

Facing the Challenges of Informal Settlements
in Urban Centers:
The Re-urbanization of Manaus, Brazil

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Introduction

The search for solutions to urban and social problems prompted by informal settlements is gaining importance in the development agenda of most large cities in Latin America. Nearly 60% of the population lives in informal, often centrally located settlements. The significance of the issue is emphasized by the inclusion of an objective in the Millennium Development Goals to reduce the number of people living in slums by 100 million by 2025 (UN, 2000). Within Latin America, municipalities are tackling the land tenure, sanitation, and urban services deficiencies of informal settlements either with their own resources or with transfers from other government tiers. A wide array of practical experience has come from the region, mainly from programs executed in the settlements located in the periphery of cities (Brakarz et. al. 2002). Notable exceptions include the well-known Favela Bairro Project of Rio de Janeiro, which is tackling the issues of informal settlements in the inner city.

Most traditional settlement upgrading projects are conceptualized as poverty alleviation operations counting on their contribution to: (1) the increase of the beneficiaries' physical capital through the regularization of land tenure and the consequent valorization of their properties due to infrastructure and urban services investments; (2) the improvement of the population's human capital through positive impacts in wellbeing and education, usually observable within beneficiary communities; and (3) the enhancement of the communities' social capital through public participation in the design and implementation of the projects. The Favela Bairro Project and recent experiences such as the Manaus project discussed in this work show that solving the problems of informal settlements in downtown areas bring about additional issues but also added benefits for the cities. New issues include the need for a more integrated and wider set of interventions in these areas than in the periphery. Also, downtown settlement upgrading

programs must consider urban issues specific to high density and high use areas, and must include interventions to tackle public transportation, traffic, road and intersection improvements, and urban services of city-wide importance. The execution of these projects is more complex in the densely occupied urban space of the city centers. For instance, the resettlement of part of the dwellers (an action required in most settlement upgrading projects to introduce road and sanitation infrastructure) increase the social and operational implementation challenges due to land scarcity in central areas. These requirements and challenges add to project costs and require more time and institutional efforts in their execution. However, these projects generate opportunities for urban development that are not present in the periphery. Full integration of the settlements to the urban structure brings social and economic benefits to communities throughout the city; examples include the removal of negative externalities generated by the settlements, the completion of the road infrastructure connecting them to surrounding neighborhoods, and the construction of city-wide urban facilities in the central areas occupied by the settlements.

The thesis of this work is that settlement-upgrading projects in downtown areas are more than poverty alleviation operations; rather they are full urban development operations that also benefit the poor. This thesis is analyzed through the discussion of a successful experience that these authors consider a good practice in project design and implementation; such discussion is useful given the limited practical experience in downtown settlement upgrading projects in the region. The difficulties encountered by recent projects to deal with the problems caused by downtown settlers by transferring them to high rise tenement buildings built on the illegally-occupied, -centrally located lands (notably Sao Paulo's Singapura and Favela do Gato projects) highlights the urgency to document and study

good practices. The Government of the State of Amazonia and the Municipality of Manaus in Brazil are dealing with informal settlements that occupy the creeks draining the city of Manaus, the *igarapes*, reaping all the urban development benefits of downtown settlement upgrading. While solving the complex issues of centrally located settlements this project avoids the pitfalls of transferring the settlers to tenements and tackles simultaneously several urban deficits of the central business district (CBD).

This project exemplifies a good practice in project design with the first phase of implementation well underway in 2007 and rapidly expanding investments to other occupied areas in the center of the city. This document discusses the issues faced by the Manaus project designers and analyzes their solutions, which have proven capable of eliciting city-wide benefits that justify the significant expenses incurred by the government in their execution.

