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The Land Market Assessment

A New Tool for Urban Management

David E. Dowall

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The Land Market Assessment

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David E. Dowall

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Deputy Director
Division for Global
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United Nations Development
Programme

Chief
Technical Co-operation
Division
United Nations Centre
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Chief
Urban Development Division
Transport, Water, and Urban
Development Department
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The Urban Management Programme (UMP) represents a major approach by the United Nations family of organizations, together with external support agencies (ESAs), to strengthen the contribution that cities and towns in developing countries make toward economic growth, social development, and the alleviation of poverty. The program seeks to develop and promote appropriate policies and tools for municipal finance and administration, land management, infrastructure management, environmental management, and poverty alleviation. Through a capacity building component, the UMP plans to establish an effective partnership with national, regional, and global networks and ESAs in applied research, dissemination of information, and experiences of best practices and promising options.

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FOREWORD

This paper has been prepared for the Land Management component of the joint UNDP/UNCHS/World Bank, Urban Management Program (UMP). The UMP represents a major approach by the UN family of organizations, together with external support agencies (ESAs), to strengthen the contribution that cities and towns in developing countries make toward economic growth, social development, and the alleviation of poverty. The program seeks to develop and promote appropriate policies and tools for municipal finance and administration, land management, infrastructure management, and environmental management. Through a capacity building component, the UMP plans to establish an effective partnership with national, regional, and global networks and ESAs in applied research, dissemination of information, and experiences of best practices and promising options.

This report was the first of a series of management tools produced by the UMP land management component. The series covers a wide range of topics, including land information management, land registration, land development policies, standards for land regulation, and urban spatial planning. The information in these reports contributes to the preparation of detailed operational guidelines to help policy makers and technical staff in developing countries carry out appropriate land development policies and techniques, especially at the city and municipal level of government.

Phase 2 of the UMP (1992-96) is concerned with capacity building at both the country and regional levels and with facilitating national and municipal dialogue on policy and program options. It emphasizes a participatory structure that draws on the strengths of developing country experts and expedites the dissemination of that expertise at the local, national, regional, and global levels.

The main goal of the UMP in Phase 2 is to build the capacity for infrastructure management, municipal finance and administration, land management, urban environmental management, and poverty alleviation by means of three interactive processes:

- **City and country consultations.** The UMP brings together national and local authorities, private-sector networks, community representatives, and other actors to discuss specific problems within the UMP's subject areas and to propose reasoned solutions.

- **Regional panels and technical cooperation.** To ensure sustained and effective support for the activities to follow country consultations, the UMP is establishing regional offices, each headed by a regional coordinator, in Kuala Lumpur for the Asia and Pacific region, in Accra for Africa, in Quito for Latin America and the Caribbean, and in Cairo for the Arab States. From 1993 to 1996 the UMP will gradually build up regional panels of urban management expertise for each of the program's five areas of concern, which will provide the structure needed to institutionalize the UMP's capacity-building objective over the long term. Developing countries will be able to draw on this pool of expertise for technical advice on a sustained basis.

- **Global support and synthesis.** Nucleus teams in Nairobi and Washington, D.C., support the regional panels and national institutions by synthesizing lessons learned, conducting state-of-the-art research, identifying best practices, and disseminating program-related materials. The present paper is part of a series of management tools produced by the UMP.

Mark Hildebrand
Chief
Technical Cooperation Division
United Nations Centre for
Human Settlements (HABITAT)

Louis Y. Pouliquen
Former Director
Transportation, Water, and
Urban Development Division

ABSTRACT

Over the next 15 to 20 years, the urban areas of developing countries are expected to double in size. The rate at which urbanization is proceeding and pushing up the demand for residential, industrial, commercial, and community land has no precedent even in the history of developed countries. Indeed, land is the essential ingredient in this process, as in all urban growth. The problem for most developing countries is not a shortage of developable land, but the ineffective and often outdated mechanisms they use to ensure an adequate supply of suitable land for urban growth.

But it is no easy matter to develop land policies that would address this problem, particularly because of the complex role that land plays in society—not only as an avenue of development, but also as a commercial good and a natural birthright. Consequently, every land decision is surrounded by an array of institutional, administrative, technical, financial, cultural, environmental, and political issues.

Despite the complexities of land development, its potential benefits are enormous. These may be measured by the lower cost of industrial and commercial development, higher standards of living for residents, and the more efficient provision of urban services, not to mention the more intangible benefits, such as individual peace of mind, cultural satisfaction, and social stability. Therefore, it is important for developing countries to understand their land issues and learn how to deal with them so that these complexities can be overcome.

This report is part of a planned series on land issues being undertaken jointly by UNCHS (Habitat) and the World Bank. The series will cover a wide range of topics, including land information management, land registration, land development policies, standards for land regulation, and urban spatial planning. The information in these reports will be used to prepare detailed operational guidelines to help policymakers and technical staff in developing countries carry out appropriate land development policies and techniques, especially at the city and municipal level of government.

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EXECUTIVE SUMMARY

i. Under the mounting pressures of urban development, cities of the developing world are in vital need of accurate and systematic information about their land markets. Such information is essential to a host of rational economic decisions in both public and private programs. Without it, cities are unable to plan and develop housing and residential plots or the urban infrastructure needed to cope with their fast-growing populations. A tool that has been developed to provide such information is the land market assessment (LMA).

LMA Objectives and Procedures

ii. The land market assessment provides accurate and up-to-date data on land prices, the supply of serviced land, and present and projected land projects. In other words, it provides a concrete foundation for defining appropriate strategies for improving land market performance. LMAs can be used to support four broad activities: 1) governmental planning and decisionmaking, 2) the evaluation of government policies and actions, 3) private sector investment and development decisions, and 4) the structuring of land-based taxation systems.

iii. Land management assessments are carried out by a team of professionals that usually includes a land economist familiar with market survey techniques; a land planner experienced in interpreting aerial photographic and satellite images; a statistician with experience in computing and data base management; data analysts for coding, data entry, and fieldwork; a draftsperson; and a group of surveyors. A computer system is used to develop the data base and conduct statistical analyses.

iv. The time required to prepare a land market assessment depends on the size of the city, the level of detail of analysis, and the number of professional staff assigned to the project. If the city is starting from scratch, it will take approximately one to two years to complete a land market assessment, although most of the basic data would have been collected somewhat earlier.

v. The first step in a land and housing market assessment is to review available reports and data sources that have been compiled by public and private agencies on land and housing conditions in the metropolitan area. In addition, meetings will be held with government officials and private real estate developers, brokers, and bankers. These preliminary efforts will yield the information needed to define the size and shape of the study area, the types of data to be collected and analyzed, and the specific policy questions to be addressed.

vi. Next, changes in housing stock or land use are tabulated from aerial photographs and satellite images. Housing types, including both informal and formal housing, are then tabulated in detail, differentiating slums and squatter settlements, land subdivisions, formal private housing developments, and public housing projects. Nonresidential uses, including industrial areas, commercial districts, and institutional uses are also recorded.

vii. Detailed information about the price and characteristics of new housing units offered in the market is then obtained to establish the current supply of housing on the market, the affordability of the current supply of housing relative to current household incomes in the metropolitan area,

and the types and locations of units selling most quickly. Households can be surveyed to obtain even more refined details.

viii. The next step is to disseminate the information obtained from the assessment. This can be accomplished through seminars, reports, and briefings to public and private sector professionals. The information will be of particular concern to officials in local, regional, and national governments who are responsible for urban land development and planning, programming and development of housing and residential plots, and the development and financing of urban infrastructure. It will also be of interest to housing and commercial developers, bankers lending on urban development projects, professional planners and advisers working for international donor agencies, and researchers working on land and shelter issues in developing countries.

Application of LMAs

ix. The land price data base developed by the LMA can be used to gauge the impact of government policies, investments, and actions. Such assessments fall into two types: ex post measurements of the effects of local public actions, and predictions of land market impacts resulting from future government actions. The ex post method in turn can be divided into measurements that employ econometric models and those that use case study comparisons to assess the effects of public investments. The econometric approach relies on regression models to isolate the net impact of a project on land values. Methods for estimating the effects are based on either time-series or cross-sectional data. The time-series method begins by defining the area from which historical land value data is collected. Usually, the analyst identifies some area in which land parcels are assumed to have benefited or been affected by a project. In the case study comparison, two areas are selected for analysis. One is located adjacent to the project and the other is a "control" case distant from the project, but similar in most other respects.

x. It is considerably more difficult to predict the likely impacts of public actions on land values. Two approaches are suggested, both of which require substantial information about land markets. The first method applies the estimates of past impact assessments to future projects or regulations. Although crude, this approach provides planners and finance specialists with some estimates. The second approach, which applies only to land use and development regulations, estimates the potential impact of a change in zoning or building controls on land values.

xi. LMA information is also used in taxation and fiscal planning. Many central governments, hard-pressed to fund the construction of infrastructure to support land development, are beginning to levy taxes, fees, and user charges on property owners. But to efficiently impose these charges it is necessary to measure the costs and benefits of infrastructure projects—particularly changes in land values.

xii. LMA information also has many applications in private sector development. In the case of residential development, most developers attempt to estimate the demand for housing units and compare it with supply. The land market assessment of the location and characteristics of projects can be used by developers to gauge the current level of the supply of projects by geographic area.

Private developers as well as public developers can then compare then current level of supply with demand to determine whether additional projects are warranted.

xiii. In sum, the land an dhousing market assessment is an essential first step toward making local land and housing markets more efficient. The information base generated by the assessment can be used to gauge market performance, identify future needs for infrastructure, assess housing affordability and assess the impacts of public policies and actions.

I. THE URBAN LAND CRISIS

1.1 Cities throughout the developing world are facing serious challenges as they attempt to cope with unprecedented population growth. In the struggle to respond to development pressures, their local institutions, both public and private, are being overwhelmed by a multitude of concerns: Will there be enough land to support urban development? Do all income groups have access to land for housing, commercial, and industrial activities? Is infrastructure expanding fast enough to support urban development, and are services being deployed in areas where needs are the greatest? How can the government finance the construction of critical infrastructure? Is the land market operating efficiently? How can the efficiency of the land market be increased? Will the prevailing patterns of population and housing density continue into the future, or are there alternatives to urban development that require less land? How can agricultural lands surrounding cities be preserved without driving the price of land beyond the reach of low- and middle-income households? Should the government attempt to aggressively control land development?

1.2 Population and economic growth does not take place in thin air. It requires land, and lots of it. The rate of land conversion to urban use for Asian cities, for example, is enormous (see Table 1.1). In Bangkok between 1974 and 1984, the rate was 32 square kilometers of agricultural land per year (Dowall, 1989a); in Karachi, 24 square kilometers per year (Dowall, 1989b); and in Bangalore, a much smaller city, about 13 square kilometers per year (Srinivas, 1989). Even in remote Kathmandu, the pace of land conversion was so rapid that the residential land area of the city doubled between 1971 and 1981 (Doebele, 1987).

1.3 Against the backdrop of these growth trends, policymakers are beginning to recognize that land-use policy—including infrastructure development, shelter provision, and land-use and environmental planning—is an important facet of national economic development planning (Menezes, 1988). Urban land-use policy is no longer a luxury best left to wealthy nations. Developing countries are experiencing urban growth on a massive scale that calls for bold action from both the public and private sector. Policymakers and private developers need to work together to solve land development problems.

Table 1–1. Annual urban land conversion, selected cities

City	Hectares	Date
Ahmadabad	565	1980
Bangalore	1,311	1983–2001
Bangkok	3,200	1974–1984
Jakarta	2,300	1979
Karachi	2,400	1971–1985
Bogota	2,325	1981
Mexico City	4,826	1970

Sources: Doebele (1987), Dowall (1989a, b), and Srinivas (1989)

1.4 Urban land problems are too complex and wide ranging to classify neatly, but they may be divided into five broad categories: 1) lack of enough land at the right price and in the right location; 2) high cost and low affordability of land and housing; 3) ineffective government programs and actions in the area of urban development 4) private sector resistance to government land regulations; and 5) environmental resource constraints to land development.

