

ENVIRONMENTAL SANITATION INDICATORS FOR UPGRADED SLUMS: THE CASE OF JARDIM FLORESTA SLUM (FAVELA) IN THE CITY OF SAO PAULO

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Contents

1. Introduction
2. Slums and Their Inter-Relations
 - 2.1. Initial Considerations
 - 2.2. The Slums in the Urban Spaces of the City of Sao Paulo
 - 2.3. The Intervention Process in Shantytowns
 - 2.4. Inter-Related Issues and Prerequisites in Slums Upgrading
 - 2.4.1. Public Health and Environmental Sanitation
 - 2.4.2. Public Urban Services in Slums
 - 2.4.3. Importance of Free Urban Spaces and Protection Areas for Water Catchments
3. Environmental Sanitation Indicator - ESI
 - 3.1. Objective
 - 3.2. Components of the Environmental Sanitation Indicator
 - 3.3. Structure of the Environmental Sanitation Indicator
4. Environmental Sanitation Indicator for Slums - ESI/S
 - 4.1. Objective
 - 4.2. Environmental Sanitation Indicator for Slums
 - 4.2.1. Water Supply Indicator (I_{CA})
 - 4.2.2. Sewage Collection and Septic Tanks Indicator (I_{CE})
 - 4.2.3. Garbage Collection Indicator (I_{CR})
 - 4.2.4. Drainage Indicator (I_{DR})
 - 4.2.5. Street and Passageways Indicator (I_{VC})
 - 4.2.6. Soundness of Geologic/Geo-technical Indicator (I_{SG})
 - 4.2.7. Gross Demographic Density Indicator (I_{DD})
 - 4.2.8. Electric Energy Indicator (I_{EL})
 - 4.2.9. Regularizing Land Ownership Indicator (I_{RE})
 - 4.2.10. Street Cleaning Indicator (I_{VA})
 - 4.2.11. Streetlights Indicator (I_{IP})
 - 4.2.12. Public Areas Indicator (I_{EP})
 - 4.2.13. Income Indicator (I_{RF})
 - 4.2.14. Education Indicator (I_{ED})
 - 4.3. Report on Environmental Sanitation for Upgraded Slums

5. Selection of the Area for the Case Study
 6. Confirmation of the Applicability of the Proposed Model
 7. Conclusions and Recommendations
- Bibliography
Biographical Sketches

Summary

This paper presents a method to verify if the upgrading process in slums promotes environmental regeneration in such a way as to raise sanitation levels to acceptable standards that would make it feasible for them to stay in their original location, without compromising the environment or the health of the population in the slum. The method is based on the use of sanitation, public health, urban and socio-economic indicators. The applicability of the method is shown through a case study carried out in the slum (favela) of Jardim Floresta, which was upgraded through the Environmental Recovery Program of the Guarapiranga Basin (PSABG - Programa de Saneamento Ambiental da Bacia do Guarapiranga) and concludes with recommendations, not only for perfecting the method, but also for the consolidation of the intervention work being done in the area.

1. Introduction

Population growth in urban areas, in major cities of Brazil, has presented a series of difficulties for public authorities, and especially for those administrations located within metropolitan areas. Among the more prominent problems that have ensued, it is pointed out issues of adequate provision of public urban services, precarious living conditions and the quality of life of the population in the urban outskirts. In the city of São Paulo, for example, with the exception of the rundown central slum areas, where there are “cortiços” (or tenement-type houses that are let and sublet), the real estate with the lowest market value is, with few exceptions, to be found in outskirts settlements, far from the city center. The majority of these settlements occupies clandestine areas where there is environmental degradation and little or no infrastructure, and presents a distinct and different process in the development of cities, with their own unique characteristics of formation, growth and change.

