

## **Environmental impact assessment as a tool for urban environmental planning and management in Brazil – a case of a mid-sized city**

Dr Marcelo Montano, Dr Marcelo Pereira de Souza

*University of São Paulo, Brazil*

Environmental management strategies have undergone overwhelming advancement in recent years, propelled by State actions (regulator and supervisory agent), and supported by the general public's requirements.

Although going to be banned from the industrial sector even in developing countries, due to acknowledged high costs involved, the end-of-pipe approach is usually applied to cities (meaning corrective actions rather than preventive ones), and the practice of environmental management in urban areas has shown to be unable to prevent environmental impacts, so as to guarantee a basic level of environmental/life quality.

In Brazil, mechanisms of governmental control are clearly inefficient and public managers in general lack the experience to use environmental planning tools, hence contributing towards the deterioration of environmental quality at the moment of an urban sprawl or any other activities associated to urban development. Basically, there is an instrumental vision regarding the role of cities in people's lives, and environmental issues are normally overlooked when a set of priorities are established by economic development requirements, leading to environmental liabilities and distancing the cities from a sustainable pathway.

This paper proposes the adoption of a differentiated approach to be applied in urban environmental planning and management. It is quite similar to an Environmental Impact Assessment (EIA) process and to some of its procedures, considering the whole city as an enterprise, with its inputs and outputs. In doing so, the flows of matter and energy define the major aspects to be considered on assessing the impacts caused by development projects, at least from the Environmental Agency's point of view.

The paper brings a case study of a mid-sized city in the State of São Paulo, Brazil, and describes the processes involved in the EIA – identification, prediction and evaluation of impacts, as well as their usual mitigation measurements. While it recognizes a major limitation of this approach in dealing with the implications related to socio-economic processes, it is believed that this proposal can contribute to improve the environmental performance of cities.

**Keywords:** environmental management, impact assessment, urban sustainability

# 1 Introduction

The environmental management strategies have undergone overwhelming advancement in recent years, propelled by State actions (regulator and supervisory agent), and supported by the general public's demands.

Traditionally, environmental issues are addressed by a set of end-of-pipe solutions, which takes pollution as a normal consequence of the development process. This approach usually means high initial investment solutions as well as operating and maintenance costs, and often does not guarantee the expected results. Therefore, end-of-pipe technologies have been gradually set aside as immediate solutions for dealing with environmental issues, especially on account of the need to meet new performance requirements through the initiative of organizations or by virtue of enacting more restrictive laws. (Souza 2004; Jones et al 2005; Brand, Thomas 2005).

The scope of environmental debates did not include urban issues within the structuring of the sustainable development discourse, at least at the beginning. Cities did not appear as particularly important in the major reports, such as Meadows et al (1972) or the United Nations Conference on the Human Environment in Stockholm in 1972 (Brand, Thomas 2005).

However, the population explosion became a specifically urban explosion during the twentieth century (Hassan, Zetter 2002). Thus, the Brundtland Report (1987) argued that the world's population would concentrate in towns, cities and metropolis throughout the Earth. However, the deficiencies of (at that time) Third World cities in terms of administrative strength, economic resources and skilled personnel were held to be incommensurate with the scale of needs produced by rapid growth and squatter developments, worn-out infrastructure and congested transport facilities. Despite the potential benefits of urbanization, cities of developing countries can rarely afford the costs that this process imposes.

In Brazil, mechanisms of governmental control are clearly inefficient and public managers lack the experience of applying environmental planning tools, hence contributing towards deteriorating environmental quality at the moment of an urban sprawl or any other activities associated to urban development (Souza 2004). Basically, there is an instrumental vision regarding the role of cities in people's lives, and environmental issues are normally overlooked regarding a set of priorities established by economic development requirements, leading to environmental liabilities and distancing the cities from a sustainable pathway. Thus, environmental agendas need to be implemented to introduce the environmental issues to the decision making framework (Zetter, White 2002). To this respect, nowadays the lobbies are seen as a "joint-venture" of political parties and economic interests, and this practice constitutes an important point to considerer in the decision making process (Rydin 2003).

Bell and Morse (2008) mention that one way to measure the presence of environmental issues in the cities' planning and practice is by sustainability indicators, including scenario studies, stakeholder's participation, introducing the systematic sustainability analysis approach. In a similar manner, Gibson et al (2005) add some sustainability requirements as the basis for decision making.

In this perspective, the environmental impact assessment as an Environmental Policy tool must be incorporated into the decision making process.