Not Enough Land in the Right Location at the Right Price

1.5 The urban land market operates to allocate land to buyers. It does so through adjustments to prices, the quantities supplied, and the quantities demanded. In many countries, policymakers are concerned that the urban land markets are not operating efficiently and that land is in short supply, land prices are high, or combinations of both.

1.6 One obstacle to the development of sound urban land policies is the fact that land markets are poorly understood, which is due in part to their complexity and in part to the lack of sufficient performance data. This lack of information often stands in the way of rational economic behavior and leads to inappropriate government policies and investment programs (see for example, Mayo, Malpezzi, and Gross, 1986).

1.7 Unlike other markets, where supply and demand determine the dynamics of market operation, land markets are not driven by perfectly competitive forces. Land is not homogeneous; each parcel is unique, having a particular set of locational, physical, and neighborhood characteristics. Actors in the land market are diverse and have divergent objectives, expectations, and strategies. In some cases, only a few buyers and sellers may participate in particular land markets, and an individual land seller or buyer can greatly influence market outcomes. When there are barriers to entry—as, for example, when all land is owned by the state or by a tribe—less than normal profits and rents can be earned. In addition, land market attributes, such as ease of entry and exit, are closely controlled by local and national government policies and by public decisions about infrastructure investment, which is not the case in other markets.

1.8 A fundamental difference between land and other commodities is that land is used exclusively for producing some other product. The demand for land is therefore derived from the demand for the product or service produced on the land. The demand for residential land is derived from the demand for housing; the demand for housing, in turn, is determined by demographic and economic factors such as the rate and level of household formation, household income, savings, and interest rates. The demand for land is also affected by the number of people wanting to hold land as an investment. These factors, also apply to the demand for commercial and industrial land.

1.9 On the supply side, the quantity and price of land depends on the spatial pattern of infrastructure, the physical developability of land, the willingness of current landowners to sell, and government-imposed limitations on how land may be used. The level of infrastructure—such as roads, municipal water, and sewage treatment trunk lines—by and large determines whether land can be developed (although this is not the case in informal settlements), to what extent, and in what physical direction. In rapidly growing cities, the infrastructure capacity is frequently inadequate and therefore impedes land development and helps inflate land prices.

Box 1. The Kathmandu Valley

The Kathmandu Valley provides a good example of how both natural topography and land development controls limit the available supply of land for future urban expansion. The Kathmandu Valley, nestled in the Himalayas, is one of the most agriculturally productive areas in Nepal. In 1981 it produced about 97 percent of the country's food grain. Valuable agricultural land in the valley is being converted to urban uses as the city of Kathmandu expands. At current urbanization rates, all Class I and II farmlands will be converted to urban use by 2020, and Nepal will become dependent on foreign imports of food. In response to these ominous trends, the government of Nepal recently embarked on a strict program to limit urban development in agricultural areas (PADCO, 1986).

1.10 A frequently mentioned but rarely proven allegation about the cause of land scarcity is speculation and land hoarding. Many public officials claim that land is purchased by speculators and held off the market in anticipation of substantial price appreciation. In many countries with high inflation, land is routinely viewed as being an excellent store of value (Walters, 1983), especially if there are no alternative financial assets. The Bangkok land market is a case in point: in 1990 the price of suburban land there increased by more than 90 percent, making it an excellent investment.

1.11 Topography can also limit land supply. Many of the major cities of the developing world are located in areas surrounded by steep slopes, marshes, or water. In other cases, the systems of rural land tenure severely limit urban development in fringe areas. The Kathmandu Valley stands as a vivid example of how topography and government regulations limit land supply (see Box 1).

1.12 Zoning and other government land-use controls such as greenbelt policies can also affect land markets. Zoning, by limiting building density or the uses allowed in certain areas, limits the effective supply of buildable land. And although establishing a greenbelt may offer certain public amenities, policymakers must recognize that this can create an adverse impact on urban land supply and prices (Dowall, 1984).

1.13 In the absence of local controls over the use of land, the market operates to allocate land to users on the basis of price. Those potential users capable of paying the highest price for a site will occupy it.

1.14 Competition among land users sets prices and determines the pattern of land-use activities in an urban area. As the pressure for urban development increases, rural and agricultural land on the edges of cities is developed. The process of converting farmland to urban uses is triggered when the demand for peripheral land pushes the price bids beyond the value of agricultural land. As Brown and Roberts (1978) have pointed out, the process of agricultural land conversion is complex and, contrary to popular belief, involves many separate land markets stretching out from the current limit of development to areas that will not be converted to urban uses for at least twenty years.

1.15 Another, much different process of land conversion occurs in built-up areas. Competition in urban land markets often causes land patterns to shift from one use to another. If a particular activity is expanding and needs more space, land already in another use may be converted to the new activity. As long as there is no restriction on such conversions, land uses in urban areas can flexibly

Box 2. Redevelopment Problems in China

Redevelopment projects in Guangzhou and Tianjin illustrate the financial difficulties of carrying out housing redevelopment projects and the resulting bias of real estate development corporations against built-up urban areas.

Two structural problems conspire against redevelopment projects in China: ironclad property rights of the existing residents and limitations on development density. In most cases (Beijing is the exception, as explained below), the rights of existing residents are protected to the extent that they must be provided with replacement units of at least the same size and be allowed to pay the same rents after redevelopment as before. It is not surprising that in Guangzhou and Tianjin more than 95 percent of the prior residents elect to return to the site.

In virtually all cases, the rents are so low that they do not even cover maintenance costs, let alone capital cost recovery. In such cases, the replacement units generate no cash flow. Thus any redevelopment project stands or falls on its ability to provide additional marketable housing units that can be sold at high enough prices to carry the entire cost of the redevelopment project. It might be possible to build profitable redevelopment projects if the new project could be extremely dense, but unfortunately planning standards and the general notion that "densities are too high" in the central cities usually makes it impossible for FARs to be increased to Hong Kong or Seoul levels. The net effect of these density constraints is that most redevelopment projects can build four units for every three replaced. This means that the one marketable unit must finance the cost of the three replacement units. This is extremely difficult, if not impossible.

In Guangzhou, land acquisition costs in old developed areas are approximately 33 percent higher than in "greenfield" areas. In Tianjin, the differences are greater since the prior residents usually receive even more usable space than they previously occupied.

In contrast, the Beijing Municipality recognizes the high costs of redevelopment, especially if all prior residents are provided with replacement units on site. Accordingly, it has developed a promising lower-cost approach to redevelopment. The municipality's new procedure is based on a series of incentives to encourage prior redevelopment area residents to move to new suburban housing estates. So far, the approach is working—between 70 and 80 percent of the prior residents elect to return to the site. This reduction in required replacement housing improves the financial feasibility of redevelopment projects by increasing the portion of marketable units.

respond to shifting demands. Virtually all growing cities with market economies are going through this transformation. Redeveloping older areas is more difficult for cities in centrally planned economies, such as China, mainly because of the nature of property rights, the structure of the institutions that oversee real estate development, and the way projects are financed (see Box 2).

1.16 Since it takes time for any land market to adjust, most of the short-term shifts in demand or supply result in price changes. Depending on the price elasticity of demand for land, increases in the price of land will reduce the demand for it. In the United States, for example, the price elasticity of demand for residential lots is inelastic, meaning that increases in demand will push up land prices if supply is fixed (Witte, 1979; Sirmans and Redman, 1979). This suggests that the inflationary effects of poor land titling and registration, lagging infrastructure deployment, government regulations, and physical constraints that limit the supply of land can be considerable. In areas with high demand and a limited choice of housing, price-inelastic demand can inflate land prices to a greater degree than in softer markets or those offering a wider set of alternative housing locations.

1.17 The efficiency and equity of urban land conversion depend on a variety of factors, such as land tenure, land records, government regulations, the availability of infrastructure, financing

sources, land prices, and the level of sophistication of private and public land development institutions. Take the case of Karachi and Bangkok. Karachi is experiencing an acute shortage of land because the Karachi Development Authority (KDA) grossly underprices residential plots and thus limits its financial capacity to fund infrastructure development.

1.18 The low pricing also increases the speculative demand for plots, thwarting the access of low-income households to plots. In the case of Bangkok, the land market is working extremely well, quickly responding to demand pressures. The success of the Bangkok land market is due largely to the absence of strict planning and development controls and an aggressive private sector.

High Cost and Low Affordability of Land and Housing

1.19 The causes of rapidly escalating land and housing prices are manifold, but they essentially stem from an excess demand for land and housing relative to supply. In Karachi, for example, where the land development, pricing, and allocation policies of the government have severely constrained the supply of land for housing, the prices of housing increased by an average of 30 percent per year between 1985 and 1987. The prices of large residential plots increased by 22 percent per year over the same period (Dowall, 1989b). In real terms, after adjusting for price inflation, land prices have increased by more than 11 percent per year.

1.20 In most cities of developing countries, policymakers are greatly concerned with rising land and housing prices. In Seoul, disenfranchised low-and moderate-income groups have been demonstrating for political action to ease housing pressures. In Thailand, Indonesia, India, and Malaysia, land and housing price inflation and housing affordability have become a critical policy issue.

Seoul

1.21 The precipitous increase in land and housing prices in Seoul is challenging the stability of the Roh government. Land prices in metropolitan Seoul are increasing at an annual rate of more than 25 percent. According to a recent study by the Korean Research Institute for Human Settlements, the annual increase in land values in 1988 (88 trillion won) exceeded the annual wage income for all of the country's workers (Clifford, 1989).

1.22 The rapid increase in land costs is due to the combined impact of continued massive migration to the capital and a series of governmental policies regarding property taxation, housing development, and planning. In the 1980s, in a move to decentralize economic activities out of Seoul, the government curtailed the suburban development of new towns, thereby limiting the opportunities for large-scale residential development. Much of the blame for rapid land inflation has been put on speculators. Current capital gains and property taxation rules limit capital gains taxes until the time of sale, and annual property taxes are based on assessed values, which represent about 10 percent of market values. Both tax practices encourage the withholding of land from the market. A final culprit is the government's well-intentioned program of limiting the prices of new apartments to a low US$597 per square meter. These price controls, together with tax polices, make it inexpensive to hold land and therefore have encouraged developers to "warehouse" their land rather than build new apartments (Clifford, 1989).

Thailand

1.23 Thailand's finance minister has recently pushed for policies that would tax assets in order to cut down on land speculation. Under the tremendous demand pressures of recent years, land prices have skyrocketed, increasing by more than 90 percent per year in Bangkok. Although the housing market has been performing well under these pressures, the prices of single-family and townhouse units have increased enormously, causing an affordability problem. In response, developers of low- and moderate-price housing have shifted their strategy and have started building high-rise condominiums. In 1990 approximately 15 percent of housing construction activity (11,500 units) consisted of low- and moderate-cost condominiums (ranging from 182,000 to 360,000 baht, which is roughly two to four times the median household income). In 1991 20,000 condos in this cost range are expected to be built.

Jakarta

1.24 According to a recent study of land prices in Jakarta, real prices of land increased by 20 percent between 1987 and 1989. That study, the first of its kind in Jakarta, surveyed land prices for parcels in DKI according to whether they have infrastructure and clear title (Dowall and Leaf, 1991). Price inflation was found to be highest for parcels lacking clear title and in areas without infrastructure, averaging more than 37 percent per year in real terms. In developed areas with clear titles, land prices have increased less sharply, averaging only 10 to 15 percent between 1988 and 1989.

