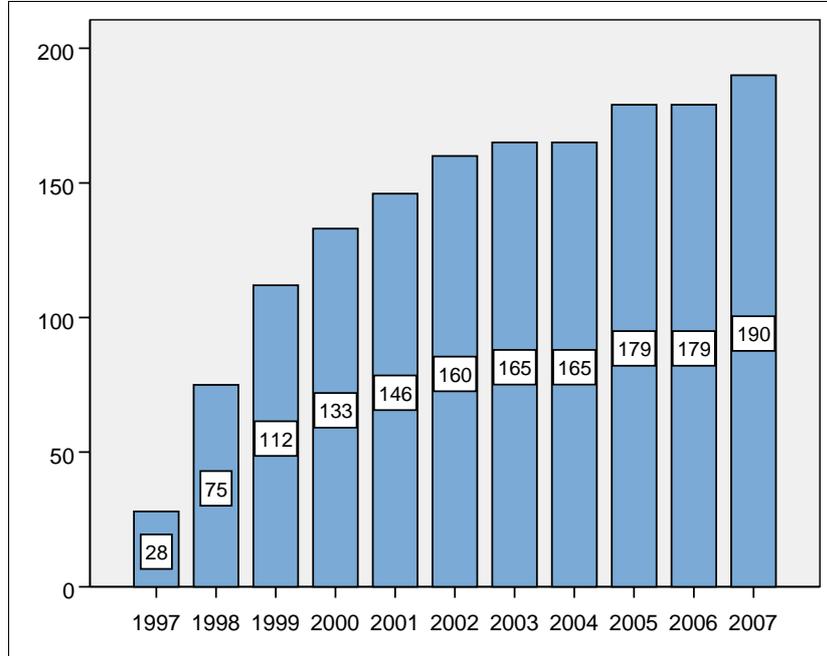
3.2 *Industrial parks in Hungary*

Modern IPs have an approximately 10-year history in Hungary. While IPs thrived during the Soviet era as a result of forced industrialisation, they lacked the dynamic influence of the market and, thus, early IPs provide little relevance for the solution of present-day environmental problems. However, the legacy of these outdated industrial estates still haunts and hinders the present-day operations of many existing IPs.

Between 1997 and 2007, the official 'IP' title was awarded to 190 successful applicants by the Ministry of Economy and Transport (MET).³ In Hungary, an IP title can be awarded to a business organisation, a public interest organisation, a regional development association or a local government if the following requirements are fulfilled:

- the IP has an area of at least 0.2 sq km (20 ha)
- if any previous activities have been carried out on the IP site, the necessary environmental documentation regarding the state of the environment must be obtained
- in case this documentation proves that the site has been historically polluted, the applicant must carry out an approved feasibility study on the need to take technical remedial action.

Figure 1 The number of industrial parks in Hungary (see online version for colours)



Source: MET (2007)

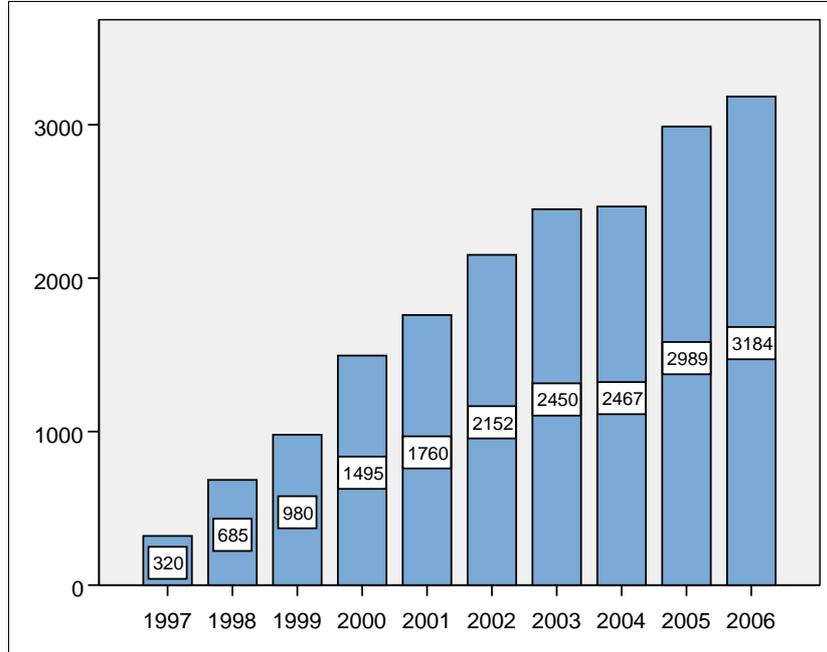
Other requirements include a feasibility study describing the planned IP, a minimum number of organisations and employees already working on the site and the approval of the local government.