## 2 Urban environmental planning and management.

According to Hall (1992), different approaches have been used to incorporate environmental issues into urban planning and management. In this sense, it can be seen that each different knowledge area has intended to demonstrate that its theoretical conceptions are correct and, from rational planning, lead to better living conditions in urban areas.

As Souza (2004) states, the planning process of cities is criticized by those who want to "denaturalize" the analysis of producing the urban space, classifying it as a socially-oriented process with problems caused by the dynamics of wealth production and the structures of power observed in modern societies, and also by those who recognize the limitations of

governments to avoid critical situations in terms of life quality (this vision is strengthened by the limitations of a typical welfare-state planning, easily recognized nowadays).

There is clearly a confrontation between social sciences and what is criticized as an “objective” or “cartesian” approach to urban planning and management, strengthened when dealing with environmental questions (Polèse, Stren 2000).

Giddens (2001) and Foladori (2001) observe that the global environmental crisis is, to a large degree, a consequence of the contradictions observed in a capitalist society around the means of production. Thus, a technical reductionism would not appropriately address environmental questions. Foladori (2001) is quite direct when stating that "technical solutions never solve the problem of social contradictions, but most of the time make them worse" (pg 137). According to them, a technically-based development is related to a continuously negative trajectory that is unable to mitigate the mentioned contradictions.

In fact, environmental problems are always linked to social effects. But resorting to natural resources for human life, caused by drastic changes on environmental systems, cannot be ignored. Therefore, the technical approach still remains useful for urban planning and management, in order to assess the impacts over the environment and to incorporate certain limitations to their occurrence.

It means to recognize and to admit as valid the conception of a city – or parts of it – as a dynamic system that is inter-related to others, which have their support basis sustained by different flows of matter and energy. Indeed, a great challenge to public administrators and to the general population is coupling the production of social space to the environmental dynamics that occur within the urban context. The cities, are responsible for a wide range of environmental effects that must be integrated to their management strategies. Although remote from most ecological fundamentals that rule natural systems, the urbanization process implies in modifications of the ecological borders, with intense importation and exportation of matter and energy.

As Odum (1998) observes, as a system increases in terms of dimension and complexity, the energetic cost of maintenance tends to rise proportionality in order to reduce the entropy growth. Applied to the urban system, this means higher social and environmental costs, as well as the economic aspects.

Traditionally, environmental management applied to the urban context has been characterized by a conflict in decision-making processes, which means an overlap of "urbanistic interests" (in essence concerning structural and functional issues) over the environmental ones. This involves different motivations surrounding the maintenance of power structures and, in some ways, reveals a great misunderstanding about the process of urban planning and management focused on environmental issues, as well as the role of different actors within it. (Polèse, Stren 2000; Zetter, White 2002; Brand, Thomas 2005; Rydin 2003).

### **3 Environmental Impact Assessment and applications**

An Environmental Impact Assessment (EIA) involves the evaluation of the effects likely to arise from a major project (or other actions) significantly affecting the environment. It is a systematic process for considering possible impacts prior to a decision being taken on whether or not a proposal should be given approval to proceed (Morris, Therivel 2001; Glasson 2005; Jay et al. 2007).

As Jay et al. (2007) point out, current studies criticising EIA as an essentially techno-rational approach to decision-making have increased among researchers and practitioners. When it was developed, the rationalist thinking supremacy concept was in place, bringing the idea of supporting decision-makers to provide objective considerations to an issue, taking into account possible alternatives, each of which were previously assessed on the basis of the available technical information, and linking it to a final decision that was taken in the best interest of society as a whole.

After almost 40 years of practice, EIA procedures have been strengthened and EIA capacity has been improved in different contexts of development. However, it is acknowledged that the instrument is limited in reaching its full potential, which means exerting influence over development decisions. Wood (2003), in a comparative review of seven EIA systems around the world, concluded that to a certain degree, EIA does exert influence on development decisions, but that it is common for the findings of EIA to be shadowed by other considerations, such as non-environmental objectives and political factors. He found that, for all seven systems, EIA generates modifications to project designs, prior to formal applications and/or during formal EIA processes, but that these are generally minor and designed to mitigate the worst effects of development.