Illegal Land Development: Features and Problems

Illegal occupation of urban land is a widespread phenomenon in Brazil: inner city slum dwellers, although occupying land outside the legal land tenure system with limited or no access to public utilities, benefit from their proximity to formal and informal employment in downtown areas. Illegal settlements in central areas create problems such as poor living conditions for the settlers and negative environmental and social impacts on the rest of populace, particularly those that utilize the central areas. The problems vary in Latin American cities; in this work the focus is downtown Manaus, whose most critical problems result from illegal settlements established in the ravines and creeks that drain the city. From the city's perspective key problems include: higher than average incidence of wastes and odors in the settlements and surrounding neighborhoods; discontinuities of street structure resulting from many settlements situated in the right of way of planned roads; overcrowding of downtown urban services by the settlers. From the settlers' perspective, key problems in downtown areas are similar to those of periphery settlements, except that downtown settlements have higher densities, thus posing a more complex and costly implementation challenge. Therefore, there is a need to both promote the social and economic advancement of slum dwellers and eliminate negative externalities that affect the entire city. The programs required to address these situations are multi-sector and difficult to implement. However, the integrated interventions of settlement-upgrading programs in central areas generate significant urban benefits for the area as a whole, along with substantial improvements in living conditions for the beneficiaries, supporting the argument that such interventions are better conceptualized as urban development programs and that their overall economic benefits help justify their above average costs.

The city of Manaus has developed policies and interventions to address the complexities of the

illegal settlements within the city center, providing practitioners with valuable lessons for the design and implementation of such multi sector urban solutions. They are implemented as part of a recent program by the Estate Government of Manaus, partially financed by the Inter American Development Bank (IDB 2005). The program focuses on urban development problems that affect the central business district (CBD) of Manaus, which are caused partially by the illegal occupation of the ravines that intersect the area, clogging an essential section of the city's natural drainage system.

As in other rapidly growing cities in Brazil, the population of Manaus increased fivefold between 1970 and 2003, from 300,000 inhabitants to almost 1.5 million. This upsurge is partially the result of the Free Trade Zone, established in the seventies, as well as the increased migratory flow from other rural areas, since Manaus is the only significant urban settlement in the Amazonian region. In 2002, Manaus had a gross density of 3,980 inhabitants per square kilometer; the municipality occupied an area of 11,458.5 square kilometers with an urban area of 377 square kilometers. It is located on low highlands, on the left margin of the confluence of the Negro and Solimoes rivers where the Amazon River forms, and occupies two river basins, Sao Raimundo and Educandos-Quarenta, with an extension of 100,625 square kilometers and 30,834 square kilometers respectively. The river basin of Educandos-Quarenta, the location of the urban development program discussed here, has 580,000 inhabitants.

This dramatic growth occurred without proper land use planning, effective infrastructure development, or social housing programs, thus leading to a surge in illegal settlements. The informal occupation of urban lands in Manaus has become a "tradition" of sorts (Plano Diretor

Urbano e Ambiental de Manaus, 2002) whether through the occupation of land in the periphery as illegal subdivisions by private agents, the direct invasion of public lands by settlers, or the invasion of infill vacant public lands in central areas. In the case of Manaus, informal settlements in the central area concentrate on the ravines, locally known as *igarapés*, generating acute environmental and urban development problems for the downtown areas, as discussed earlier. Several interrelated factors have generated this outcome. Low-income households did not have formal access to affordable housing solutions, as Brazil's formal housing production and financing systems catered only to middle-income households and formal unionized labor. Hence, the majority of immigrants that came to Manaus had to find housing solutions on their own. Also the city lacked sufficient investments in infrastructure to support this expansion. Land use control instruments could not cope with the fast growth of the last decades. Before 2002, when a new master plan was approved, urban expansion and land development were managed according to a plan dating back to 1975, and by confusing and disarticulated legislation and regulations. The lack of clarity in the land use regulations was compounded by inadequate institutional capacity to enforce them in a rapidly growing city.

Some illegal settlements occupied central areas vulnerable to environmental risks, such as the ravines. The lower part of the basin crossing the central business district (CBD) is densely settled and contains the oldest illegal settlements established in the *igarapés*; these block the ravines that are essential in the natural drainage of the city, with has an average rainfall of 2,139.75 mm, 75% concentrated in the months of December to May. These unplanned settlements generate water pollution and waste accumulation as raw sewage and garbage are thrown directly on the *igarapes*, while also creating rancid odors and loss of aesthetic value in public and open spaces. In the past, this area has recorded the highest annual rates of landslides and illnesses due to lack of sanitation. Most housing in the area lacks potable water, sanitary means of disposing waste waters and regular electricity, often holding clandestine

connections. The frequent flooding of the occupied areas of the *igarapés* is caused by the seasonal fluctuations of the Negro river water table, as well as the clogging of the drainage network and diminishing permeability conditions in the watersheds due to urbanization.