The criteria for assessment also include social (*e.g.*, the number of new jobs created, the number of SMEs within the park) and environmental aspects (*e.g.*, the present state of the environment, in the case of brownfield developments), as well as criteria relating to the implementation of R&D results and the cooperation of IPs with other types of organisations (*e.g.*, research institutions, other IPs and employment agencies). A jury which convenes annually and also contains a representative of the Ministry of Environment decides on the proposals submitted for the IP title.

While IP titles do not provide immediate advantages to their owners, they make it possible for them to apply for support specifically designed to assist such clusters of organisations. Special funds for such purposes are designed within the Economic Development Operative Programme and the Regional Development Operative Programme, with the amount of support available (also including other operative programmes) totalling around EUR 1 billion for the years 2007 to 2013.

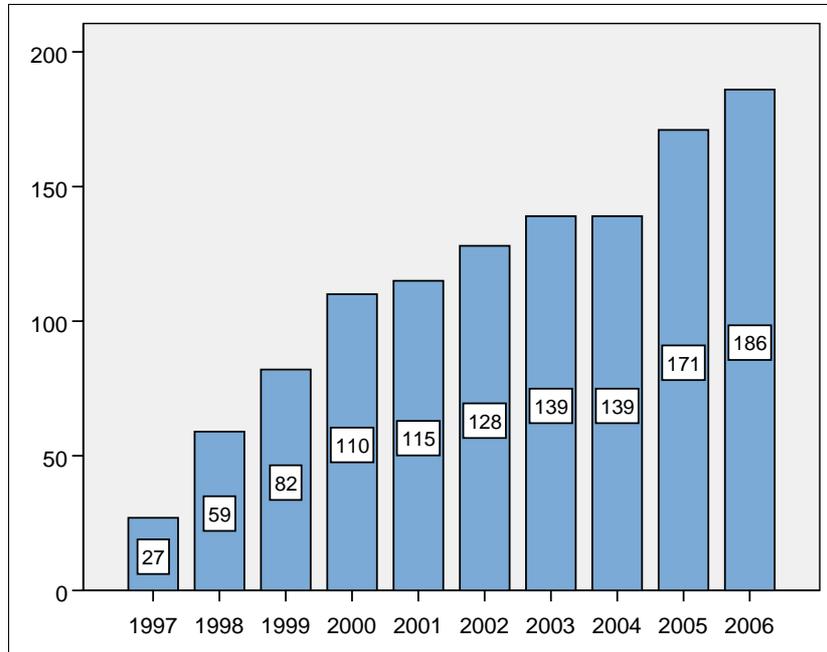
The importance of such advantages gained by the awarding of the IP title for its holders is reflected by the fact that by 2007, 3184 industrial units had started operation in IPs and accounted for a total turnover of approximately EUR 30 billion while providing jobs for 186 000 employees. This latter figure demonstrates the importance of IPs to the country, since the total industrial employment amounts to around 746 000 persons (meaning that IPs employ about 25% of the total industrial workforce in Hungary).

Figure 2 The number of organisations in industrial parks (see online version for colours)



Source: MET (2007)

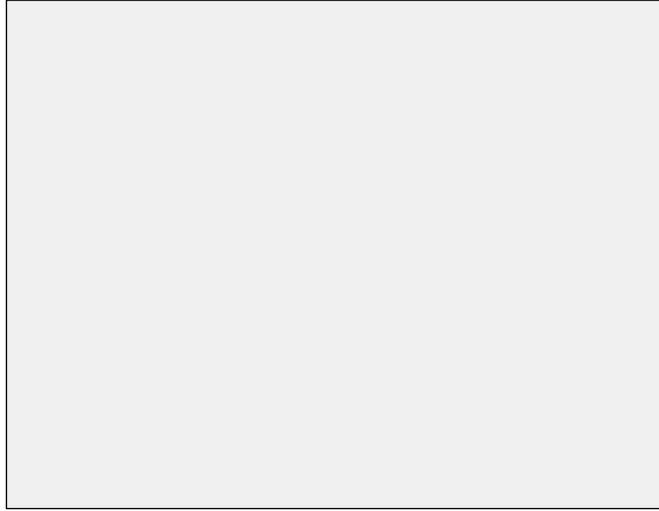
Figure 3 The number of employees in industrial parks (see online version for colours)



Source: MET (2007)