The perspective for the future is that there will be a decrease in the growth rate of the cities in Brazil, without, however, presenting any change in the pattern of growth on the outskirts. It can be noted that any reversal of the pattern of segregation, characteristic of Brazilian cities, will not take place in the short term. Slums (favelas), “cortiços” and peripheries, devoid of public urban services, will be part of these cities for the next millennium. The complexity of addressing such diverse questions and subjects, involving several different disciplines, makes it difficult to determine the correct measures that public authorities should take in order to ensure appropriate environmental sanitation levels in the slums that would result in improved living conditions for this segment of the population. Another difficulty relates to the problem of how to determine the extent of public health and environmental sanitation in those slums that have already been upgraded. In this respect, knowledge of the environmental

sanitation conditions that exist in a slum and/or an upgraded slum is vitally important for orientating any process of intervention or maintenance in these areas.

It is been considering upgraded slum that one in which the result of intervention process will be directed to solve the problems referents to the network of basic infrastructure (water, sewage, drainage, garbage collection), street and passages, soundness of geologic and geo-technical condition, housing unsanitary condition, and the necessity of urban equipment, in order to integrate the upgraded slum to the neighborhood where it was located. This study presents a method, called the Environmental Sanitation Indicator for Slums, to verify the situation of environmental health in upgraded slums, evaluating if the upgrading process promotes environmental regeneration in such a way as to raise sanitation levels to acceptable standards, that would make it feasible for the slums to stay in their original location, without compromising the environment or the health of the inhabitants.

2. Slums and Their Inter-Relations

2.1. Initial Considerations

Over the years, the term slums have presented changes, which have almost always been linked to the evolution of the socio-economic situation of their inhabitants. The most appropriate definition for slum today would be: a spontaneous housing settlement, located on private or public land, acquired in an illegal way in relation to the rightful ownership of the land and whose buildings are found to be in disaccord with the laws of the use and occupation of land, independently of the number of buildings involved or the type of houses constructed there. The slums may be considered one of the more conspicuous signs of the failure of our present economic and social system. Ever since the appearance of the first slums, their inhabitants have been, in some form or other, socially excluded.

The failure of the State to find a solution for the question of the slums has not only had serious consequences for this sector of society, the slum dwellers, but also for the rest of the city's population. By occupying certain urban areas, slums have provoked changes in relation to the original designated use of these areas, causing harm, not only to the environment, but also to the population of the city in general.

2.2. The Slums in the Urban Spaces of the City of Sao Paulo

From the 70's, slums, as well as illegal allotments, were concentrated on the outskirts in the southern region of the city. 70% of the illegal occupations made by slums are to be found in public areas. In the case of São Paulo, these occupations have occurred, mainly, because of the fall in the buying power of the population in recent decades – the minimum salary lost 46% of its real value in the decade of 1980 – and the existing loopholes in municipal legislation with regard to land zoning, that permits the approval for allotments, in areas inappropriate for housing or public use. In the city of São Paulo, there were 1594 slums registered in 1987, with an estimated population of 815,400 inhabitants. By referring to Table 1, it is possible to observe that 60,6% of the slums were make up of less than 50 households.

Number of Houses	Nº of Shantytowns	%
02 to 09 houses	453	28,42
10 to 49 houses	513	32,18
50 to 99 houses	252	15,81
100 to 199 houses	189	11,86
200 to 499 houses	148	9,28
500 to 1000 houses	24	1,51
More than 1000 houses	15	0,94
Total	1594	100

Table 1: Households in slums in the Municipality of São Paulo in 1987

Using Table 1 presented by the Municipality of São Paulo, which categorizes the size of the slums in the municipality, slums can be classified as follows: a small sized slum is one that has up to 49 households; a medium sized slum one with between 50 and 499 households; and a large slum is one that has more that 500 households. Data from a study carried out shows the impressive number of almost 2 million people living in slums in the municipality of São Paulo in 1993, which represents 19,4% of the total population of the city.

2.3. The Intervention Process in Shantytowns

Historically, the first interventions in shantytowns, by public organs, in the city of São Paulo, occurred in the 50's and bore the marks of the political policies of the times: the removal of the slums. The public authorities pursued this policy until the end of the 70's, when proposals of intervention with a view to upgrading gained more favor. By the 80's, the possibility of removing slums became unfeasible because of the sharp rise in the number of inhabitants of the same. As the policy of removal was not an option, the slum, in reality, became home for a significant part of the population. In the 90's, the slums showed strong signs that they were here to stay – the number of households, made of concrete and ceramic blocks, is increasing. In relation to the upgrading process in the slums, projects are elaborated with a view to urban intervention in the area, seeking solutions to widen and improve the streets and passages within the slum, preparing the way to implant infrastructure and urban services.