1.25 In recent years, government officials and private sector developers have become increasingly concerned about the difficulty of acquiring land for suburban housing projects. It now takes developers between 2.5 and 3 years to obtain development permission (Hoffman, 1989), but the current process of land acquisition is equally time-consuming for the government. Because of these delays, the market cannot respond quickly enough to the increasing demand for housing, and housing prices in DKI continue to rise. One possible response would be guided land development, where the public sector provides infrastructure to fringe land to facilitate private sector development.

India

1.26 Strong population growth, urban migration, and the limited deployment of infrastructure have sent land prices spiraling in India. In Bangalore, for example, a medium-sized city of about 4.5 million that is growing at 8 percent per year, residential land prices have increased by approximately 12 percent per year, far outstripping the increase in the incomes of residents. As a result, housing affordability in the city has declined. Because this pattern is common in other Indian cities, the Urban Land Ceiling Act was passed in 1976 in an attempt to stop land speculation and land inflation. While well-intentioned, this act has caused substantial problems—significant reductions in the supply of land for residential development, the creation of a vast black market for real estate, and an overall worsening of housing affordability in India's major urban areas (Acharya, 1989). These and other ancillary concerns prompted the establishment of the Task Force on Housing and Urban Development. This group has proposed a land-price monitoring system for India, and the data collected will be used to gauge trends in land prices in cities across the nation, thereby enabling policy analysts to assess the impacts of a myriad of government policies and actions on the urban land market (Center for Research, Planning and Action, 1990).

1.27 There has been some successful experimentation with progressive land development, where infrastructure is added incrementally. An informal subdivision project consisting of 1,800 plots in a village near Delhi was recently completed. Plot prices were one-eighth to one-tenth the prices found in formal sector subdivisions around Delhi. Such examples of successful informal sector development need to be cataloged and assessed for possible replication in other settings.

Malaysia

1.28 A recent appraisal by the World Bank concluded that newly built housing prices in Malaysia increased by an annual rate of 18.9 percent between 1972 and 1982, a rate about triple the overall increase in consumer prices (World Bank, 1989). The reason for the rise in housing prices appears to have been the combination of high government-imposed housing standards, the complex and time-consuming housing project approval procedures, the sluggish response of the housing industry increases in housing prices, and high demand for housing. For example, it takes between five and eight years to obtain all the necessary permits from 15 to 20 government agencies for subdivision approval. In Thailand, in sharp contrast, it takes about five months to secure subdivision approval from five government agencies. The Bank concluded that the most critical policy issue was the weak response of housing supply to price increases.

Ineffective Government Urban Land Development Programs

1.29 A careful examination of the actions that national and local governments have taken to improve urban land development will reveal a depressing record of failure and mismanagement in most countries. Although there are pockets of success, they are exceptions. Most problems fall under one of three headings: poor conceptualization of problems, such as failing to consider market forces; poor coordination between government agencies and between government agencies and private organizations, both formal and informal; and not enough funds to undertake the appropriate execution.

Poor conceptualization of problems

1.30 As explained in a recent report by the United Nations, most land development policies are less then effective (UNCHS, 1989). Too often, municipal or national land development policies

Box 3. The Effects of India's Urban Land Ceiling Act

The Urban Land Ceiling Act of 1976 has been applied in 70 cities with populations in excess of 200,000. It is widely acknowledged that the act has failed to achieve its principal objectives of redistributing land, limiting land speculation, and giving the poor greater access to land for housing.

The overall effects of the act have been enormous: thousands of hectares of land have been frozen in litigation; small-scale real estate development has been made more difficult as more complex and costly regulations have been added; growth has leapfrogged to outlying areas, aggravating the already massive loss of agricultural land. These problems have arisen because the act has further distorted the operation of urban land markets. The only way to improve urban land markets and increase their responsiveness to demand pressures is to deregulate them—that is to remove regulatory impediments to housing and land development. Policymakers in India ten to favor retaining the act, but this reflects a poor conceptualization of the problems of efficient land market operation (PADCO, 1991).

are the products of the political process, reflecting the aspirations and wishful thinking of government officials. Most policymakers fail to consider how governmental programs will adversely affect land and housing market operations. Consider, for example, India's Urban Land Ceiling Act, which has frozen land development activities in many cities across the nation (see Box 3). Commonly, plans and policies are the result of inappropriately applying the experiences of other countries.

1.31 In the development of public land, it is quite common for agencies to ignore market forces in the design of housing or land development projects. For example, up until recently, Indonesia's National Urban Development Corporation did not consider the annual effective demand for housing or the competitive supply of housing in the local markets it was considering for possible investment (Dowall and Sherer, 1989). In many cases, the agency would buy far too much land than was warranted by market conditions or it would build housing that was too expensive for residents to purchase.

1.32 Another frequent problem is that land development policies are driven by a far too limited set of objectives and fail to consider broader institutional, cultural, and historical factors. As a result, land policies frequently generate a host of unanticipated side effects.

1.33 A growing trend in most countries is that an increasing amount of development is simply taking place outside the formal sector. In many instances, the activities of the informal sector are ignored by the government—data are not collected on informal development and planners and policymakers are unable to understand how the informal sector operates. Ignoring the informal sector

Box 4. Bangkok's Road Problem

Since 1980, traffic congestion has been a major problem in Bangkok. The principal cause is that the roadway system has failed to provide distributor roads to handle the flow of traffic from small access streets (*sois*). Instead, virtually all trips have to be made on Bangkok's limited system of major roads. Without distributor roads, the lands for housing and commercial development cannot be used efficiently.

In large metropolises, main roads divide the urban areas into blocks. The size of these blocks depends on the density of development. Typically, they range from 1 to 10 square kilometers. In Bangkok, these blocks are so large that they are referred to as "superblocks." The pattern of main roads is coarse and some of the superblocks exceed 50 square kilometers. The paramount defect of these superblocks is their lack of distributor roads. As a result, small access roads have been built directly from the main road into the superblock. Rarely does the soi go all the way through the superblock, and so it cannot operate as a distributor. Instead, the city has an array of dead-end sois that fail to contribute to a network system.

Between 1984 and 1988, almost 30,000 hectares of land were urbanized, most of it located in the suburban areas. These areas are developing in this same pattern of superblocks. Traffic congestion will continue in these areas unless there is some advance planning and programming of a system of roads.

Why, then, haven't distributor roads been developed in Bangkok? One reason is that Thailand's local governments leave the construction of minor roads to the private sector. In Bangkok, road building has been turned over largely to developers, whose main objective has been to provide access to parcels owned by the initiating builder, but the privately constructed roads fail to generate opportunities for the further development of residential parcels that are not under the control of the builder. As a result, many parcels remain "land-locked." Unless the roadway system is corrected, valuable land will remain vacant, traffic congestion will persist, and leapfrog development will continue to plague the region (PADCO, 1990).

won't make it go away and understanding how it operates is essential to planning for future development.

1.34 But the main reason most local governments are unable to cope with rapid urban population growth is that they are "flying blind;" they simply don't know what is going on in their local land market. Visits to the planning offices of most large cities in the developing world reveal how little is known about patterns of urban land development, the number of housing units (both formal and informal) built in the past year, land and housing prices, rents for office buildings and factories, infrastructure deployment patterns, land subdivision patterns, and so on. This same criticism can be made of the private sector. Developers frequently overbuild markets (for example, shophouses and condos in Bangkok) because they don't have up-to-date information about property markets.

Poor coordination between government and between government and the private sector

1.35 One global problem is the lack of coordination between public agencies, on one hand, and between the public and private sector, on the other. As a result, work is often duplicated by various agencies. In Thailand, for example, the Government Housing Bank shares its housing mandate with the National Housing Authority, municipal housing authorities, and several initiatives sponsored by the Royal Thai government. An extreme example is the Bangkok Metropolitan Authority's twenty-seven functions, each of which is shared with at least one central government agency. This system is a natural response when agencies are unable to rely on each other for support functions and have to do everything themselves.

1.36 It is also quite common to find that the people actually making the plans are not the ones making key decisions about public investments and private development. Consequently, housing or large-scale land development projects are not integrated with other public infrastructure projects—projects are built, but lack road access. Since the key decisionmakers often do not use planning and land market information to guide their actions, there needs to be much stronger coordination between those who develop policies and those who implement them. Land development policy-setting is too important to leave entirely to planners—it needs to be better integrated with national economic development programs (van Huyck, 1987). More important, there needs to be broader support and participation from government implementing agencies, private sector groups, and citizen organizations.

1.37 Poor coordination between private sector organizations is also prevalent. One example is the failure of banks and investors to assess the investment decisions of their competitors. In Bangkok, the private provision of roads is not coordinated at all. The situation in Kathmandu is similar (Doebele, 1987).

Lack of funds

1.38 Because of their rudimentary taxation systems, most cities of the developing world lack the financial resources to implement critical urban development programs (World Development Report, 1988). Governments simply don't have the mechanisms for taxing the land value gains resulting from investments in infrastructure, land registration, and titling. If they could tax land effectively, they could finance infrastructure investment and land registration and titling systems.

1.39 The "free-rider problem" prevents the private sector from financing these investments. That is to say, they cannot exclude nonpayers from benefiting from the investments. Thus financing must come from the public sector.

1.40 In Karachi, investments in infrastructure approximately double the value of residential plots (Dowall, 1989b). In Jakarta, infrastructure adds 80 to 110 percent to the value of a residential plot, depending on the type of tenure held (title of ownership). Having a clear title (Agraria certificate) adds 40 to 50 percent to the value of a residential plot, depending on the level of infrastructure available to the plot (Dowall and Leaf, 1991).

1.41 Clearly, the land value benefits associated with government actions are considerable, and that they could form the basis for property taxes that could be used to recover public investments (Bahl, Collen, and Warford, 1973).

1.42 As local governments begin to seek new approaches for financing urban development, techniques such as special assessment districts, development fees, and exactions and beneficiary charges will come into use. But these fiscal tools cannot be developed without accurate information about land values, the cost of providing infrastructure, and its impact on land values.

Private Sector Resistance to Government Land Regulations

1.43 Although governments shape urban land policies and provide investments in infrastructure, it is largely the private sector (both informal and formal) that builds cities. Without the full cooperation and compliance of private land and housing developers, most government programs would fail. At the same time, developers all too often ignore or resist following government regulations, with the result that development becomes haphazard and expensive to serve. Numerous examples can be cited of developers failing to provide required parking, encroaching on setback areas, and not providing required open space.

1.44 Developers are often a negative force resisting the implementation of new urban land development policies. They routinely fight height limitations, parking requirements, and zoning changes, even though such actions would make the community better-off.

1.45 An urban land policy agenda cannot be set without the participation of both the public and private sector. Policies need to balance the needs of society with the economic and financial realities of real estate development.

Environmental Resource Constraints to Land Development

1.46 Urbanization and rapid urban land conversion are having serious environmental repercussions in the cities of the developing world. Despite the acute awareness and policy attention accorded environmental problems in developed countries over the past twenty years, policymakers in less developed countries until recently considered adverse environmental impacts the price they had to pay for rapid economic development. Now, there is a growing constituency for more rigorous environmental standards, and the pressure to preserve environmental quality will proliferate as economies develop and their middle-class blossoms. Although the emerging environmental movement will focus on a broad range of issues, urban development and land use will be a central concern.

1.47 At the same time, the emerging environmental policy must not stifle the operation of land and housing markets. Concerns over environmental quality must be balanced with housing availability and affordability. However, even in those areas where resources are limited and the environment has traditionally been regarded as a luxury good, policymakers should pay particular attention to at least the following three potential problems: 1) pollution and resource degradation that threatens the economic well-being of communities; 2) disposal practices that make it expensive to implement resource recycling; and 3) land-use decisions that undermine the value of land and housing markets (Foster, 1989).