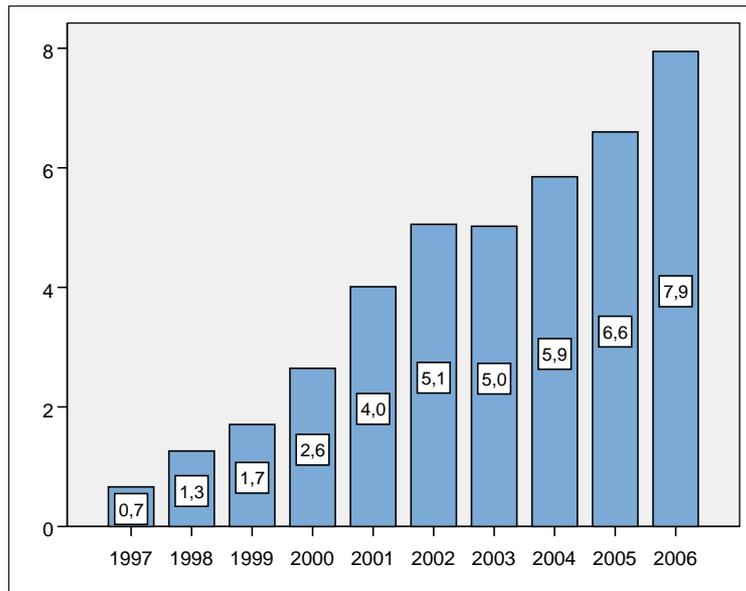
In 2006, IPs occupied a total land area of 98 sq km (approximately 9888 ha), while only a little over 53% of the IP-designated land was actually occupied, which indicates a significant potential for development.

Figure 4 The total area occupied by industrial parks (km²) (see online version for colours)



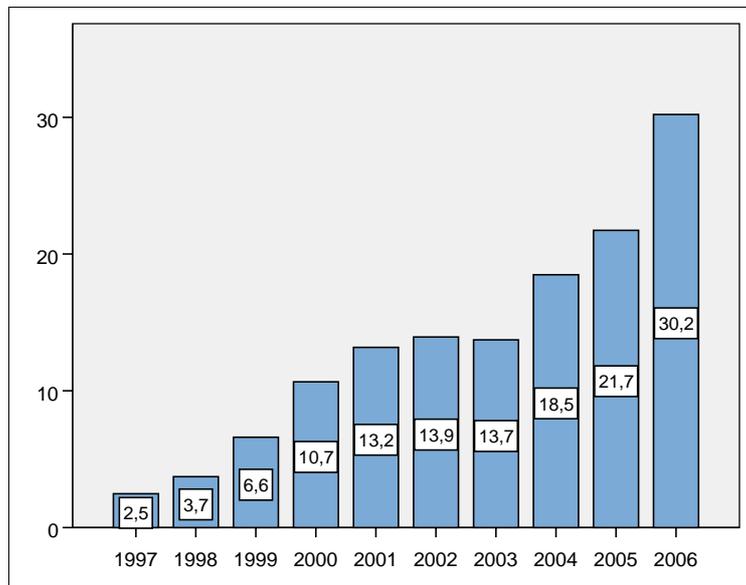
The companies situated in IPs invested EUR 7.9 billion in new developments in 2006 and exported EUR 1.95 billion worth of products (65% of the products were exported) – a contribution to national exports above the average level of the Hungarian corporate sector (MET, 2007).

Figure 6 The total investments (in billion EUR) (see online version for colours)



Source: MET (2007)

Figure 7 The total turnover (in billion EUR) (see online version for colours)



Source: MET (2007)

Recently, the MET invited applications for two new types of IPs: *Small-Region Economic Development Parks* (IPs which contribute to the development of small regions and involve micro enterprises and SMEs) and *Integrating Industrial Parks* (IPs with concentrated innovation potential). These two awards recognise the important role that small- and medium-sized companies and regions plays in the development of the country's economy.

Another special objective of the government is to promote logistical services within and among IPs in order to increase the competitiveness of the Hungarian economy.

4 A survey of industrial park practices in Hungary

Based on the literature and the initial review of IP development in Hungary, the research focuses on the environmental practices of IP organisations.

The following research questions are defined:

- What are the most important environmental problems of Hungarian IPs?
- What are the most important environmental activities carried out by IP organisations in Hungary?
- Are Hungarian IPs aware of the notion of IE?
- Are the companies situated in IPs engaged in any waste utilisation activities?
- What are the barriers to a more widespread use of the principles of IE in Hungary?

Although the situation of the country and its IPs is somewhat special as a result of the long transition process to a market economy, the answers to these questions are relevant not only to the countries in a similar situation, but (more generally) in most developed and transitioning countries.