2.4. Inter-Related Issues and Prerequisites in Slums Upgrading

When elaborating a project to upgrade a slum, it must be remembered that we are not dealing with the implanting of a new housing project in which we can mould the land into an urban housing estate, for example with the use of landscapers, to guarantee the best results. We are, in fact, dealing with intervening in an area that has already been occupied spontaneously, located, almost always, in places that are not suitable for housing, and where the basic network of infrastructure implanted in the area and the constructions built by the population, were, almost totally, carried out without the necessary criteria or technical support.

2.4.1. Public Health and Environmental Sanitation

In cities, especially those with high rates of urban concentration, man's "intrusion" occurs in such a way as to be both fast and intense, provoking changes, often irreversible changes, in the characteristics of the environment, with harmful effects for both man and nature. The activities engaged in by men, especially in urban areas, produce substances that when brought into contact with nature – the air, water and soil – contaminate and cause their pollution. The adequate implementation of these sanitation measures is a *sine qua non* condition to guarantee that urban settlements do not contaminate the environment or reduce pollution discharges to such a level that the means itself cannot absorb them, through auto-cleansing, without causing alterations that would hinder their beneficial use.

In this context, it is emphasized that the concept of basic sanitation must be broadened in favor of the wider concept of environmental sanitation, which would ensure that, when providing the means for adequate garbage collections and sewage and waste disposal, care is taken to avoid any contamination of water bodies and swamps by liquid and solid residue deposits, the contamination of wells or water tables caused by the absence of a sewage collecting system and inadequate deposit of solid residues and sediments and the reduction in the outflow in drainage canals, by dumping garbage on wasteland and riverbanks. Sanitation must therefore, free itself from its present connotation of being solely the implementation of public works and assert itself in integrated action directed at the preservation of the quality of the environment. Environmental sanitation is best understood as that environmental quality that is capable of preventing outbreaks of diseases transmitted through the environment and that promotes the perfecting of ecological conditions that benefit the urban and rural population.

2.4.2. Public Urban Services in Slums

The recovery of an urbanized milieu for a slum depends as much on the capacity of those intervening to create the conditions necessary to implant infrastructure that serves all the houses in the area, as it does on guaranteeing that these houses have access to good and efficient public services. In this way, it will be possible to ensure that adequate conditions for environmental sanitation will be a determining factor in guaranteeing full health for the population. The concept of what public service is varies, depending on the characteristics of the society, its political organization and its level of development. In relation to these public services, it is important to note that, as well as being made available, they should also be executed adequately and with quality, otherwise, a series of other problems will arise, such as, public health problems or pollution of the environment or even a worsening of living conditions in general, since neutralizing the sources of pollution is directly linked to these services.

2.4.3. Importance of Free Urban Spaces and Protection Areas for Water Catchments

The importance of preserving and maintaining free urban spaces and protected areas for water catchments is directly related to the role they play in the surrounding environment. The free urban areas not only constitute pleasant areas for restoring body and spirit and suitable places for spending our leisure time, but they also serve for the

sanitation of adjacent areas and reduce the effects of pollution in the atmosphere. The occupation of areas by slums brings with it two problems: the first relates to the loss of space for public use and the second to the sharp increase in the number of inhabitants, reducing still further the proportion of public space per habitant. In relation to the protected areas of water catchments, it is well to remember that water is a natural element indispensable for man. By occupying areas near reservoirs, or the water basin sources or other types of environmentally protected areas, the slums are detrimental to the natural resources and to society as a whole, as well as jeopardizing the very existence of these water fonts.