The illegal occupation of the area generates problems of marginality, exclusion and vulnerability for the settlers. Although the inhabitants benefits from living in a central area accessible to employment, infrastructure, and urban services (especially health and education), living conditions are extremely poor. Low quality houses (mostly wooden shacks on stilts) and the dire environmental conditions of the land and water areas they occupy expose these settlers to higher than average health risks. They are also forced to live in an area devoid of open spaces and recreation, as well as inadequate circulation and access to the residential units, making services such as emergency provisions and garbage collection extremely difficult. It is estimated that at least 7,000 families, totaling 36,000 people, live in high-risk conditions, mostly in shacks over water.

To address the issue posed by the *igarapés* and other informal settlements, the Master Plan of Manaus (Plano Diretor Urbano e Ambiental de Manaus, 2002) contemplated the designation of Areas of Special Social Interest (AEIS in its Portuguese acronym), a norm that allows for flexible land subdivision regulations for low-income housing and the phased provision of infrastructure to improve affordability. However, in order to apply these norms to the informal settlements within the *igarapés*, solutions were needed for the environmental problems created by the illegal settlements themselves.

The Urban Development Program for the Igarapés

The urban development program for the area, designed with IADB assistance, adopted an integrated approach to the problem through: (1) the provision of drainage infrastructure and environmental rehabilitation to restore the drainage functions of the *igarapés*, (2) the upgrading of urban and environmental conditions of the CBD, particularly by eliminating the negative environmental externalities prevailing in the *igarapés*, and through the construction of an urban park, and recreational and cultural facilities in the reclaimed lands unsuitable for housing, (3) providing new basic housing in suitable reclaimed lands and infill public land nearby, (4) the promotion of social inclusion and spatial integration for the settlers; and (5) the opportunity to test legal and urban instruments suitable for similar situations in other areas.

The program initially includes the Igarapés of Manaus, Bittencourt and Mestre Chico, but contemplates further stages to assist other areas. Its initial focus is the lower part of the watershed next to the CBD; the improvement of local urban conditions (environmental, sanitation, public spaces, and road infrastructure) would not only benefit the people in the area, but also improve the quality of life of other city inhabitants using the CBD. The program was developed to promote equity, amongst the social groups and within different areas of city, while helping reduce social and spatial exclusion.

The strategy adopted in the *igarapés* emphasizes the need for coordinated action in five fronts: environment; sanitation; social development; urban open spaces and services; and social housing. The main objectives are to: (1) improve the environmental conditions in the *igarapés* by

Figure 1. View of illegal settlement on the waterbed of the Manaus igarape



Figure 2. View of the illegal settlement merged with the CBD to be changed into a park



recuperating the micro and macro drainage systems, organizing the use of the lands subject to frequent flooding, and preserving the recharging areas of the aquifers in the upper parts of the watershed; (2) construct new houses for the residents in the *igarapés* who need to resettle and support improvements in suitable existing homes; (3) provide infrastructure and urban services for the sustainable use of the reclaimed areas and integrate them into the city (potable water, sewerage, roads, electricity, open spaces and cultural and recreational facilities); (4) strengthen community participation to guarantee the social sustainability of the interventions; (5) contribute to the prevention of informal settlements by supporting access to serviced residential land for low-income families and improving the municipality's administrative capacity to develop and enforce land use plans and residential land subdivision regulations.

The program builds on the abundant experience of Brazil in solving the urban, environmental, and social problems emerging from the rapid, uncontrolled expansion of its cities. Moving away from previously failed policies that relocated informal settlers to housing estates in

the periphery, upgrading programs in areas such as Favela-Bairro in Rio de Janeiro and Manaus focus on integrating the informal settlements into the formal structure of the neighboring boroughs; these experiences follow the guidelines set by the United Nations (Habitat, 1995; Global Strategy for Housing for 2000) to improve living conditions for people occupying squatter settlements, giving priority to actions that promote an integrated urbanization in which environmental problems and deficiencies in infrastructures and services are resolved “*in situ*.” Also, upgrading programs include the issuance of property titles to beneficiaries, securing their tenure of the land and houses. However, it must be stressed that this approach condones the informal occupation of land as an initial step in the overall solution to housing problems, which is a high cost solution. In Brazil, the informal occupation of lands is an acute problem fueled by inadequate housing policies and finance systems that fail to meet the low-income population's needs. In the long run, in order to extend access to formal housing solutions to all segments of the population, Brazil's housing policy needs significant improvements.