4.1 Survey results – quantitative analysis

In order to gain an overview of the environmental activities of IPs in Hungary, a countrywide questionnaire survey was conducted in 2007 by the Department of Environmental Economics and Technology at the Corvinus University of Budapest.

IP organisations (organisations serving as administrative umbrellas for the IPs) were chosen as the unit of research, with further plans to survey individual business units within the IPs at a later stage. As described above, the survey aimed to identify the most important environmental activities of these umbrella IP organisations in Hungary, because – by nature – they have a good overview of park activities and have an interest in supporting the operations of the companies within their confines. These organisations were also expected to be aware of any initiatives taken by their companies and the awareness of IP representatives relating to environmental issues can be used as an important indicator of current and future environmental performance.

Using the MET's inventory of active IPs (containing basic park data as well as the contact information for each park), a list of 150 IPs was created and an electronic questionnaire was sent to these IP organisations. The voluntary survey resulted in 28 completed questionnaires, which means a 19% response rate.

IPs of various sizes and types filled in the questionnaire (as shown in Table 1), which compares the most important basic information relating to IPs in general (the 150 parks in the initial list) and the relevant data of the sample. While a sample representative of the total population of IPs in Hungary could not be fully achieved, the data displayed in Table 1 show that the basic characteristics of IPs in the sample are comparable to a typical IP in the country (somewhat higher averages are the result of two exceptionally large IPs in the sample).

Table 1 The characteristics of Hungarian industrial parks in general and sample industrial parks (average values)

	<i>Size of IP (thousand m²)</i>	<i>Number of enterprises within IP</i>	<i>Total turnover (in billion EUR)</i>
Hungarian IPs	550 000	17	168
Sample IPs	650 000	23	226

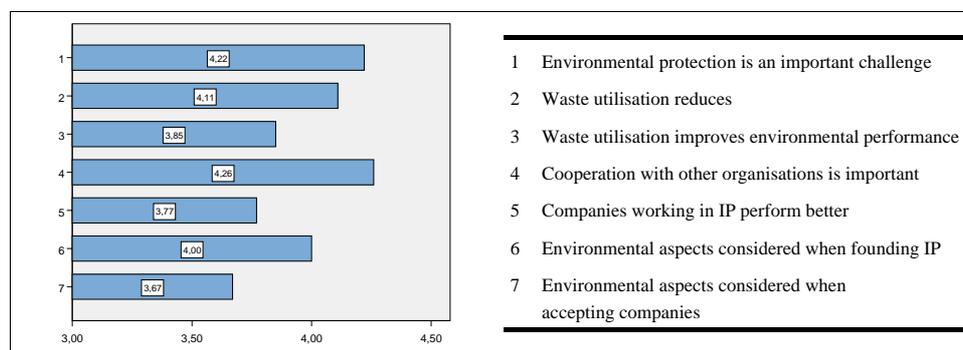
While the questionnaires were addressed to the contact person of the IP organisations provided by the inventory of the MET, they were often directed to someone with a deeper overview of the environmental issues related to park operations; in some cases (mainly in the case of bigger parks where the staff dedicated to environmental functions were present), the questionnaires were filled in by environmental representatives, but in other cases, park management or local government representatives completed the survey.

The first part of the questionnaire aimed to characterise the general attitudes of park managers towards environmental issues and the environmental performance of their IPs.

The following chart shows the result of this part of the survey: the respondents' opinions about questions relating to the general environmental aspects of IP operations.

As Figure 8 shows, the general questions raised by the questionnaire implied more agreement, while the questions relating to more concrete issues raised doubts among the respondents. Thus, most of the IP managers agreed that environmental issues provide one of the most important challenges to the corporate sector these days – a finding which is hardly surprising in the light of ever stricter environmental regulations in post-socialist Hungary.

Figure 8 The general attitudes of respondents towards the environmental issues relating to industrial parks (see online version for colours)



Note: The average values provided are based on a scale from 1 (do not agree) to 5 (completely agree).

The respondents agreed even more with the necessity of cooperation with other types of organisations such as research and educational institutions, local governments and civil societies, *etc.* Since in order to move in a more sustainable direction, cooperation between different organisations is essential, this result is promising. However, practical experience shows that such forms of cooperation are still limited and much has to be done to overcome the barriers to a much broader collaboration between different organisations.

The respondents were much less positive about the environmental issues relating to their own IPs. This is reflected in a lower level of agreement with the statement suggesting that organisations situated in IPs usually have a better environmental performance compared to organisations outside of IPs. However, in the light of the characteristics of environmental services provided by IP organisations, which we also surveyed and will describe below, this result is not surprising.