3. Environmental Sanitation Indicator – ESI

3.1. Objective

The Environmental Sanitation Indicator – ESI – was developed to evaluate the efficiency of the State's Plan for Sanitation, in such a way, as to fulfill the norms and regulations arising from Law N° 7.750, of March 31st, 1992, that deals with the São Paulo's State Policy for Sanitation. It is a model developed with the specific objective of verifying the current sanitation conditions in the municipalities. The idea of using the ESI is to identify and evaluate the sanitation situation in each municipality, in a uniform manner.

3.2. Components of the Environmental Sanitation Indicator

The ESI is composed of indicators selected from the fields of environmental sanitation, socio-economics, public health and hydro sources. The variables chosen were the ones deemed easy to access and easy to rate, in order to facilitate the elaboration of a report. There are six groups of indicators: *The Water Supply Indicator (I_{AB})*; *The Sewage Indicator (I_{ES})*; *The Solid Refuse Indicator (I_{RS})*; *The Vector Control Indicator (I_{CV})*; *The Hydro Resources Risk Indicator (I_{RH})* and *The Socio-Economic Indicator (I_{SE})*. According to the Basic Manual of the ESI, other information with regard to the municipalities and/or regions should be added to these indicators, when it involves unusual or relevant aspects related to environmental sanitation. To address this, a Regional Indicator was elaborated to identify which elements or circumstances on the municipal or regional level, would put the health of the population or the environment at risk. Among the targets dealt with by the Regional Indicator, slums were nominated as an important issue presented in several Brazilian municipalities. Thus, with this variable in mind, the Environmental Sanitation Indicator for Slums (ESI/S) was used in all municipalities with slums.

3.3. Structure of the Environmental Sanitation Indicator

The ESI is calculated by working out the average of each specific indicator, and is related directly or indirectly, to the environmental sanitation, using the following formula:

$$ESI = 0,25 I_{AB} + 0,25 I_{ES} + 0,25 I_{RS} + 0,10 I_{CV} + 0,10 I_{RH} + 0,05 I_{SE}$$

The Table 2 presents the indicators, sub-indicators and purpose of using each of the indicators that make up the ESI.

Indicators	Sub-indicators	Purpose
Water Supply Indicator I_{AB}	Area Covered (Service) (I_{CA})	To calculate the number of houses connected to treated water supply systems.
	Quality of Water Furnished (I_{QA})	To monitor the quality of the water furnished.
	Capacity of Production System (Quantity) (I_{SA})	To compare water supply and demand; program extensions or new production systems and treatment programs and reduction of losses.
Sewage Sanitation Indicator I_{ES}	Area Covered by Sewage Collection and Septic Tanks (I_{CE})	To calculate the number of houses connected to sewage systems and/or septic tanks.
	Treated Sewage and Septic Tanks (I_{TE})	To indicate the reduction of polluting agents.
	Capacity of the Treatment (I_{SE})	To compare the supply and demand of present installations and program new installations or extensions.
Solid Refuse Indicator I_{RS}	Garbage Collection (I_{CR})	To calculate the number of houses served by garbage collection.
	Treatment and Final Deposits (I_{QR})	To determine the situation of the final deposit of the refuse.
	Capacity of Final Deposits (I_{SR})	To indicate the needs for new installations.
Vector Control Indicator I_{CV}	Dengue (I_{VD}) e Esquistossomosis (I_{VE})	To identify the needs for corrective and preventative programs to reduce and eliminate vectors, transmitters and/or carriers of the disease.
	Leptospirosis (I_{VL})	To indicate the necessity of preventive programs for the reduction and eradication of rats.
Hydro Resources Indicator I_{RH}	Water Volume (I_{QB})	To determine the extent of the water volume or geographical risk.
	Availability of Water Fonts (I_{DM})	To calculate the sufficiency of water fonts in relation to demand.
	Isolated Sources (I_{FI})	Deals with the control of water used by the population in urban areas not served by official water supply.
Socio-Economic Indicator I_{SE}	Public Health Indicator (I_{SP})	To indicate the possibility of inadequate sanitation services, that can be evaluated through: infant mortality linked to diseases transmitted via water (i_{mh}); deaths of infants and the elderly linked to respiratory diseases (i_{mr}).