Nowadays it is recognized that, in countries with mature EIA systems, there is some agreement about the need to improve EIA outcomes (Barker and Wood 1999; Wood 2003; Christensen et al. 2005; Jay et al. 2007). The limitations on contributing to sustainable development, considering the results verified so far, encourage the inclusion of environmental, political, societal and economical issues with the same basis of assessment. Therefore, a great diversity of instruments can be seen, such as Social Impact Assessment, Health Impact Assessment, Strategic Environmental Assessment, and also Sustainability Assessment - each one working within a specific focus, but all of them sharing an empty space that EIA could not fill satisfactorily.

Some EIA systems allow for different approval mechanisms to be used for different projects, according to Ahmed and Wood (2002) "without placing a heavy burden on the competent authority". This strategy is applied in several countries (Wood 2000), leading to a "full EIA" process, a "scoped EIA" with simplified procedures, or even a simple approval mechanism by submitting an application form.

In Brazil, EIA is formally linked to the environmental licensing processes, conducted by governmental agencies, and is applied to verify what is called "environmental acceptability" of the proposed activities. In fact, the role played by EIA process is focused on the discussion about the changes introduced by the projects and on the quality of some environment components, guided by legal requirements.

One of the major deficiencies of the Brazilian EIA system is the low degree of commitment with the follow-up and monitoring procedures. As Sánchez (2006) appoints, there is a huge discrepancy between the rigor applied to the identification and assessment of impacts and the level of interest (surprisingly small) to check if the project was implemented in accordance with the requirements and if mitigating measures reached their environmental protection goals.

## **4 The project-EIA approach: the cities as enterprises.**

The process of urbanization has been referred to as a major source of significant environmental impacts of anthropogenic origin, both in magnitude and in extension. In fact, urban settlements have been crucial to the deterioration of environmental quality regarding physical, biological and socioeconomic aspects.

Scientific literature attributes to urbanization a series of environmental impacts: pollution and contamination of surface and ground water resources by point or diffuse sources, air pollution, altering water characteristics from rain, erosion and soil contamination, removal of vegetation, displacement of wildlife, changes in the socio-economic conditions, various impacts on local populations, changes in micro and meso climates, and so on. (Characklis, Wiesner 1997; Zandbergen 1998; Pauleit, Duhme 2000; Sutherland, Tolosa 2000; Luria, Aspinal 2003; Zannin et al 2003; Sullivan et al 2004).

However, there are several dominant interests (economic/politics) deciding and establishing a considerable conflict among the stakeholders. In order to contribute to address these conflicts, and considering the conceptual framework of Environmental Impact Assessment (Canter 1996; Morris, Therivel 2001; Glasson et al 2005), the present paper proposes to apply to the cities (and to the public activities) the same approach applied to project-EIAs, establishing a set of

requirements to be achieved by the projects, in terms of their environmental performance and taking into account legal and social requirements.

According to this approach, the environmental effects caused by the city's development could be better controlled following the systematic framework of assessment and management given by EIA procedures, which means:

- A normative control, imposed by legal requirements, quite similar to a licensing process. In Brazil, the legal framework given by the National Environmental Policy (Law 6.938/1981 and followed by the National Environmental Council resolutions) sets the environmental licensing as a process to verify the acceptability of projects previous to construction, and to control the environmental effects throughout their life cycle;
- A voluntary control, applying certain instruments already widely disseminated in the private sector, as certifications and auditing. Certifications are coupled to an Environmental Management System implemented to inspect objectives and targets given by the organization's Environmental Policy.

In both cases, controlling mechanisms will be more effective when coupled to a systematic assessment of environmental impacts caused along the different stages of urbanization processes, considering the procedures of the Environmental Impact Assessment.

The central aspect is to visualize the city (and all of its components) as a "single" enterprise, with flows of matter and energy and related environmental impacts. As a consequence, public administrators are responsible for them and, similar to private enterprises, there are some environmental performance requirements to be achieved.

According to the operational principles presented by IAIA (1999), the present paper suggests the application of an EIA process in compliance with the following steps:

- Screening: to determine whether or not a development project should be subjected to EIA and what level of detail, within the cities' context, it implies in different approaches that range from simplified approval mechanisms up to a "full EIA" process, depending on the impact potential;
- Scoping: to identify the issues and impacts that are likely to be important, for instance - water and air pollution, noise, spatial segregation;
- Examination of alternatives: to establish the preferred or most environmentally sound and benign option for achieving proposal objectives;
- Impact analysis: to identify and predict the likely environmental, social and other related effects of the development projects and/or urban equipments;
- Mitigation and impact management: to establish the measures that are necessary to avoid, minimize or offset predicted adverse impacts and, where appropriate, to incorporate these into an environmental management plan or system;
- Evaluation of significance: to determine the relative importance and acceptability of residual impacts (i.e., impacts that cannot be mitigated);
- Preparation and review of environmental studies: to document clearly and impartially impacts of the proposal, the proposed measures for mitigation, and the concerns of the interested public and the communities affected by the proposal, determining whether a satisfactory assessment was provided;
- Decision making: to approve or reject the proposal and to establish the terms and conditions for its implementation - with an adequate level of public participation;
- Follow-up: to ensure that the terms and conditions of approval are met; to monitor the development impacts and the effectiveness of mitigation measures; and, where required, to undertake environmental audit and process evaluation to optimize environmental management.

The project-EIA in general is supported by a characterization of different flows of matter and energy associated to the activities or enterprises, in order to identify and evaluate the level of impact to be caused. Considering the city as a single enterprise, EIA must focus on “urban elements/equipments” (for example, associated to the surface drainage system, transport, solid waste, and so on) and the impacts associated to them.

It must be highlighted that some urban elements, before their implementation, are subject to an environmental licensing process that must verify their environmental acceptability (or viability) before it is concluded. In Brazil, the environmental licensing follows a three-step process - Previous Licence, Implementation Licence and Operation Licence. Regarding this, two observations must be made:

- It is necessary to assess whether the environmental licensing concerning these elements/equipments has been effective in ensuring its environmental viability and legal compliance;
- The Brazilian environmental licensing system does not give to urban equipments, in general, the same status given to other activities (except in case of specific regulation, as seen with solid waste landfills, sewage treatment plants and, in certain situations, industrial districts) which means an absence of systematic monitoring and verification of environmental performance throughout their lifecycle.

Based on empirical observations, the case of a medium-sized Brazilian city is discussed.

### **1. A case: São Carlos city – Brazil.**

São Carlos is in the central region of São Paulo state, with a surface of 1.140 km<sup>2</sup>, from which approximately 70 km<sup>2</sup> constitutes its urban area. Its population is of about 220.000 inhabitants, with an annual growth of 2%. It is a typical city undergoing high levels of industrial and agricultural development.

Table 1 shows the results of a screening step for an EIA process, as determined by ordinary licensing guidelines.

Table 1: Screening step for the EIA-licensing process applied to urban elements

<b>Urban elements</b>	<b>Mechanisms of approval</b>
Urban mesh (residential and/or commercial areas)	Simplified mechanisms (normal and without environmental issues). Scoped-EIA (rare) Full-EIA (very rare)
Industrial districts	Scoped-EIA Full-EIA (rare)
Urban solid waste management system	Full-EIA
Transport infrastructure	Simplified mechanisms
Wastewater system (treatment plant)	Scoped-EIA
Wastewater system (infrastructure)	Simplified mechanisms
Surface drainage	Simplified mechanisms

Following a formal EIA process the scoping stage results in a set of questions related to the main impacts expected to be considered in the environmental studies and therefore in decision making. These impacts can be described, in general, as shown in Table 2.

Table 2: Urban elements and main impacts expected over environmental components

Urban elements	Phase/stage	Main impacts
Urban mesh	Construction	Loss of native vegetation, changes in runoff conditions, soil loss (erosion) and sediment transport/siltation, reduction of soil permeability
	Operation	Reduction of soil permeability, climate change (micro and meso scales), noise, water/groundwater/air/soil pollution (diffuse and punctual), spatial segregation
Industrial Districts	Construction	Loss of native vegetation, changes in runoff conditions, soil loss (erosion) and sediment transport/siltation, reduction of soil permeability
	Operation	Water/groundwater/air pollution, soil contamination
	Close-down	Water/groundwater/air pollution, soil contamination
Urban solid waste management	Construction	Loss of native vegetation, soil loss (erosion) and sediment transport/siltation
	Operation	Water/groundwater pollution, soil contamination
	Close-down	Water/groundwater pollution, soil contamination
Transport infrastructure	Construction	Interference on protected areas (Permanent Preservation Areas), soil loss (erosion) and sediment transport/siltation
	Operation	Water/air pollution (diffuse), noise
Wastewater system (treatment plant + infrastructure)	Construction	Interference on protected areas (Permanent Preservation Areas), soil loss (erosion) and sediment transport/siltation
	Operation	Water/groundwater pollution (in case of disruption of pipelines), soil loss (erosion) and sediment transport/siltation
Surface drainage	Construction	Interference on protected areas (Permanent Preservation Areas), soil loss (erosion) and sediment transport/siltation
	Operation	Water pollution, soil loss (erosion) and sediment transport/siltation

Given the situation verified in the study area in terms of environmental impacts related to the elements described, São Carlos can be taken as a representative city from the totality of Brazilian mid-sized cities.