Another statement generating low agreement implied that the environmental performance of organisations/IPs can be improved by the utilisation of waste materials. This result indicates a low level of awareness of the benefits of waste utilisation and also reflects the lack of experience of IP managers in the field. Again, this finding is in line with the results obtained from the latter parts of the questionnaire, as shown in the next paragraphs.

The last two statements related to a much more concrete issue: whether IPs took environmental issues into account when the park was founded or when accepting new companies to be tenants. Our results relating to these questions show that a relatively high number of IPs took environmental issues into account when choosing a location for the park and setting up the necessary infrastructure, while after this initial phase, the parks investigated the environmental performance of potential new companies only to a limited extent.

In order to learn more about the actual problems of IPs in Hungary, the respondents were requested to describe the most pressing environmental issues of their parks, as well as introduce their most significant environmental activities. After analysing the qualitative answers given to these two questions, the following conclusions can be drawn.

Regarding the *most pressing environmental problems* related to IP operations:

- Several respondents believed that there are no significant environmental problems within their IPs. This primarily describes the situation of newly founded IPs rather than the old ones established before the transition to a market economy. These latter parks often mentioned remediation as their most important problem to be solved.
- The most pressing problems according to the respondents are the collection of hazardous and household wastes, the handling of sewage water and rainwater runoff. Noise and transportation problems, as well as the emission of carbon dioxide, were also mentioned, but by only a few respondents.
- No environmental problems related to the scarcity of natural resources were mentioned by park managers, which can be contributed to the fact that both old and new IPs are well-provided with infrastructure and energy and raw materials are within easy reach for the companies operating within them.

- All the problems indicated by the respondents reflected some sort of or another regulatory requirement by the state or local government. This strongly suggests that IP managers are still predominantly concerned with regulatory compliance and other measures fall outside of their perspective.

Regarding the *activities of companies operating within the IPs*, the respondents indicated the following tendencies:

- In about half of the IPs, the respondents stated that their companies do not carry out any environmental activities or have no information about such activities. In some cases, the low level of activities carried out in the park explains this phenomenon, while in other cases, the type of activities (predominantly service and logistics) may account for the low level of environmental activities.
- Those IPs where the companies carry out environmental tasks within the park are most likely to be involved in waste management activities, such as the collection of household and hazardous wastes, the selection of different components, *etc.* This activity is most often outsourced to companies outside the IP.
- The second most important activity inside IPs is the management of sewage water.
- One or a few respondents mentioned air pollution abatement, forestation and other activities.

Based on the preliminary review of several IPs in Hungary, a list of potential environmental services provided by IP organisations was compiled. This list was then used to map the services provided by the IPs in the sample, either through their own activities or by using third-party service providers (outsourcing). Figure 9 shows the findings of this inquiry.

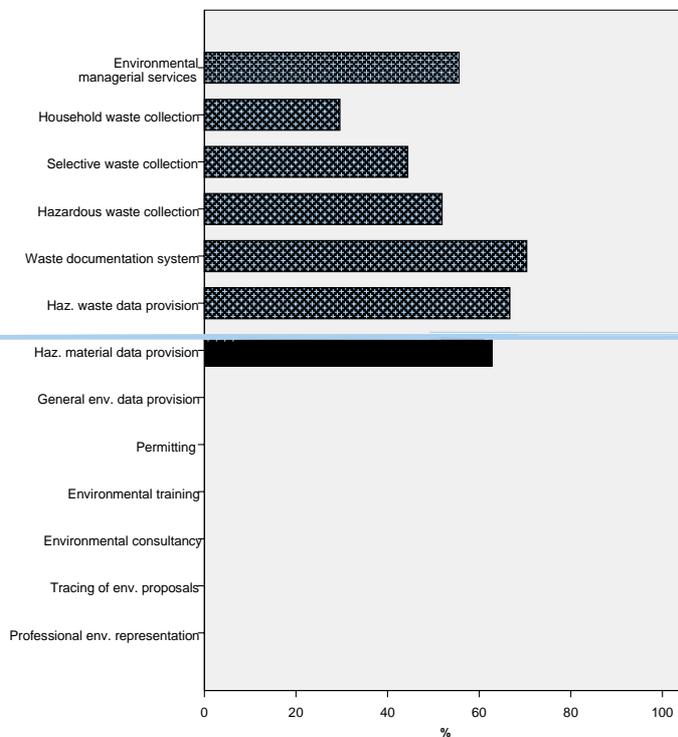
An analysis of the data suggests that many IPs offer a very limited number and selection of environmental services to the companies operating within their confines. Several parks indicated none or that only one or two services are provided – and even these are often offered through third-party service providers. This situation mainly characterises small or medium-sized IPs, as the interviews also demonstrated: for these parks, it is not economically feasible to organise such activities; they would rather hire specialised organisations or simply leave such tasks to the companies operating in the park.