Conclusions About the Urban Land Crisis

1.48 Throughout the developing world, urban expansion is taxing the capacity of local institutions, both public and private, to adequately respond to development pressures. Compounding the problem is the lack of up-to-date information about land and property market conditions. Although the precise causes of planning failures are a subject of considerable debate, the lack of accurate and up-to-date information about urban growth is clearly thwarting effective urban planning. Without the kind of information the land market assessment (LMA) can provide, it is difficult, if not impossible, to plan for and promote urban development. Many planners and policymakers have been merely following the assumptions or often inappropriate standards of other countries, sometimes with disastrous results.

1.49 For their part, private sector investors and developers can use LMA information to identify development opportunities and assess the demand for projects they are considering. On a broader scale, better information enables developers, consumers, bankers, and land markets to operate more efficiently.

1.50 The objective of this report is therefore to offer a method for assessing the past, current, and likely future patterns of land market operation, focusing on the demand, supply, and price of land for urban development. It explains why land market assessments are useful and what steps are taken in conducting land market assessments, and offers some examples of the use of LMAs. The report should be of interest to a large audience: public sector officials in local, regional, and national offices concerned with planning, programming, and financing urban land development and planning; public officials responsible for programming and developing housing and residential plots; private sector housing and commercial developers and bankers lending on urban development projects; the community of professional planners and advisers working for international donor agencies; and researchers and academics concerned with land and shelter issues in the developing world.

1.51 The central concern here is to explain how LMAs can be applied in the cities of the developing world. However, the method is equally applicable in cities in developed countries. Most of the examples of land market assessments focus on housing and residential land markets. This is because housing accounts for the largest use of land in cities and because the supply of land for housing the poor has become a critical problem in most cities of the developing countries.

II. WHY LAND MARKET ASSESSMENTS ARE NECESSARY

2.1 The purpose of the land market assessment is to provide an accurate and up-to-date core of information on the operation of the urban land market. This information includes prices, statistics on the supply of serviced land, and detailed descriptions of present and projected projects. Thus it provides the concrete foundation needed to define appropriate strategies for improving land market performance. LMAs can be used to support four broad activities: governmental planning and decisionmaking; the evaluation of government policies and actions; the structuring of land-based taxation systems; and private sector investment and development decisions. The remainder of this section discusses how LMAs can be used.

Providing Information for Public Sector Planning and Decisionmaking

2.2 The most significant benefit of the LMA is that it can vastly improve the quality of land development planning and policymaking by providing public officials with basic assessments of the state of the land market. In development planning, as in medicine, diagnosis is the first step in problem solving. The LMA is a method for assessing the current condition of the land market. Therefore, one of its primary objectives is to answer the following questions:

1. Is the supply of urban serviced land expanding to meet growing population and employment needs?

2. Which land uses are growing the fastest?

3. Where is urban land conversion taking place?

4. Where is urban land conversion outstripping the supply of serviced land?

5. Are land prices increasing faster than the overall rate of inflation?

6. Where are land prices the highest and where are land prices increasing the fastest?

7. How much land is being provided with the minimum services needed for future urban development?

8. Is there enough serviced land to accommodate urban growth for the next five years?

9. Is the price and affordability of housing and commercial and industrial space changing—are real occupancy costs greater now than before?

10. Which segments of the population do not have access to housing from the formal private sector?

2.3 Land market assessments can also be used to provide baseline estimates of future urban land requirements. They can be used to guide infrastructure programming and investment decisions and the development of land-use planning policies. For example, LMAs can be used to estimate the demand for residential plots and commercial and industrial space associated with projections of population and employment. Armed with these estimates, planner can gauge the adequacy of the current supply of land for urban expansion and develop plans for expanding the supply of serviced land.

Using LMAs to evaluate government policies and actions

2.4 Governments exert great influence, both positive and negative, over land market outcomes. Through investments in infrastructure and regulations over land development, governments shape the operations of land markets, creating the potential for substantial increases in land values. At times, however, government plans and regulations unintentionally cause negative side effects on land market operations. Given the important role that governments play in shaping land market outcomes, it is extremely important that the implications of their investment and regulatory decisions to be understood.

2.5 Unfortunately, adverse effects of planning regulations are complex and frequently difficult to estimate—in large part because little is known about the price of land or the demand and supply conditions. With the land market assessment, an information base can be established to monitor land markets and thus evaluate the potential effects of new government policies and programs. The LMA can be used to answer a variety of questions: Are certain public policies or actions constraining the land market? Is infrastructure placement limiting residential development? Are greenbelts or agricultural land preservation policies limiting development? Are planning standards and building codes pushing up housing prices?

Using LMAs for structuring land-based taxation systems

2.6 As local governments begin to seek new approaches for financing urban development, techniques such as special assessment districts and beneficiary charges will come into use. These fiscal tools cannot function without accurate information about land values and the impacts of infrastructure developments on land values. The LMA, by systematically cataloging land value information, can play a critical role in making these new financial tools functional. As a first step, the LMA can serve as a foundation for gauging trends in land prices. Over time, as data on land prices are tabulated, the government can gauge the impacts of public investments and use the information to set taxes, fees, or user charges.

Providing information for private sector investment and development decisions

2.7 Unlike stock, bond, and commodity markets, land markets are disorganized. There is no central clearinghouse for information about land prices, land conversion, and the demand for land. Most private sector land developers must take substantial economic risks when launching projects. Unfortunately, the lack of information about land and property markets in most cities of the developing world has thwarted attempts by private sector developers, bankers, and consultants to prepare feasibility studies of potential projects.

2.8 LMAs can fill this gap. For example, by illustrating the effective demand for low- and moderate-cost housing, LMAs can help stimulate the production of such units by the private sector. At the same time, LMAs can indicate when the production of certain urban uses far exceeds effective demand and thus help to bring about faster land market corrections. In the long run, with improved information about the market, the risk associated with development is reduced and developers may be able to operate with lower rates of profit (Walters, 1983).

2.9 The information provided by LMAs can also help improve the quality of loan underwriting and private investment decisionmaking. Overall, more informed lending decisions can lead to a more efficient use of private capital for land development.

Conclusions Regarding the Benefits of LMAs

2.10 As should be clear by now, the benefits of LMAs are significant and are likely to draw widespread support from public and private sector planners and decisionmakers, as well as many other quarters of the public and private sector. As explained below, when organizing for the LMA, care should be taken to involve the full participation of benefiting agencies.

III. ORGANIZING FOR LAND MARKET ASSESSMENTS

3.1 Before the LMA process is even begun, it is important to develop broad support for it. The best way to do this is to invite both the public and private sectors to participate in the planning and execution of the LMA. To avoid conflicts between competing line agencies in government, the responsibility for executing the LMA should be lodged with the executive office of the local government and should include the full participation of the private sector.

3.2 In San Pedro Sula, Honduras, for example, it was suggested that the city create a line agency, the Department of Land and Housing Development, that would report directly to the mayor. Among its many powers, this agency would have statutory authority to compel government agencies and public utilities to gather relevant information on land market operation. It was felt that a centralized authority reporting directly to the mayor was the only effective way of implementing the assessment. In other cases, this manner arrangement may not work.

3.3 The full cooperation of the private sector is essential. To this end, a land market assessment steering committee should be established, consisting of prominent professionals in the private sector development community. The group should be established at the start of the LMA process to discuss how the LMA can be used to improve the performance and efficiency of the private and the public sectors. Agreement must be reached about which types of data to collect and the frequency of collection, and firm protocols should be set for preserving the confidentiality of sensitive market information. Procedures for periodically disseminating land market assessment reports should also be drafted. It is also important to address the concerns of citizens who feel that the government is snooping. Here, the most effective method is to take the time to explain what the surveys will be used for and what they will not used for (for example, for land-use planning purposes, not for tax collection audits). Survey teams must explain how the anonymity of those interviewed will be protected (for example, the survey teams are not to submit the names of those interviewed to the government agency managing the LMA).

3.4 The surveys must be conducted in both formal and informal areas of the city or town. The process in both areas is essentially the same, but it may be necessary to slightly modify the surveys or the types of information collected in informal areas. Experience in Karachi, Jakarta, and Bangkok indicates that informal land brokers can be identified quite easily and that they have little difficulty responding to questionnaires of the type presented in Annex A (discussed below). The housing project survey discussed below and presented in Appendix C may need to be modified to accurately capture relevant information about informal land and housing developments.

3.5 In Bangkok, the Housing Policy Subcommittee of the National Economic and Social Development Board serves as the steering committee for carrying out periodic aerial photographic assessments of the region's land and housing markets. The committee seeks input from the Thai Real Estate Association and from the financial and academic communities.

Resources Necessary for Setting up a Land Market Assessment Process

3.6 The LMA is carried out by several types of professionals: a land economist with experience in market survey research; a land planner with experience in interpreting aerial

photographic and satellite images; a statistician with experience in computing and managing data; two data analysts for coding, entering data, and fieldwork; a draftsperson; and a team of research assistants for conducting field surveys. A team of this size will not be needed in smaller towns. The minimum level of staffing is probably one urban planner who has been trained in applying the LMA and one to two survey assistants.

3.7 In large cities and metropolitan areas, a computer system will be needed to develop the data base and to conduct statistical analyses. The minimal system is an IBM AT compatible system with 640k RAM, two disk drives, and 40mb hard disk. The system should have graphic capabilities, with either a color or monochromatic monitor. A high-speed dot matrix printer is necessary and it should be able to handle continuous feed paper up to 14 inches wide (35.5 centimeters). For large metropolitan areas, the best method of presenting land and housing market information is to use a computer-mapping system. Such a system can be run on the IBM compatible system with a type "A" multicolor pen plotter and a 12-by-12-inch (30-by-30-cm) digitizing pad. The total cost for the computer equipment is between US$6,000–7,000, or US$4,000–$5,000 without the computer-mapping capability.

3.8 The software for running the computers and developing the data base and map files will require LOTUS 1-2-3 or a comparable spreadsheet system, an advanced statistical package such as SPSS- PC+ or STATGRAPHICS, and ATLAS GRAPHICS, a computer-mapping system. A word processing system such as WordPerfect, Microsoft Word, or Wordstar, and a graphics program such as Harvard Graphics, or Lotus Freelance will be needed for preparing reports. The prices of these software packages vary considerably, but should cost less than $2,000. Thus, for less than $10,000 a complete computer installation can be created for conducting the land and housing market assessment. This system can also be used for other management and research functions such as financial modeling, demographic projections, data base management, and report production. In smaller cities and towns, the data can be analyzed manually using a small pocket calculator or adding machine.

Timetable for Conducting Assessments

3.9 The time required to prepare a land market assessment will depend on the size of the city, the level of detail of analysis, and the number of professional staff assigned to the project. If the city is starting from "scratch," it will take approximately one to two years to fully complete a land market assessment. However, much of the information needed for the land market assessment has probably been collected already, shortening the time required for completion. The LMA should be updated every three to five years, depending on the rate of urban growth and available resources.

Dissemination of land market assessment information

3.10 A principal benefit of the land market assessment is that it increases the level of understanding about the current state of land market operations. Thus, it is important for the results of the analysis to be widely disseminated. This can be accomplished by way of seminars, reports, and briefings to public and private sector professionals. In the long run, it is desirable to issue an annual report on the state of the land market. This report should pinpoint key constraints in the land market and identify actions for removing land-supply bottlenecks. The report should be widely distributed to both public and private decisionmakers.

Developing Baseline Information

3.11 The first step in launching a land and housing market assessment is to review the reports and data that have been compiled by public and private agencies on the land and housing conditions in the metropolitan area. Meetings should be held with government officials and private real estate developers, brokers, and bankers.

3.12 Using the results of these preliminary efforts, the study team can proceed to define the precise scope of the land and housing market assessment, including the size and shape of the study area, the types of data to be collected and analyzed, and the specific policy questions to be addressed (Dowall, 1980).