Without a single exception, the impacts described at Table 2 are easily verified in field surveys. Depending on where they occur, the negative effects can assume a dramatic perspective – the more fragile the environmental conditions are, the worse the effects to be caused. Figures 1 to 4 (recently taken by the authors), can illustrate the situation. They reflect different types of failures in the licensing/controlling system, which is showed to be unable to deal with the impacts along the whole life cycle of urban equipments or elements.

Figures 1 and 2 shows a situation of impacts over surface water and over legal preservation areas near the city's centre, following the disruption of a wastewater pipeline (Figure 1) and along a bridge construction (Figure 2). In these cases, the EIA procedures would provide to decision-makers information to properly respond to this situation, in terms of prevention and mitigation of the impacts to be caused. A private enterprise, in a same situation, could receive some administrative penalties.

Figures 3 and 4 illustrate the lack of concern of public administrators with environmental impacts along time. The irregular disposal of solid waste (Figure 3) implies, in most of the cases, in impacts like water and soil pollution that can be transformed in serious threats to public health. At the same way, Figure 4 shows a typical drainage solution applied in the city – the problem here is limited to remove the runoff without considering the impacts to be caused.





*Figure 1: disruption of a wastewater pipeline*



*Figure 2: construction of transport infrastructure and impact over Permanent Preservation Areas – soil loss and siltation at urban streams*



*Figure 3: irregular disposal of solid waste*



*Figure 4: surface drainage equipment causing erosion and degradation in streams*

What is seen is that although the licensing process brings some specific legal requirements to control the impacts to be caused, it has to be improved in order to increase the commitment by the managers with their environmental objectives and responsibilities.

One of the main questions is that, unlike private enterprises and their duty to respond to governmental agencies, the city (and urban elements/equipments as well) seems to be no one's

property. Especially for “intra-urban” elements (transport infrastructure, urban mesh, and elements of surface drainage), the actions by the environmental agencies are not as effective as what is true for private enterprises.

As a result, these elements lack an Environmental Impact Assessment framework and, consequently, the management along their life cycle is far from satisfactory. In fact, there is no examination of alternatives, the impact analysis is very weak and does not exert any influence on the projects, the mitigation is deeply cost-limited and barely effective, decision-making is guided only by administrative requirements and there is a definite absence of impacts follow-up.

## 5 Conclusions

Considering the current decision making framework applied by the managers of Brazilian cities, and the prevalence of economic/political interests, the present paper proposes, from the Environmental Agencies point of view, that the cities could be managed as enterprises. Their activities must receive the same approach that is applied to any enterprise in a project-EIA, establishing a set of requirements to be achieved by the projects, in terms of their environmental performance and taking into account legal and social requirements.

The EIA system in Brazil (and related Environmental Licensing) does not guarantee, in itself, an appropriate environmental performance related to urban equipments, considering the generalized level of impacts observed in socioeconomic, physical and biotic resources. However, when obeying the law, it could be a good start inducing the managers of the cities to consider some environmental requirements in their development projects.

There is a need to improve the practice of environmental management of cities, and the framework given by EIA procedures shows to be particularly attractive, considering the monitoring problems faced in developing countries. The project-EIA approach calls for the establishment, by the decision-makers, of a set of objectives and targets coupled to their organization's environmental performance (in this case, the city itself).

Thereafter, based on identification of significant environmental impacts associated with urban equipment and activities, the decision making stage would bring the terms and conditions to be observed at the implementation stage of a development project. This means the environmental performance requirements and the procedures for systematic monitoring of the impacts along their life cycle.

Playing an important role in this approach, mechanisms for public participation must be strengthened in order to bring to decision making within an EIA context an adequate balance among the stakeholder's interests. As a consequence, this arrangement stimulates mutual – between society and local authorities – influence and accountability.

This approach could stimulate the adoption of other environmental planning tools, such as strategic environmental and sustainability assessments, hence introducing environmental issues in the early decisions.

The decision making process will be better if democracy principles can be applied to the environmental planning, in order to consider the “same” law and requirements for all types of investments (public and private ones) and to really guarantee the stakeholders' participation instead of only a few interests deciding the outcome.

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