The most commonly offered service of IP organisations is the collection of information relating to environmental solicitations advising tenant companies about financial opportunities. This result, however, may be misleading: the IPs most certainly included their own fund-seeking activities as a service provided to tenant companies, since their activities (*e.g.*, the development of infrastructure) also benefit the companies operating within their borders.

The second and third most mentioned activity was the collection of municipal waste and the provision of environmental data to authorities, followed by selective waste and hazardous waste collection and assistance provided during the environmental permitting processes.

In line with the pre-identified problems within IPs, this shows that the most important activities of IPs in Hungary relate to the management of (park) communal and hazardous wastes.

Figure 9 The environmental services provided by Hungarian industrial parks (see online version for colours)



not identify such companies, 25% could name one or two such activities, while only two park managers had information relating to a more complex system of waste utilisation. Wastes identified as being reutilised within the parks are of variable nature: from the utilisation of plastic, metallic and wooden wastes to the grinding and recycling of waste bricks, no single activity emerged as characteristic of the IPs in the sample.

A similar share of respondents (70%) could not identify any waste utilisation activities between IP companies and the organisations *outside of the IPs*. The same persons who identified intrapark waste recycling were better informed about waste reutilisation outside the park.

When asking about the barriers to overcome the environmental problems encountered by IPs, more than half of the respondents mentioned a lack of financial resources and the high cost of environmental solutions. This view still reflects the legacy of end-of-pipe thinking and indicates a lack of awareness of the benefits of preventive and IE solutions to environmental problems. The other problems mentioned by the respondents included an overly bureaucratic state administration, 'inappropriate' or challenging environmental regulations and a broader lack of awareness of environmental problems.

4.2 Qualitative analysis

While the questionnaire survey provided some insights into the current situation at Hungarian IPs, five interviews were conducted in five different types of IPs to highlight the most important factors determining their environmental performance. The parks that participated in the interviews were selected to provide insight into the impacts of varying historical backgrounds and ownership structure, as well as geographical location. Here, we introduce these parks shortly and then summarise the conclusions that we could draw from these visits.

The *Ózd Industrial Park*, the history of which dates back to the 1800s, used to be an emblematic IP of the Soviet era. Based on coal and iron mining in the region, the IP used to employ around 13 000 people in its heyday in several metallurgical industries and provided the town not only with employment, but with schools, hospitals, housing and even heating and hot water, utilising the waste energy from its facilities. Such industrial complexes were the success stories of an era long gone, but interestingly, some traces of modern environmental protection principles can be identified within their confines (for an analysis of this phenomenon, see, *e.g.*, Desrochers, 2002). However, such industrial formations could not be justified under market conditions and they inevitably collapsed during the early 1990s. With the original industrial operations shut down, the city built around the Ózd industrial giant has suffered a lot.

Today, one of the most pressing problems of the park is the monitoring and remediation of polluted land, an important activity during the last few years. This is also an important prerequisite for the repopulation of the park which, in turn, is crucial for a region with high unemployment rates and sluggish economic development.

The *Rába Industrial Park* in Győr is located in one of the most developed regions of the country and based on the former premises of one of the biggest machinery production companies of socialist Hungary. While the transition process to a market orientation brought about many difficulties for the company, by continuously modernising its technology, selling off a significant share of its resources and setting up an IP (which is home to a giant multinational car manufacturing company) the economic situation of Rába Industrial Park seems to have stabilised. This situation results in a higher level

of awareness of environmental problems, as well as a more active role in the organisation of environmental management of the park. These activities are facilitated by an environmental manager, who has up-to-date knowledge of the problems and possibilities in the environmental field.

Siófok Industrial Park is located in the vicinity of Lake Balaton, one of the most precious natural areas and tourist destinations in the country. This small IP has been set up to utilise the surplus land of two companies based in the oil pipeline production and assembly industry. The IP is located in a less industrialised region of the country and is home mainly to local businesses. While the IP organisation does not see many environmental problems within the park, they have a natural interest in keeping their land clean of any environmental problems.

Hatvan Ipari Park is a new IP in the eastern part of the country, characterised by the presence of an industrial giant in the car electronics industry and other multinational corporations. The Hatvan Industrial Park plays an important role in the economic and social development of the region. The Hatvan municipality, through owning a share of the IP, is interested in generating new employment opportunities, as well as improving the competitiveness of the region. Regarding environmental issues, greenfield investments in the park are not compromised by a historical pollution legacy, but the high volume of material and energy flows (e.g., CO₂ emissions) will require more attention in the future.