Define Area

3.13 The definition of the area will depend on the political boundaries of the local government, the spatial organization of tabulated data (such as population, infrastructure, and cadastral and building activity), and the location of employment centers and commuting patterns in the metropolis. The size of the land and housing market assessment area will depend on how far into the periphery households one will search for housing (to purchase or rent) over the next ten years. In most cases, the information is tabulated at a district or subdistrict level, and these units form the basis for defining the study area with respect to data collection and availability.

Establish geographic zones for data organization

3.14 If the LMA data base is to be useful in assessing precise land market conditions and is to effectively gauge the impacts of government policies and investment decisions, it should be spatially divided into zones.

3.15 On a conceptual level, these zones should be defined so that each provides a homogeneous pattern of land and housing market characteristics. For example, the boundaries of the zones should be set so that the land-use patterns within zones are roughly similar, not a mixture of commercial, industrial, or residential areas. In outlying areas, the zones should be similar with respect to the pattern and density of urban development. The zones should also be similar in terms of social and economic conditions such as household income. The finer the grain and the more homogeneous the zones, the more accurate the data base and the assessment of the effects of government policies and investments. At the same time, the greater the number of zones, the more difficult and expensive it will be to collect and update data.

3.16 Another consideration in defining zones is that their size and total number should be based on the underlying base of existing data. Although it is impossible to delineate different zones from those in the data base, zones can be combined into larger groupings. In large metropolitan areas (with a population of 1,000,000 or more) where the potential number of zones is large and is likely to be difficult to manage, it is appropriate to combine zones. The zones should be small enough, however, to illustrate the activities of fundamentally different housing and land markets but not too large to mask important differences in market activity. (On the problems of large-scale urban models, see Lee, 1974). A land and housing market information base of 344 zones was developed in Bangkok,

a metropolitan region of six million or more. Map 1 illustrates the zone system used for the Bangkok Land Market Assessment. In Karachi, 271 were tabulated (Dowall, 1989). In other cities, the number of zones for urban modeling has ranged from 100 to more than 1,000. For purposes of analysis, given computer and software capabilities, the total number of zones should be limited to less than 500. The limitation of a maximum of 500 cases should not present any significant problems for developing a clear assessment of a metropolitan area's land and housing market.

Basic land-use and population data for tabulation

3.17 For each geographic zone, data on land use and population attributes should be collected for at least two points in time—a "base year" and "current year." Ideally, the two years should span a period of five to ten years. Data on the following variables should be collected:

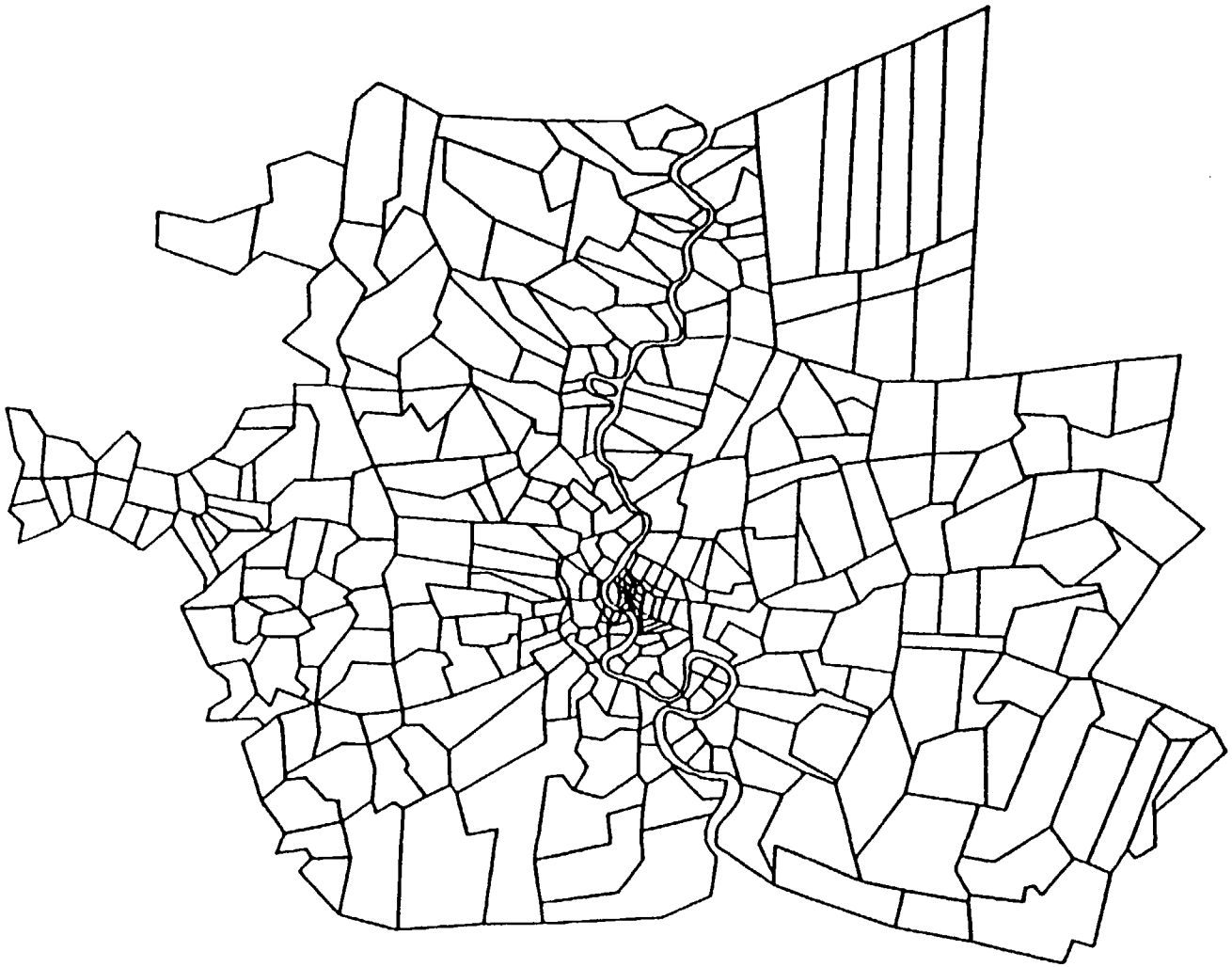
1. zone identification number
2. size of zone in hectares
3. x and y coordinate of the centroid of the zone
4. total urbanized land in base year of hectares
5. total urbanized land in current year in hectares
6. total residential land area in base year (g.a.)
7. total residential land area in current year (g.a.)
8. total housing units in base year
9. total housing units in current year
10. commercial land area in base year (g.a.)
11. commercial land area in current year (g.a.)
12. industrial land area in base year (g.a.)
13. industrial land area in current year (g.a.)
14. institutional land area in base year (g.a.)
15. institutional land area in current year (g.a.)
16. vacant land area in base year
17. vacant land area in current year
18. vacant land with infrastructure in base year
19. vacant land with infrastructure in current year
20. change in urbanized land, base-current year in hectares
21. change in residential land area, base-current year
22. change in total housing units, base-current year
23. change in commercial land area, base-current year
24. change in industrial land area, base-current year
25. change in institutional land area, base-current year
26. change in vacant land area, base-current year
27. change in vacant land with infrastructure, base-current year
28. population in base year
29. change in population, base-current year
30. population density in base-current year
31. change in population density in base-current year

3.18 Baseline data on land-use changes, infrastructure availability, and population by geographic zone over time can be used to arrive at a detailed assessment of the spatial patterns of urban development in a metropolitan area. The data can be tabulated from land-use surveys, aerial photographs, or satellite images.

Land value information

3.19 The next step in collecting data is to assemble land price information by zone and year. This information is available from a variety of sources. Many countries levy property taxes and therefore compile information on land value assessments. Although in many instances these

Map 1. Metropolitan Bangkok: Kwaeng Location



assessments lag or understate the market, they may provide a usable measure of land price inflation. In cases where private land value information is also available, it can be used to verify the public land value assessments.

3.20 Land value information can also be directly collected from interviews with real estate brokers. For example, in both Jakarta and Karachi, approximately 100 real estate brokers working in either the formal or informal sectors were interviewed to obtain land value information on plot prices. In all cases only experienced brokers were surveyed. Annex A presents a description of the Jakarta broker survey. The general approach used in the survey is as follows:

- A survey questionnaire was set up containing a series of questions designed to help brokers appraise the current probable selling price of several specific types of residential plots (for example, a 120-square-meter plot located on a collector street). The appraisal process was repeated for plots with different types of land tenure and levels of infrastructure. The appraisals covered only those neighborhoods in which the broker worked. Once the appraisals were completed, the brokers were asked to estimate the probable selling prices of the previously appraised plots for 1980, 1985, and 1987 in Karachi and 1987, 1988, and 1989 in Jakarta. All prices were tabulated in terms of price per square meter and adjusted to constant price levels.

- Since the objective of the land price data base was to comprehensively cover the metropolitan area's active land markets, interviews were scheduled in approximately 100 neighborhoods. Within each neighborhood, at least three brokers were interviewed. For each type of plot appraised, the median value was to be included in the data base. Within each neighborhood, median values of between three and nine types of parcels were tabulated for each year.

- A variety of methods were used to identify brokers. Membership lists of professional organizations were used for brokers in the formal sectors and advice from village headmen and residents for informal brokers.

- The results of each interview were tabulated on a questionnaire form. The information recorded on each form was computer-coded using Lotus 1-2-3. The coding was verified for accuracy.

- The land price data were organized according to zone and combined with additional information on land use and population.

3.21 In most cases, data on land values (based on appraisals) can be tabulated by type of land. All land values should be expressed in constant prices. For example, a comprehensive collection of values for serviced and unserviced residential, commercial, and industrial land might include the following variables for each zone, in addition to the variables listed above (continuing the same sequence of numbers):

32. median land value (per square meter) for serviced residential plots located on side streets, base-current year
33. change in median land value (per square meter) for serviced residential plots located on side streets, base-current year
34. median land value (per square meter) for serviced residential plots located on side streets, base-current year
35. median land value (per square meter) for serviced residential plots located on side streets, current year
36. change in median land value (per square located on side streets, base-current year meter) for serviced residential plots
37. median land value (per square meter) for serviced commercial plots located on main streets, base year
38. median land value (per square meter) for serviced commercial plots located on main streets, current year
39. change in median land value (per square meter) for serviced commercial plots located on main streets, base-current year
40. median land value (per square meter) for serviced industrial plots located on main streets, base year
41. median land value (per square meter) for serviced industrial plots located on main streets, current year
42. change in median land value (per square meter) for serviced industrial plots located on main streets, base-current year
43. median land value (per square meter) for unserviced parcels located on side streets, base year
44. median land value (per square meter) for unserviced parcels located on side streets, current year
45. change in median land value (per square meter) for unserviced parcels located on side streets, base-current year

3.22 It may not be possible to tabulate information on all of these variables, but this list is offered as an example of what might be collected. Once the land value information has been coded into the spreadsheet, patterns and trends of land values over time and space can be calculated. This information can be used to determine where land values are increasing fastest and also where land is priced low enough to make the construction of low- and moderate-cost housing feasible.

Design Layout of Spreadsheet Data Base

3.23 With the delineation of land and housing market study zones, a data base system should be established for coding data. The data base should be developed on a microcomputer, using a

spreadsheet system such as LOTUS 1-2-3 (Landis, 1986). Basic information for each zone should include: 1) zone identification number; 2) size of zone in hectares or square kilometers; and 3) an "x" and "y" coordinate for locating each zone. The spreadsheet data base should be stored on a hard disk and frequently "backed up" on a diskette in case the file is inadvertently erased.

3.24 Once the initial spreadsheet file is created, the basic land use, population and demographic and land value information can be added. Tabulations can be made of which zones experienced the greatest population increase between the two years and what share of the metropolitan area's total population increase took place in central city, inner suburban and peripheral areas. Such calculations generate useful information for identifying growth areas in the metropolitan region. Population density patterns and their change over time can be recorded as well.