Social Debt Versus the Environmental Problem - The Urbanistic Solution

The investments financed by the urban development program were designed to take on two urgent tasks: restoring the drainage function of the *igarapés* and improving the housing and social deficiencies of those settlers living on the waterbed of the *igarapés* in the areas they are actually occupying or nearby. By tackling the two problems simultaneously, the program made the execution of infrastructure and the reclamation of the land possible, while also improving living conditions of illegal occupants without affecting their social networks, sources of employment, and access to urban services. A third component of the program took on the long-term issue of preventing the proliferation of informal city settlements.

Program objectives are broader than in traditional drainage improvement or settlement upgrading projects, concentrating on the integrated solution to environmental and social problems posed by the illegal occupation of the *igarapés* to improve the overall urban quality of the CBD. The program converts lands reclaimed in the rehabilitation of the drainage system (requiring a drainage channel narrower than the original *igarapé*) into public spaces in the dense city center. The new parks financed by the program increased the availability of city's green area to 1.7 square meters per inhabitant by adding a park of 59,000 square meters. This park occupies part of the expanded banks of the Manaus and Bittencourt Igarapés and includes 11,000 square meters of new construction for sport and leisure activities, with a local commercial center; kiosks; a stage; a community pavilion; a center for the elderly; lakes, athletic areas; children playgrounds; and other public spaces and accessibility infrastructure (staircases, bridges, etc) designed to facilitate access to the area from the rest of the city. These new facilities mainly benefit the central area and are surrounded by important commercial streets

which service the entire city population; hence they are expected to benefit most of the urban population as well as the residents of the surrounding areas.

The program also contemplates investments in improvements and additions to the local street network, with three objectives: to complete the street grid interrupted by the *igarapés* and other natural features; to construct local streets, according to the standards of the AEIS, which provide access to residential areas; and to build arterial streets and avenues in the project area, servicing the whole city and designed based on a citywide traffic study.

Those occupants of the *igarapés* that needed to be resettled were allowed to choose among several options, each costing approximately US\$ 10,000. These options included (1) a small new house in the central area, (2) a basic house with a large plot of land in the periphery, (3) an upfront cash subsidy to buy a house in the local housing market and (4) a cash handout for those who wanted to leave the city to return to their settlement of origin. Intense community participation accompanied the program design process to discuss the options with the community and assist them in making their choices. All the potential beneficiaries participated in the process and chose an option. The majority decided to stay in the area, opting for option 1 listed above. The scarcity of land in the downtown area forced the adoption of a medium to high-density solutions for the housing solutions (677 inhabitants per hectare, within the range of the net density of downtown Manaus of 691 inhabitants per hectare). The new houses were built in compact, three story structures in approximately 21,000 square meters of land available in urban infill areas within the existing street grid near the CBD. The government owns 74% of the land, while the

remainder is privately owned and was acquired by eminent domain. The availability of public land in the city center is due to the fortunate fact that originally most of the land was owned by the government and that the private demand for land in Manaus concentrated on the lots facing the streets, leaving portions of the large, central

city blocks unsold. In the current phase, the housing project will construct a total of 1,637 residential units, arranged in building blocks of a narrow frontage that minimize the footprint of the houses while maximizing the use of the land.