Budaörs Industrial Park is near Budapest, the single most prosperous region in the country. The vicinity of the capital combined with a very good transportation infrastructure makes this park one of the most successful in the country. While not a greenfield investment, the park has solved any remaining environmental problems arising from earlier activities. Today, many organisations within the park deal with services and help reduce the overall environmental impact. The IP organisation offers a wide array of environmental services to its companies, including selective waste management and consultation services.

While the small number of interviews cannot guarantee the representative nature of this sample, they nonetheless helped in uncovering some important factors which characterise Hungarian IP performance. The most important findings are summarised below.

The *former history of an IP* influences the current problems and activities to a great extent. As described in the previous sections, many IPs still suffer from the negative inheritance of the pretransition era and their efforts inevitably focus on clean-up and monitoring activities. In one of the interviewed IPs, several attempts have been made to date to make good the damage done to the environment during the years of heavy industrialisation and soil and groundwater pollution monitoring continues at present. Since the potential new entrants to the park are wary of being made liable for historical environmental damage, the IP organisation must take environmental protection seriously. In this certain case, the issue of who should bear the financial burden of the previous damage has still not been completely settled – disagreement continues between the IP organisation and the tenant companies – making challenging the move towards higher levels of cooperation in the environmental field.

Newly established IPs do not have to tackle such problems and can concentrate on day-to-day environmental compliance and – perhaps – beyond compliance measures.

The *general situation of the region and the IP* has an important impact on the potential of IPs and, thus, their environmental activities. This is reflected best by the differences between the IPs relating to the requirements for new tenant companies. Parks in disadvantaged regions and with a less favourable infrastructure concentrate more on the employment and economic development effects of new investments, while the parks in more developed regions and with better infrastructure are in the situation of being able to require stricter environmental entry and operation conditions from potential new tenant companies.

The *role of local municipalities* within IPs influences the goals and objectives (as well as the activities) of the IP organisations in the environmental field. While some Hungarian IP organisations are owned and controlled by local municipalities, other municipalities only have a limited share in the IP organisation and other IPs have never included local governments as owners of the parks. In general, the interviewees agreed that the local governments have an important role in the life of IPs – whether directly (through ownership) or indirectly (through local regulatory and development activities). Local governments can foster or hinder the development of different types of activities within a settlement and, thus, all the interviewed IPs tried to maintain good relationships with municipalities – irrespective of how close their formal relationships are. On the

- *Basic awareness of environmental issues.* As described above, the IP title in Hungary requires that the park should identify its most important environmental problems and prepare a plan for solving such problems during its operations.
- *Clean-up activities.* IPs with a longer history face the problem of fixing past damages done to the park environment and have a focus on the clean-up of their premises. Many such remedial actions have been carried out in this field in Hungary, but the task has not been accomplished yet. Remediation-based activities may require conflict resolution and resort to legal course and are of a typically defensive nature.
- *Provision of basic services.* Most of the IPs in our research provide a basic set of environmental services to their tenant companies, most often through third-party service providers. These activities, however, do not require much effort on behalf of the IP organisation and do not utilise the potential of IPs in relation to environmental protection. Nonetheless, a basic level of networking is in place.
- *Provision of a complex system of services.* While the companies within our sample do not yet provide a complex system of environmental services to their companies, attaining this level would result in more complex organisational and networking behaviour – potentially beneficial for both the IP organisation and IP companies. According to our results, IP managers believe that such a complex solution to environmental problems is hindered by a lack of financial resources. The low volume of currently provided services is also in part led by minimal demand for such activities from IP actors. The barriers to overcoming this are complex and may be sociocultural, informational and managerial or relate to perceived or actual legislative barriers.
- *The implemented IE principles.* The IPs in the sample demonstrated a very low awareness of the principles of IE and had a very limited knowledge of concrete environmental tools, instruments and options (such as the utilisation of waste inside and outside the parks). While a few examples of more complex industrial ecosystems may exist in the country, the analysis of the sample indicated that such a level of systems thinking does not generally occur in Hungarian IPs.

Our empirical investigations suggest that the IPs in Hungary still operate mainly at the first two levels of the model with a small amount of extant third-level behaviour. In order to move towards the goal of adapting environmentally beneficial IE-type behaviour, a number of conditions should be fulfilled, one of the main conditions being an increase in readily available financial resources, as suggested by sample IPs. Along with this must come higher awareness of the environmental and economic benefits of the measures which go beyond compliance. Policy interventions based on an analytical step-by-step approach to identifying the barriers to and drivers for achieving sequentially higher levels of environmental protection and network complexity (along the lines of such a model as described above) is a logical approach which could bear fruit.