Using Aerial and Satellite Images

3.25 Since governments in most metropolitan areas do not compile detailed information regarding changes in housing stock or land use by small area, it is necessary to interpret and tabulate aerial photographic surveys. Ideally, two aerial surveys that closely correspond with the time interval of the assembled demographic data listed above should be used for the housing and land-use analysis. From the field surveys of the metropolitan area and preliminary assessments of the aerial surveys, a list of housing types, including both informal and formal housing development, should be compiled for detailed tabulation, and it should differentiate slums and squatter settlements, land subdivisions, formal private housing developments, and public housing projects. Nonresidential uses, including industrial areas, commercial districts, and institutional uses can also be tabulated.

3.26 If aerial photographs are not available,an effort should be made to acquire satellite images. Satellite images can be obtained for less than US$2,000 (Bertaud, 1989). SPOT images have been available since 1986, and offer good resolution (10 meters in panchromatic mode). Combined with a thorough ground survey, SPOT images can be used to develop land-use typologies for assessing land-use and urban development patterns (Bertaud, 1989). Appendix B summarizes the use of satellite images for land market assessments.

Tabulating Housing, Commercial, and Industrial Uses

3.27 Once the typology has been established, tabulations of housing by type of unit should be made for each zone. For example, using aerial photographic interpretation, it may be possible to differentiate the following types of housing (for satellite images, the level of differentiation will be much coarser):

- informal housing settlements
- public sector housing projects
- formal private sector low-density housing estates
- formal private sector medium-density housing estates
- formal private sector high-density housing estates.

3.28 For each category of housing, the number of habitable units should be estimated for the base and current-year aerial photographs or satellite images. A comparison of the tabulations provides a clear picture of changes in the housing stock over the period. Calculations of absolute changes in the type of housing and change in housing by zone and by type will identify the specific patterns of housing supply dynamics.

3.29 Although trends of past housing construction provide a partial assessment of future housing activity, a separate projection of housing demand is a more accurate method of gauging the future. Projection models of regional housing demand, such as the USAID system (Struyk, 1987), can more fully incorporate the demographic factors that shape housing demand. With consistent projections of future housing needs, land requirements for residential development can be determined.

Assessing Land Conversion Trends

3.30 The rate of land conversion within each zone over time can easily be determined using either aerial photographic survey or satellite image information. By calculating the area converted from agricultural to residential and other urban uses and correlating it with housing unit changes or changes in commercial and industrial employment, an estimate can be made of the land required to support urban growth. This information can in turn be used to estimate annual requirements for land. Map 2 illustrates land conversion patterns for Metropolitan Bangkok between 1974 and 1984.

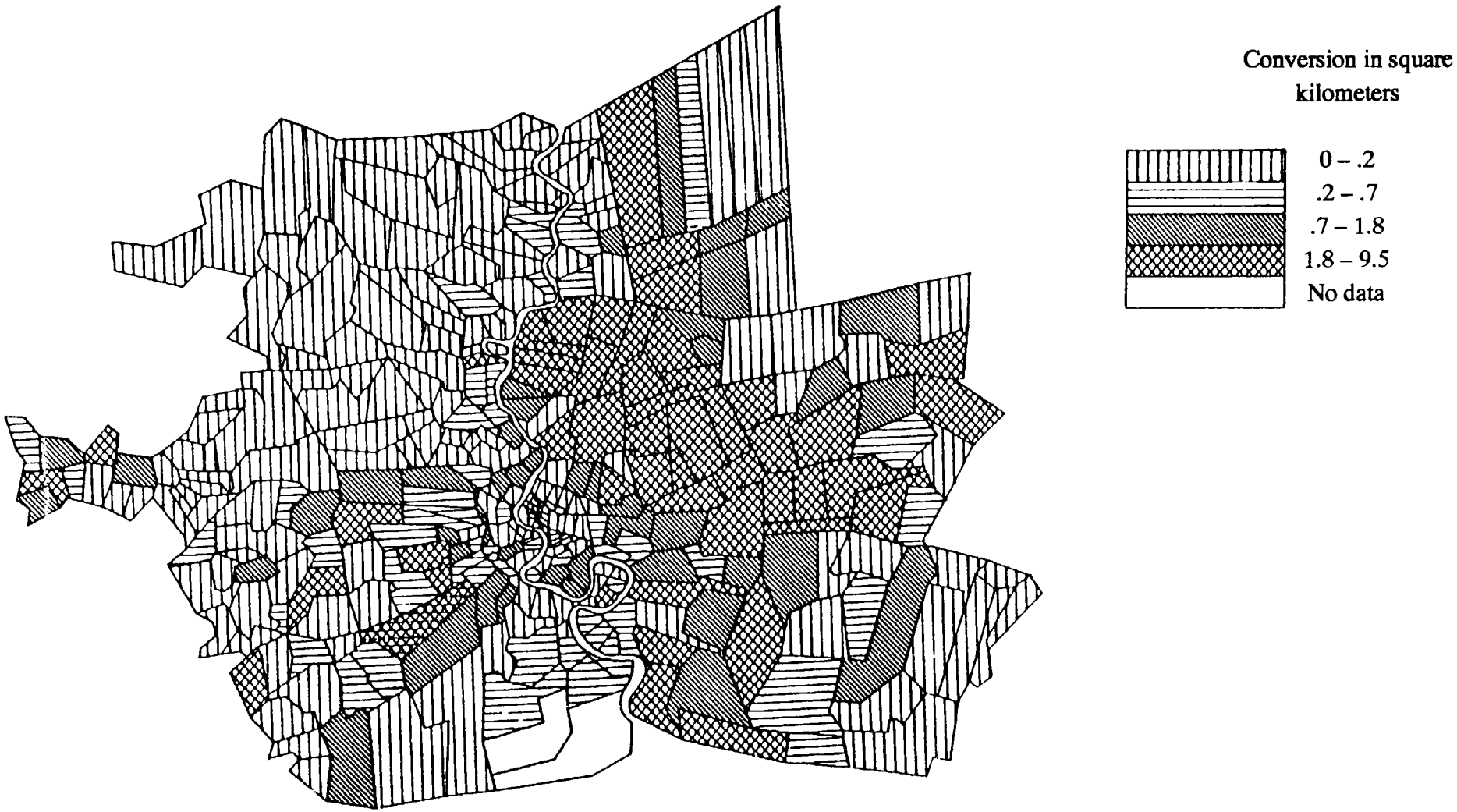
Estimating Current and Future Developable Land Supply

3.31 The most critical element of the assessment is the estimate of the current and future supply of developable land. Developable land is defined as land that has reasonable access to roads and other critical infrastructure systems, such as water and electricity, and is not constrained by physical impediments such as steep slopes or by governmental limitations on development. Which lands are potentially developable can be determined by examining parcels for physical constraints, governmental policies, and the location of current infrastructure. must Additional assessments should be made of the potential for the redevelopment of urban areas. Although difficult to gauge precisely, redevelopment potential can be measured by determining past redevelopment activity and extrapolating into the near future. Depending on the type of infrastructure and the cost required to extend services, land located within 1/2 to 1 kilometer of existing infrastructure should be classified as developable, assuming there are no physical and governmental constraints. The potential supply of serviced land can be estimated by combining this information with land-use data on vacant parcels (Dowall, 1980, 1981, 1989).

3.32 Future supply conditions are estimated by assessing and mapping proposed infrastructure. If a parcel is expected to have access to road and water systems within the next five years and has no other constraints, it should be classified as developable in the future estimates.

3.33 In determining land supply, it is extremely important to consider vacant and underutilized parcels in built-up areas. Although many vacant parcels do not have road access, or are not well suited for development, their location and potential for infill construction make them important sites to consider when estimating land supply. Gauging the potential of underutilized parcels is more difficult. Here areas with low-rise older buildings should be evaluated and estimates made of the net urban development potential.

Map 2. Land conversion in square kilometers 1974-84 in metropolitan Bangkok



3.34 Future land market conditions can be assessed by comparing the land supply estimates with future demand. For example, the number of years of supply of serviced land should be estimated by dividing the annual urban land requirements by the current supply of serviced land. A table showing the annual increase in the stock of serviced land and the annual urban land requirements should be prepared to illustrate whether the current and future supply of serviced land is sufficient to meet urban growth requirements over the next five to ten years.

3.35 The land-supply estimates should be tabulated for each zone. This information can then be analyzed to determine the spatial patterns of land supply. Levels of current supply can be compared with past and anticipated patterns of land conversion to determine whether there is sufficient land in areas of high demand in the metropolitan region.

Adding Project Information to a Land Market Database

3.36 Detailed information about the characteristics and price of housing units offered in the market can be obtained from a survey of projects currently on the market. This section describes the basic strategy for carrying out a survey of housing projects, but the same technique can be applied to commercial and industrial projects.

Drawing up a sample of projects

3.37 To gauge current market activity, a list should be compiled of the housing projects, both formal and informal, currently offering units, The list of projects should be assembled from newspaper ads and interviews with bankers, community organizers, government officials, real estate brokers, and other key informants. All the identified projects should be classified into the same housing typologies used for the aerial photographic or satellite image interpretation. Based on the relative share which each type of housing represents of the total number of housing units selling at present, a stratified random sample of housing projects can be drawn up for further research (Malpezzi, Bamberger, and Mayo, 1982).

Project surveys

3.38 Detailed interviews with the sales personnel at each of the sampled project sites should be conducted by field interviewers. The following types of information should be obtained:

- land area of project
- number of housing units or plots by model type or size
- the selling price of units or plots by model type or size
- the sales rate of units or plots per month by model type and size
- the terms of financing available for the project; and
- profiles of buyers of units or plots including income, occupation, prior residence, and whether they were first-time buyers.

3.39 Annex C contains a project survey questionnaire used in Bangkok.

Combining project surveys with market information

3.40 These project surveys provide detailed information on the current supply of housing on the market that can be used to assess the affordability of the current supply of housing relative to current household incomes in the metropolitan area. They also provide a clear picture of the types and locations of units selling most quickly.

3.41 The housing price information and land value information can be used to gauge overall housing affordability in the metropolitan area. Following current financing practices and lending terms, it is straightforward to estimate the monthly payment necessary to finance the purchase of a house. Housing affordability can be determined by comparing monthly housing costs to monthly current household income (Malpezzi, Mayo, and Gross, 1985).

Using LMAs for Strategic Planning

3.42 Many governments formulate their plans for future development without a firm understanding of how their city is growing. As a starting point, it is useful to assess the current performance of the local land market using a technique such as the LMA. This will help authorities set an agenda for making the metropolitan area's land and housing markets more efficient.

3.43 A variety of questions need to be answered and evaluated to determine whether the markets are performing efficiently. These questions were presented in section 2.2. The usefulness of LMAs for planning can be illustrated through the San Pedro Sula, Honduras strategic land-use planning process.

Case Study: Applying the LMA Process to San Pedro Sula, Honduras

3.44 The city of San Pedro Sula faces a major challenge. Over the next 13 years its population will grow by approximately 150,000 persons—15,000 per year. Between 62,000 and 83,000 new housing units will be needed. This growth in population and housing demand, as well as associated economic activities, will require (depending on the amount of infill and development that occurs) the development of upward of 3,500 hectares of land, an amount equal to two-thirds of the land urbanized since the beginning of the century. Put another way, the physical development of San Pedro Sula over the next 13 years will equal 66 percent of the level and pace of development that has taken place over the past 90 years.

3.45 Since 1985 there have been clear signs that the land and housing markets of the city have come under increased pressure as a result of rapid population growth. The price of serviced urban land is now increasing at an average of 15 percent per year in real, inflation-adjusted, terms. Since the late 1970s the proportion of barrios created through land invasions, squatting, and illegal subdivision of land has accounted for about one-third of all new barrios.