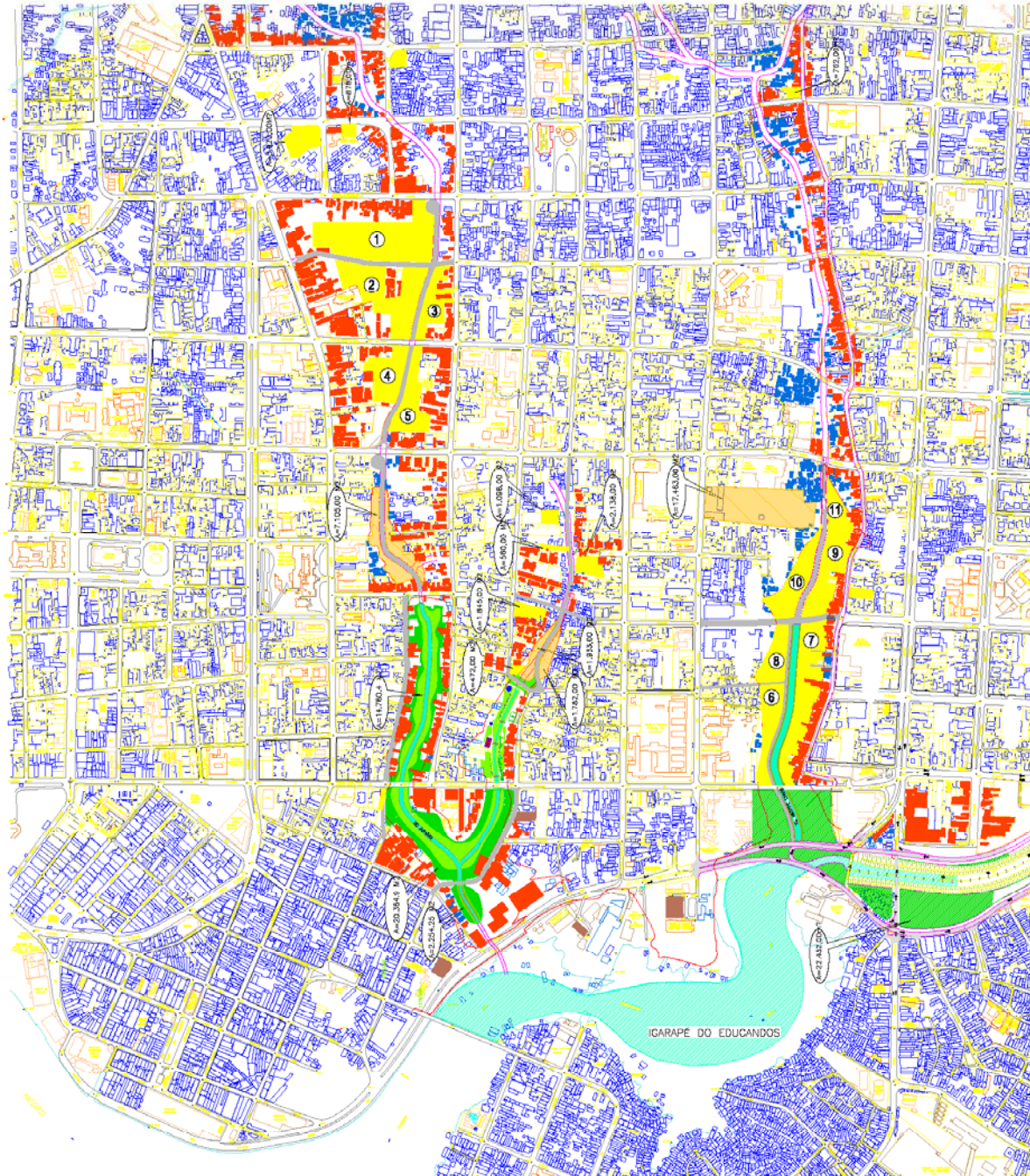


Figure 3. The project area – the Mestre Chico, Educandos, Bittencourt and Manaus Igarapes

Table 1: Land Use Data

Urban Parameters (Mestre Chico, Manaus and Bittencourt)	Total
Residential Units (number)	1,637
Built Area (square meters)	100,444
Maximum Built Footprint (square meters)	35,307
Habitants (number)	6,875
Available Land (square meters)	101,270
Green Area (square meters)	46,068
Circulation Area (square meters)	19,984
Percentage of Green Area	47 %
Percentage of Circulation Area	20 %
Occupation Rate (%)	78 %
Floor to Area Ratio	1,05
Net Density (habitants per hectare)	678