	Income Indicator (I_{RF})	To determine the population's capacity to pay for and the municipality's capacity to invest in these services, which can be evaluated through: distribution of income of less than three minimum salaries (i_{3s}); average income (i_{rm}).
	Education Indicator (I_{ED})	To determine the level of language used in campaigns for sanitation and environmental education through: index of no formal schooling (i_{ne}); index of schooling up to primary level (i_{e1}).

Table 2: Indicators, sub-indicators and purpose of ESI

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Bibliography

Abiko, A.K. (1995). *Serviços públicos urbanos*. São Paulo. Texto Técnico - TT/PCC/10. EPUSP. [This paper presents the concepts of urban public services. It show how public service varies depending on the characteristics of the society, its political organization and its level of development]

Almeida, M.A.P. (1994). *Urbanização de favelas em Diadema, no período de 1983 a 1988*. São Paulo. Dissertação (Mestrado) - Escola Politécnica, Universidade de São Paulo. 168p. [This paper reports the characteristics of the interventions performed by the Municipality of Diadema, State of Sao Paulo, within the period 1983 to 1988, covering 51 public sites formerly occupied by slums]

Almeida, M.A.P. (1999). *Indicadores de Salubridade Ambiental em Favelas Urbanizadas: o caso de favelas em áreas de proteção ambiental*. São Paulo. Tese (Doutorado) - Escola Politécnica, Universidade de São Paulo. 226p. [This paper presents a method to verify if slums upgrading promotes urban environment regeneration in order to enhance sanitation standards so that it makes possible for slums not to be removed without compromising the environment and population health]

Hespanhol, I. (1999). Água e saneamento básico: uma visão realista. In: Rebouças, C.A.; Braga, B.; Tundisi, J.G., organização e coordenação. *Águas Doces no Brasil: capital ecológico, uso e conservação*. São Paulo. Escrituras Editora. [This paper shows the problem of water supply, basic sanitation, health and environmental aspects involved in urban areas of Brazil]

PUPPI, I.C. (1981) *Estruturação Sanitária das Cidades*. Curitiba, UFP, CETESB, São Paulo. [This book introduces all the essential aspects of the importance of to preserve urban spaces and the sanitation conditions in the city]

São Paulo (Estado). (1999) Secretaria de Recursos Hídricos, Saneamento e Obras. *ISA: Indicador de Salubridade Ambiental, manual básico*. São Paulo, 1999. Edição SRHSO/Sabesp. São Paulo. [This paper presents information about the Environmental Sanitation Indicator - ESI]

São Paulo (Município). (1988). Secretaria Habitação e Desenvolvimento Urbano. *Censo de favelas do município de São Paulo*. Sehab. [This presents extensive information about the number of slums and its households in São Paulo city]

Taschner, S.P. (1997). *Favelas e cortiços no Brasil: 20 anos de pesquisas e políticas*. Cadernos de Pesquisa do Lap. n.18. mar/abr. FAUUSP. [This paper shows the evolution of slums and shantytowns in Brazilian Metropolis in the last 30 years]

Biographical Sketches

Alex Abiko is a Professor of urban engineering at the Escola Politecnica of the University of Sao Paulo. His main areas of interest are: urban and housing management and urban settlements upgrading including slums (favelas). He has conducted several researches on these topics including on site studies on slums upgrading all over Brazil, taking into account besides infrastructure and engineering aspects, issues on environmental and financial sustainability, institutional design and community participation.

Marco Placido de Almeida is a Civil Engineer, Assistant Professor and Coordinator of School of Civil Engineering and School of Architecture and Urban Planning of the University of Mogi das Cruzes, Sao Paulo. He completed his PhD in civil engineering at the Escola Politecnica of the University of Sao Paulo, USP. With Werna; Abiko, et al., he co-edited "Pluralismo na Habitação" (2000, Annablume), a case study from many new models of housing offering in Brasil. Professor Almeida's research purposes are focused in slums and upgraded slums. His interests also include environmental engineering and urbanism.