5.2 Policy background

Both the questionnaire results and interviews clearly demonstrated that IP managers are well aware of the importance of present-day environmental challenges and they offer at least a limited array of services towards their tenants. However, it also became clear that more complex activities, such as the harmonisation of environmental activities within IPs or the implementation of the principles of IE, are beyond the means of IP organisations.

The reasons for this were provided to us by both the respondents of the questionnaires and by the interviewees. The IP representatives often specified a lack of financial resources or the general situation of the park (economic and employment conditions and the history of the IP, as was previously mentioned) as barriers to a more comprehensive set of actions in the environmental field. However, also often mentioned was the lack of interest of the organisations operating within these parks, which may even break down the faint initiatives of IP organisations.

The gap between the potential of IP organisations in the environmental field, as suggested by the literature and the level of actual measures, calls for policy intervention.

In Hungary, IPs have been seen by consecutive governments as engines of economic growth and tools to increase employment. However, there are currently only very limited regulatory tools to promote the development and competitiveness of the IPs in the country. The cornerstone of the IP regulatory environment is that which defines the condition of the acquisition of the IP title; apart from some planning documents, no other regulations are available. As mentioned earlier, however, the IP title presumes at least a minimum level of awareness of the environmental problems of title holders.

Thus, regarding policy, the single most readily available means of promoting IP development is through the use of EU funds available to the Hungarian economy. The operative programmes of the so-called 'New Hungary Development Plan' will provide about EUR 1 billion to IPs between the years 2007 and 2013 in order to facilitate innovation and increase their competitiveness. This is a significant increase over the EUR 40 million available during the period of 1992–2007 and is expected to become a major contribution to the development of IPs in Hungary (Rakusz, 2007).

While these funds are not specifically aimed to improve the environmental performance of IPs in the country, sustainable development is one of the horizontal requirements of any support provided to the applicants. Also, the modernisation of the operations and funds available from other operative programmes related to environmental protection justify at least a certain amount of optimism.

6 Conclusions

We defined our research objectives as being the provision of an initial overview of the environmental performance of Hungarian IP organisations. Both our questionnaire survey and the conducted interviews indicate that Hungarian IPs have started out on a pathway towards environmentally conscious management, but there is still a long way to go.

For *IP organisations*, it is important to understand and monitor the most important environmental impacts caused by park operations and learn about new tools and techniques – both technological and managerial – in order to reduce these impacts. Since the businesses operating within IPs often do not require such services, IP organisations should be proactive and approach businesses with new services in the

field, even when success may only be measured after some years. As with individual businesses, individual leadership in the environmental field is also very important at IPs. Environmental managers, if well suited to the task, can coordinate IP activities and make things happen. Some optimism may be justified in this field, taking into account the awareness of the surveyed IP representatives about the environmental issues within their parks.

Policy makers should consider the creation and implementation of a national IP development strategy in order to provide direction to development tendencies. Such a strategic document should include references to environmental protection within IPs and sustainable development in general. The funds available from European and national sources may benefit the IPs in Hungary, but environmental considerations and potential benefits from sound environmental management should be stressed by government actors. Government institutions should also facilitate cooperation between different stakeholders, as well as R&D towards state-of-the-art solutions in the environmental field. Since the most important motivation factor for business organisations to improve their environmental performance is still the regulatory environment, governments at both the local and national levels can do a lot to provide a push for IPs and for their businesses to move forward.

Individual business units, their behaviour towards the environment and their openness to new solutions are crucial factors in the greening of IPs. While this research did not look at the individual companies located within IPs, evidence suggests that these organisations often operate in an isolated manner and do not search for possibilities to cooperate with each other or the coordinating IP organisation. However, more research is needed in order to uncover the motivation factors and actual behaviour patterns of the individual businesses within IPs which – we believe – will help move IPs in the direction of sustainability.

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Notes

- 1 The vast amounts of organic residues that accumulated over millions of years in the Earth's crust and have been utilised as fossil fuels by humans in recent years provides such an often ignored counterexample, one which also demonstrates the problems arising from discharging a previously intact mass of material.
- 2 See, *e.g.*, some practical case studies at <http://www.epa.gov/innovation/international/ecology.htm> and http://www.roi-online.org/case_study.asp.
- 3 The data in this section are based on an overview of IP development in Hungary compiled by the MET (2007).