This typology adequately fills the existing available interstitial plots, allowing for high density while still building single-family homes, and creates a strong urban image by merging building elements and urban space, expressing unity in a language with spatial attributes typical of central residential districts. It utilizes the traditional urban morphological elements of Brazilian cities: the house; the plot; the street; the block; the “*vila*” (narrow alley); the square; the “*largo*” (small enclosed square); and the “*escadarias*” (stairways). Building elements are assembled appropriately, with public spaces structured by groups of residential blocks, emphasizing the neighborhood scale and collective nature of public spaces. This design option facilitates social control of public spaces, reducing the incidence of street violence and vandalism (Rau 2007).

The housing typology adopted for the residential units, based on the following premises, is in accordance with Brazilian and international best practices and complies with the parameters set by local regulations:

1. Develops a solution based on individual single-family homes that eliminates areas held in common by the beneficiaries, thus reducing the long-term building deterioration risks posed by the difficulties usually encountered by communities to maintain areas held in condominium. Single-family houses are placed on top of one another in order to maximize the use of the land.
2. Allows layout variation to cater to specific family requirements and the topography of the site, resulting in two different layouts derived from the arrangement of identical interior spaces (with the same configuration and total area). The design uses two modules of 3.30 m x 8.10 m, one for the living room, bathroom, and kitchen and another for the bedrooms. The modules are arranged both side-by-side, forming single-floor units, or stacked to form two-floor units (common in downtown Manaus), allowing all homes to have direct access from the street. The housing units are combined according to the topography of the site, either individual two-floor units or blocks of ground floor houses with two-floor units on top.

3. Independent of the layout, all houses have 50 square meters of net floor area, a common standard for social housing (7 square meters per inhabitant for average family sizes of 4.5 members). The floor space of the homes is 25% above the size of low income housing as required by the local legislation.
4. The design allows for phased expansion and upgrading by the occupants. As the beneficiaries receive the house at no cost, it is imperative to be cost conscious in fulfilling the project requirements; this approach leads to the construction of basic housing units that the beneficiaries are expected to later expand and improve with their own resources. A cost efficiency study indicated that the best solution was to deliver the units with a living room, kitchen, bathroom, two bedrooms, and two verandas. These standards allow for adequate privacy when sharing walls between bedrooms and environmental comfort, with cross ventilation provided by the verandas, Venetian doors, and adequate floor to ceiling height.

The government of the State of Amazonia has

invested the equivalent of 200 million US dollars in this urban program. The Municipality of Manaus is responsible for the operation and maintenance of the infrastructures and public spaces financed with these funds. A socio economic cost-benefit analysis was carried out to determine the best combination of investments and the most efficient solution to the drainage, sanitation, road improvement, and resettlement problems. In addition, a social and economic evaluation, based on an analysis of scenarios with and without the program, was made for each of the investments in the watershed that includes the igarapés of Manaus, Bittencourt, and Mestre Chico.

The benefits were estimated based on contingent valuation surveys to calculate the willingness to pay (WTP) for the investments on the part of the citizens of Manaus. WTP, computed for the direct program beneficiaries, as well as the rest of the city, is considered an accurate proxy of the value assigned by beneficiaries to the improvements financed by the program. The drainage works were subjected to an analysis that helped determine the most cost effective

Figure 4. Birds eye view of the project



alternatives, including the type of works (galleries and open culverts versus open culverts only) and surfacing (concrete versus gabion), as well as the optimum recurrence interval of floods prevented by the works. The alternatives of galleries and open culverts with concrete surfacing were chosen on the basis of superior environmental benefits and beneficiary community's preferences. The optimum recurrence interval was determined to be 25 years, taking into account the probability of 10, 25, 50, and 100-year floods.

The costs considered were the investments and the operation and maintenance costs assessed at efficiency prices. Opportunity costs of land used for public housing and works were also considered, although some is owned by the state. The benefits accruing from drainage and road improvements include shorter travel time and cost savings, expected appreciation of real estate properties and prevented damage. The benefits of resettlement were estimated based upon the differential between the rental value of the housing solutions and current rental prices.

The benefits of sewer and water services, as well as public spaces, were estimated based on the WTP values.