3.46 A land market assessment of the San Pedro Sula metropolitan area conducted in 1989 (PADCO, 1989) provided much-needed data on the city's land markets and led to the proposal that the city establish a strategic land development process and create a powerful line agency for its execution.

3.47 **San Pedro Sula LMA conclusions.**

1. Over the past 30 years, the population of San Pedro Sula grown at a compound rate of 6 percent a year.

2. Between 1978 and 1988, its population increased by 107,000, an annual increase of 4.9 percent.

3. During this same period, San Pedro Sula's housing stock increased from 30,254 to 58,383, which represents an annual increase of 6.8 percent.

4. Since the stock of housing increased more rapidly than population between 1978 and 1988, the average number of persons per house declined from 5.73 to 4.8, a 16 percent decrease.

5. The spatial patterns of population growth between 1978 and 1988 indicate that much of San Pedro Sula's development took place on the east side, in an area adjacent to the city center, and an area farther from the center to the southeast.

6. From 1978 to 1987, building permits were issued for 107 workshops and factories and 481 commercial facilities. In the early part of the period, most of the industrial development was located on the east side of the city center.

7. Over the past ten years the densities in San Pedro Sula have increased with urban development. Although densities gradually decline with distance from the city, there is evidence that peripheral growth poles are emerging to the southeast.

8. The availability of essential services—such as potable water, electricity, and sanitary and storm drains—varies. Barrios within the first ring road have full coverage of services. Farther out, the coverage is more limited. Between the first and second ring roads, most settlements have water and electricity but lack waste disposal systems, although they are under construction. On the periphery, most of the informal areas lack paved roads and proper waste and storm water drainage systems.

9. The physical growth of the city has accelerated. Between 1950 and 1988 the city's growth consumed approximately 100 hectares per year; however, land conversion is currently running at 400 hectares per year. This acceleration is due to several factors:

- an increase in illegal subdivisions
- urbanization initiatives of the municipality
- private sector development
- layout and installation of new roads and infrastructure by the city and DIMA (the municipal water department).

10. Between 1976 and 1988 the total land use of the city increased to 5,317 hectares; 3,398 for residential, 656 for commercial and services, 508 for industrial, and 755 of open and institutional spaces. As of 1988, the city had approximately 9,760 hectares of available land for future development.

11. According to the 1988 census, San Pedro Sula contains 7,122 dwelling units that are of substandard condition and need replacement. An additional 2,265 units are needed to reduce overcrowding. Thus, the city has a current housing deficit of approximately 9,500 units.

12. Economic conditions in terms of the income of San Pedranos have deteriorated over the past ten years, as real, inflation-adjusted, family income declined between 1980 and 1986. (At the present time, the median income in San Pedro Sula is approximately US$300 per household.) With housing and land costs increasing over time, especially over the past three years, housing is becoming much less affordable.

13. Because of the declining affordability of housing and the increase in low-income households, the informal segment of San Pedro Sula's residential land market has been proliferating. Between 1978 and 1987, invasions accounted for 27 of 94 new barrios created—nearly 30 percent of all new barrios.

14. As of 1988, 38 percent of the total population of San Pedro Sula lived in these informal settlements.

15. A review of five low-cost housing projects in San Pedro Sula revealed that lot prices range from US$2,786 to US$5,200. The financing terms offered and the required downpayment indicate that all five projects require payments of between US$41 and US$65 per month. Using a ratio of 20 to 25 percent of income going to lot payments, these lots are affordable to families earning US$250-300 month, which is affordable to those earning at or slightly below the median household income of San Pedro Sula.

16. However, land price inflation is creating making housing less affordable. The real (inflation-adjusted) prices of serviced residential land increased at an annual compound rate of 15.4 percent between 1985 and 1988, much greater than before 1985, when the real rate of increase for such land was only 2.6 percent. Patterns of price increases for raw undeveloped land suggest that

developers, both formal and informal, are bidding up prices in their search for raw land inside the urban limits. In these areas, the price of raw land increased an average of 18 percent per year between 1980 and 1985.

17. San Pedro Sula's economy, like that of Honduras, is oriented toward agricultural production and consequently is greatly affected by changes in world commodity prices and climatic conditions. Notwithstanding these conditions, the Banco Central de Honduras projected that between 1988 and 1990 agricultural exports would increase by 4.7 percent in real terms. Income from these exports was expected to increase by 6.8 percent between 1988 and 1990 and by 7.2 percent between 1990 and 1992.

18. According to a survey of firms with at least 10 workers, San Pedro Sula had 42,891 workers in 1986. Of this number, 21,436 (or about 50 percent) were employed in industrial manufacturing. Trends covering the much broader economically active population indicate that 153,572 persons were in the labor force in San Pedro Sula in 1987. This is an increase of 102,206 over the 1974 estimate, or an annual increase of 8.8 percent per year. The increase of 100,000 economically active persons reflects the dynamism of the San Pedro Sula economy and explains the rapid growth of the city's population during the 1970s and 1980s.

19. A key element in the management of San Pedro Sula's future development is the fiscal capacity of the city to fund infrastructure. The city's ability to generate revenues has been adversely affected by legislation limiting the tax on undeveloped land located outside the urban limit line to 1 mill, whereas similar properties located inside the urban limit line are taxed at 3 to 5 mills.

3.48 The general outlook for San Pedro Sula is one of substantial demographic and economic growth. To date, the city has done a remarkable job of accommodating urban development. However, there are indications that future growth will create substantial pressure on San Pedro Sula's land and housing markets. To cope with these growth pressures effectively, the city needs to develop and implement clearly focused policies.

Projections of land for housing development

3.49 The amount of land needed for housing development in San Pedro Sula has been calculated from the projections of housing demand, including the required replacement of units. These estimates are based on the patterns of densities of residential estates for low-, middle-, and upper-income projects apportioned according to the income distribution of San Pedranos. According to these patterns of housing density and plot sizes, the additional demand for housing will create a need of 700 to 840 hectares of land between 1989 and 1993. The total demand for residential land from 1994 to 1997 is expected to range from 440 to 620 hectares for the low and high growth scenarios, respectively. And from 1998 to 2001 the demand for residential land is expected to range from 530 to 800 hectares. The total demand for residential land from 1989 to 2001 will range from 1,670 to 2,260 hectares (see Table 3–1).

Economic growth and nonresidential land needs

3.50 Continued economic growth in San Pedro Sula will increase the need for additional land for commercial, service, and industrial uses. The LMA conducted in 1989 provided projections of urban development requirements for each of these uses.

3.51 Between 1974 and 1987 San Pedro Sula's economically active population increased by 8.7 percent per year. In absolute terms, the increase was 102,206 (from 51,366 to 153,572). This meant the labor force participation rate (the ratio of economically active persons to the total population) increased from 34.6 to 54.7 percent. This rate is not likely to increase so the labor force's gain should closely parallel population growth rates in the future. Thus, the requirements for nonresidential activities will grow at the same rate as the residential ones, and the relationship between residential and nonresidential land uses will remain about the same.

3.52 According to the 1988 land-use survey of San Pedro Sula, nonresidential land uses accounted for approximately 36 percent of all urban land uses. Commercial, service, and institutional uses constitute 75 percent of all nonresidential land uses. These land-use proportions were used to estimate the future nonresidential land-use requirements presented in Table 3–1.[1]

Table 3–1. Residential land requirements in San Pedro Sula

Period	Low-growth hectares	High-growth hectares
1989–1993	700	840
1994–1997	440	620
1998–2001	530	800
Total 1989–2001	1,670	2,260

Source: PADCO (1989)

3.53 As Table 3–2 illustrates, between 1989 and 1993 the total demand for nonresidential land should range from 400 to 480 hectares. During the 1994-1997 and 1998-2001, the need for nonresidential land will range from 250-355 to 300-460 hectares. Overall, between 1989 and the year 2001, the total demand for nonresidential land will range from 950 to 1,295 hectares. These projections are gross land requirements and they do not take into account whether actual nonresidential development will take place on land that is currently developed.

Total land requirements for urban development, 1989–2001

3.54 The total land needed to support urban development can be calculated by combining residential and nonresidential requirements. Table 3–3 illustrates the total land requirements for the

1. During the years 1989-92, a significant portion of additional residential land demands are associated with filling the housing deficit. While it could be argued that this growth should be excluded from the calculation of non-residential land needs, it has been included because there is a similar "catch-up" in the commercial and industrial markets as well. Commercial and industrial building permits have been well above the historical ten-year average for the past two to three years.

Table 3–2. Nonresidential land requirements in San Pedro Sula

Period	Low-growth hectares	High-growth hectares
1989–1993		
Commercial, Institutional Services	300	360
Industrial	100	120
Total Non residential	400	480
1994–1997		
Commercial, Institutional Services	190	265
Industrial	60	90
Total Non residential	250	355
1998–2001		
Commercial, Institutional Services	225	345
Industrial	75	115
Total Non residential	300	460
1989–2001		
Commercial Institutional Services	715	970
Industrial	235	325
Total Non residential	950	1,295

Source: PADCO (1989)

next thirteen years. On an annual basis, between 200 and 270 hectares of land will be needed for urban growth between now and the turn of the century. This is below the peak levels of land conversion that have occurred over the past two to three years, but it is likely to be the rate that is clearly sustainable.

3.55 Over the next 13 years, a total of 2,620 to 3,555 hectares of urban uses will be developed. According to the 1988 land-use survey, the total urban land area of the city of San Pedro Sula was 5,317 hectares. Thus, in the next 13 years, the urban area of the city will expand by one-half to two-thirds. This implies that the physical development of San Pedro Sula during the remaining years of the century will proceed at a rate 3.5 to 4.6 times faster than its historical average.

3.56 Land requirements of this magnitude pose an enormous challenge for planners. Unless the growth is accommodated, the price of land and housing will continue on the path of inflation and the housing affordability crisis will worsen.

The strategic land development process

3.57 The results of the land market assessment formed the basis of a proposal for a strategic land development strategy for San Pedro Sula. The recommendations are based on three and one-half months of fieldwork and analysis, and reflect numerous discussions with city officials, housing developers, bankers, businessmen, and citizens (for details, see PADCO, 1989). The following seven steps were recommended:

Table 3–3. Total land requirements for urban development in San Pedro Sula

Period	Low-growth hectares	High-growth hectares
1989-1993		
Residential	700	840
Commercial, Institutional & Services	300	360
Industrial	100	120
Total	1,100	1,320
1994-1997		
Residential	440	620
Commercial, Institutional & Services	190	265
Industrial	60	90
Total	690	975
1998-2001		
Residential	530	800
Commercial, Institutional & Services	225	345
Industrial	75	115
Total	830	1,260
1989-2001		
Residential	1,670	2,260
Commercial, Institutional & Services	715	970
Industrial	235	325
Total	2,620	3,555

Source: PADCO (1989)

1. Set quantitative land and housing development targets.
2. Prepare a San Pedro Sula development plan.
3. Establish institutional capacity for plan implementation.
4. Remove impediments to efficient land and housing market operation.
5. Design and implement mechanisms for financing development.
6. Promote private sector initiatives for low-cost housing development.
7. Develop a monitoring program for reviewing the progress of the strategic land development process and conduct ongoing forward planning and programming.

Implications of the San Pedro Sula example

3.58 The San Pedro Sula LMA helped identify the critical issues affecting the performance of the city's land market. The assessment revealed that the land market was becoming overheated and that real land prices were rising markedly. Projections of land demands for residential,

commercial, and industrial uses clearly suggested that considerable land will be needed for urban development over the next decade. The situation called for a fresh approach to land development planning, including a more aggressive posture by the public sector to stimulate land development and infrastructure financing for urban growth. As a result, it was suggested that the city establish a powerful land development agency, which is now under consideration.