The analysis proved the economic feasibility of the program, with an economic internal rate of return (EIRR) far above 12%, the rate used by international financial institutions as cutting point for economically feasible projects. The sensitivity analysis demonstrated robust results in the feasibility study, up to a 25% increase in costs or up to 30% reduction in expected benefits, except for investments in drainage and resettlement projects, where only a 5% cost increase, or a 10% reduction in benefits, would still yield an EIRR above the cutting point. Given the reduced margin for cost overruns drawn from this last result, the need for an efficient implementation process is pressing.

Prerventing the Proliferation of Informal Settlements: Opportunities In Manaus for Promoting Formal Urban Development

The new Master Urban and Environmental Plan, prepared by IBAM in 2001 and approved in 2002 by the Municipal Council, contemplates the creation of Areas of Special Social Interest (AEIS), as set by the *Estatuto da Cidade* (the Brazilian legislation for urban development), as well as conditions for the designation of specific areas for social housing. These include, among other measures, allowing the gradual construction of infrastructures, smaller lot sizes, and higher densities. The efficient use of this legislation not only allows the regularization of informal settlements, but also more importantly, promotes the expansion of affordable residential land for low-income households, a key measure to prevent the proliferation of informal settlements.

For these reasons, the Igarapés Program contains resources to finance the strengthening of the Municipal Institute for Urban Planning (IMPLURB) the administrative and technical entity responsible for land use planning and regulation. The Institute must be capable of devising and implementing a sustainable strategy of slum prevention that goes beyond punctual solutions to emergency situations. In this strategy, priority should be given to an integrated intervention of control and prevention of informal settlements with the following goals:

(1) prevent the occupation of recovered land that is designated for green space; (2) promote the revitalization of surrounding neighborhoods that benefit from the program; (3) prevent the spread of informal settlements in the city and the proliferation of land uses that fail to comply with the master plan. In order to develop the strategy the IMPLURB must: (1) identify and declare the Areas of Special Social Interest (AEIS) complying with the master plan; (2) define specific guidelines and rules for the AEIS; (3) identify public land suitable for low income housing; (4) develop low income housing programs, to include, in particular, the provision of minimally serviced land for phased housing construction; (5) define priorities to regularize the existing informal settlements, designing programs and finding sources of financing.

The financing for these activities within the urban program will cover three years, including specialized technical assistance, materials, and equipment to accomplish the following: update information on the informal settlements; diagnose the settlements in detail and then identify suitable legal and urban strategies to deal with the problem; and develop training programs.

Final Remarks

The Igarapés Program shows how the solution of a spatially confined social and environmental problem can have several urban ramifications, which creates complexities while also generating benefits for the entire city. To seize this opportunity it is necessary to tackle simultaneously the most pressing issues, such as environmental decay and social disintegration of the illegal settlements in the *igarapés*, as well as deal directly with the root causes of their deteriorated conditions and solve the infrastructure and public space deficiencies that impact their integration into the city. Furthermore, it is necessary to capture all urban development opportunities offered by the program, in this case, supplying open public space and sports and entertainment facilities for the city. Capturing these opportunities requires a wide multisector vision of the problem and the insight it offers beyond the conceptual confines of a single sector view or the domination of a single profession in the conceptualization and operation design.

This approach prompts complex, expensive projects requiring the coordinated execution in time and space of multisector interventions, as well as significant resources. Securing the public resources requires significant political

commitment on the part of the elected officials, a commitment that can be supported by technical studies showing the social and economic benefits of the investments. As discussed in this work, the technical and socio-economic rationale for investing public resources in this type of programs is solid as the economic benefits are larger than the costs mostly due to their wide urban impacts. In a well-designed urban program, the diversity of positive outcomes outweighs the expenses, thus strengthening public support for the program. As expenses benefiting settlers are not recuperated, one important outcome of the economic evaluation is to establish an investment ceiling for the program so that investment costs do not exceed the overall benefits.

The prevention of new informal settlements is critical to the sustainability of the solutions financed by these programs. This requires an adequate institutional and legal framework for land development regulation that facilitates the production of affordable land for residential uses, thus reducing the illegal occupation of land and adding an important institutional development dimension to the urban program.

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