Case Study: The National Housing Authority of Thailand

3.59 Recent experience in Bangkok provides another example of the practical value of a land and housing market assessment. The Bangkok Land Management Study was conducted to assist the National Housing Authority (NHA) of Thailand improve the overall delivery of low- and moderate-cost housing in Bangkok (Bangkok Land Management Study, 1987). The study began by developing a data base of the Bangkok residential land market. Some of the objectives of the study, related to the land and housing market assessment were as follows:

1. Assess the current performance of the NHA's land acquisition and housing development programs with a view to improving the capability of the National Housing Authority to provide low- and moderate-income housing.

2. Provide a thorough understanding of the operation of the Bangkok residential land market so that NHA policymakers can design and implement appropriate land and housing development strategies.

3. Identify specific housing market segments not now served by the private sector that can and should be served by the NHA.

4. Determine appropriate roles for the private sector to deliver low- and moderate-income land and housing development in cooperation with the NHA.

5. Train NHA staff in the use of new tools, computer equipment, and procedures and prepare procedure manuals for various aspects of land and housing market assessment.

3.60 The land market assessment of the Bangkok metropolitan area showed that most of the population growth and residential development between 1979 and 1984 took place in a ring 11 to 20 kilometers from the central business district. Inspection of private housing development projects in the metropolitan area revealed that most projects were located within this ring and that they averaged 24 hectares. However, recent NHA projects in Bangkok were more remote and much larger (averaging 98 hectares). The LMA revealed that the rate of sales of housing decreased the farther the project was located from the central city. Perhaps the most important finding was that private sector developers were "moving downmarket," building and selling housing units below US$8,000. In terms of price, these units were in direct competition with the NHA's product, and they were better located. Assessments of fringe land ownership indicated that the average size of parcels was less than one-half a hectare, which was considerably smaller than the average size of NHA projects.

3.61 The results of the Bangkok LMA suggested that the NHA's current policy of building large housing projects on the fringes of Bangkok were inappropriate for current market conditions.

Based on the LMA, it was suggested that the NHA shift its housing development efforts to smaller-scale projects located closer to the central city. Also, since the private sector was moving into the lower price range, it was suggested that the NHA concentrate on increasing the supply of low-cost land for private housing development and that it not attempt to compete directly with private developers as long as they are moving "downmarket."

3.62 As shown in the Bangkok case, it is quite clear that land market assessments can be used to evaluate the competitive position of government housing programs in relation to private sector projects. The LMA played a critical role in illustrating the need to alter government housing and land development programs.

Using LMAs to Evaluate the Impacts of Government Actions

3.63 The land price data base developed by the LMA can be used to gauge the impacts of government policies, investments, and actions. This section presents a series of techniques for assessing impacts. An example of how infrastructure investments increase the economic value of residential plots is taken from the Karachi case study.

3.64 Fundamentally, there are two types of land market impact assessments: *ex post* measurements of the effects of local public actions, and predictions of land market impacts resulting from future government actions. Within each approach, there are several ways of estimating effects.

Ex post impact assessments

3.65 Over the years, many researchers—including water resource economists, transportation analysts, and housing economists—have attempted to assess how government actions affect land values (see Harris, 1973). A problem encountered in all this work is that public actions are difficult to isolate from the myriad of factors affecting land values. As Bahl, et al. (1973, p. 182) have suggested, "the most difficult measurement problem is that of isolating project effects on land values from all other factors that might influence land values."

3.66 Two devices used to estimate investment effects are econometric models and case study comparisons. The econometric approach relies on regression models to isolate the net impact of a project on land values. Methods for estimating the effects are based on either time-series or cross-sectional data. The time-series method begins by defining the area from which historical land value data are collected. Usually, the analyst identifies some area in which land parcels are assumed to have benefited or been affected by a project. Often service boundaries of a project are used to determine the effects of public investment. As Bahl et al., have suggested, land values can be regressed on factors that affect land values and a dummy variable indicating whether the project was in place can be used to isolate the land-value effects of the project. The regression equation usually takes the following form:

$$PV_t = a + bD_t + C_iX_{it}$$

where PV_t is the land value of a parcel at time t, D_t is a dummy variable equal to zero before the completion of the project and equal to one afterwards, and X_{it} is a vector of factors that influence land

values such as accessibility and zoning. The estimating equation determines values for coefficients a,b,c. The value of b determines the net effect of the project on land value. Either linear or logarithmic forms can be used.

3.67 The main problem with the time-series approach is that it is not capable of incorporating exogenous factors, such as demand shifts, that are not specified in the equation. Another problem is that the impact of the project may extend beyond the area for which the data have been compiled. The first problem causes the estimate to be biased upward, and the second biased downward.

3.68 An alternative to time-series estimation is the use of spatial cross-sectional land value data. In this approach, land value data are collected, and along with other factors, the distance from the project is included as an independent variable. Another variation is to include a dummy variable indicating that the parcel is provided with the project's service, such as water service or infrastructure. In either case, the coefficient associated with distance or service benefit can be interpreted to gauge the impact of the public investment.

3.69 Another way of estimating the effects of public investment on land values is the case study comparison. Instead of using time-series or cross-sectional spatial data, two areas are selected for analysis. One is located adjacent to the project and the other is a "control" case distant from the project. The two cases should be as similar as possible except for the influence of the project.

3.70 As in the econometric approach, regression equations are run. Significant differences in land values that cannot be explained by the nonproject factors are hypothesized to be estimates of the public investment impact. Time-series data can be used in the case comparison approach, and as outlined above, can be used to isolate effects. The regression equation can take the following form:

$$\text{proj}PV_t - {}_{control}PV_t = a + bD_t$$

where ${}_{proj}PV_t$ is land value in the project area at time t, ${}_{control}PV_t$ is land value in the control area at time t and D_t is the dummy variable equal to zero before the project and one afterwards. Independent variables X_{it} can also be incorporated into the case comparison approach, where control site values are subtracted from project site values such as:

$$\text{proj}PV_t - {}_{control}PV_t = a + bD_t - C_i({}_{proj}X_{it} - {}_{control}X_{it}).$$

3.71 Both the econometric and case comparison approach can be used to gauge the impacts of government regulations on land values. For such applications, evaluations are set up to measure the effects of zoning or other development controls.

Predicting land value impacts of future public actions

3.72 The likely impact of public actions on future land values is difficult to predict. Two approaches are suggested, both of which require substantial information about land markets. The first method applies the estimates of past impact assessments to future projects or regulations. In the most literal sense, if the impact of a freeway interchange was found to raise property values by US$25 per square meter, then this figure would be applied to the new project (adjusted for inflation). Obviously this approach is crude, but it provides planners and finance specialists with some estimation.

Table 3–4. Average residential plot prices by level of infrastructure development and year in Karachi (Rs. per square yard)

Level of development	1980	1985	1987	1988
Developed	1,201	1,300	1,618	1,746
Developing	499	572	695	756
Not developed	267	371	429	454

Source: Dowall (1989b)

3.73 The second approach, which applies only to land-use and development regulations, estimates the potential impact of a change in zoning or building controls on land values. For example, if the government is considering changing its land subdivision requirements so that residential projects must contribute a greater amount of land for public facilities, the impacts can be assessed by calculating how the regulatory changes will alter the financial performance of hypothetical projects.

Case Study: Assessing the Impact of Infrastructure Development on Plot Prices, the Case of Karachi, Pakistan

3.74 To gauge the impact of infrastructure deployment on land prices in Karachi, land price data collected from real estate brokers were analyzed to determine whether the plots were located in neighborhoods that were fully developed, were developing, or not developed. These are defined as follows:

> **Developed**: Plots located in neighborhoods where all infrastructure has been installed and all services have been completed.
>
> **Developing**: Plots located in neighborhoods where the development work is under progress—not all of the services and infrastructure are in place.
>
> **Not developed**: Plots located in neighborhoods where no services and infrastructure at all have yet been provided in any part of the scheme.

3.75 As Table 3–4 illustrates, the level of infrastructure development plays a critical role in determining land prices. The ratio between the prices of developed and not-developed plots ranges from 4.5 to 3.8 for 1980 and 1988. To gauge the impact of infrastructure on plot price, a regression model was developed to capture the effects of infrastructure development, using a dummy variable. The dummy variable "developed" singles out plots located in fully developed areas with infrastructure as defined above. To measure the effects of infrastructure, the following log form equation was estimated:

$$lnV_x = c + d + hx$$

where V_x is the estimated plot price at a distance of (x) kilometers to the CBD in 1988 rupees per square yard; c is the constant; d is the dummy variable for developed areas; h is the distance gradient

coefficient; and x is distance in kilometers. For all years, the regression estimates are highly significant; all independent variables have the correct sign. The results provide extremely important findings about the benefits of infrastructure. Based on market conditions prevailing in 1987 and 1988, plots with full infrastructure (cases when the dummy variable "developed" is equal to 1) are valued at approximately 100 percent more than plots without infrastructure. Put another way, the provision of infrastructure doubles land values, after holding constant for distance from the city center. Table 3–5 illustrates these patterns for 1988 by calculating plot price by distance for developed, developing, and undeveloped plots for selected distances.

3.76 These results suggest that the Karachi Development Authority (KDA) is creating substantial increases in land values through its scheme of development programs. By pricing its plots at the cost of land development and by not charging market prices that reflect the added values of infrastructure, the KDA is giving the "development gain" away to allottees. Given the patterns of the actual development of plots and the rapid increase in plot transfers as reflected in the KDA transfer and nonutilization fees, many KDA allottees are simply not building housing on their allotted plots but are selling their plots to cash in on the value gain created by the KDA-constructed infrastructure (Dowall, 1991).

Using LMA information for taxation and fiscal planning

3.77 Until recently, many local governments relied on central government subventions to finance water, sewerage collection and treatment, and roadway projects. But now, burdened by a debt crisis, many central governments are extremely hard-pressed to fund the construction of infrastructure to support land development. Funds must be generated at the local level. One method of raising revenues is to levy taxes, fees, and user charges on those property owners who directly benefit from infrastructure investments. But to efficiently impose these charges it is necessary to measure the costs and benefits of infrastructure projects. Some methods for assessing the impacts of infrastructure investments were presented earlier. This section illustrates how these assessments can be applied to

Table 3–5. Estimates of plot prices by level of infrastructure and distance, 1988 (Rs. per square yard, Karachi)

Distance to CBD, km..	Developed	Not developed
0	3,060.3	1,512.9
10	1,413.0	698.5
20	652.4	322.5

The regression equation presented below was used to estimate the values in Table 3–4.

Year	Constant*	Distance	Developed+	R^2	F Signif.
1988	1,512.9	-.07728	2.02	.491	.0000

All statistics significant at .05 level.

*The constant has been converted from log basis to rupees per square yard. Developed dummy has been converted to a multiple of the constant value.

Source: Dowall (1991)

projects to determine the potential benefits of public investments, using the Karachi Development Authority (KDA) as an example (Dowall, 1991)

Case Study: Determining the Potential Benefits of Public Investments in Karachi, Pakistan.

3.78 The KDA is Karachi's major land developer, charged with the responsibility of developing and distributing residential plots to residents. Over the past ten years, the agency has had a difficult time financing the construction of serviced plots, claiming that it lacked sufficient resources to provide necessary infrastructure. The information gathered by the Karachi land market assessment was used to estimate the market value of fully serviced plots for 1980 and 1985. These two years provide an estimate of the potential revenues that could have been created by the KDA if it had priced the sale of plots at their full development value.

3.79 A specific regression model was developed for 1980 and 1985 to estimate the potential selling price of developed plots. The model reflects the size of plots as well as distance and whether the plot is fully developed with infrastructure. The equation takes the following form:

$$\ln V_x = c + a_1 d_1 + a_2 d_2 + hx$$

where V_x is the estimated plot price in 1988 rupees per square yard; c is the constant; d_1 is the dummy variable for plots larger than 120 square yards; d_2 is a dummy variable for developed areas; a_1 and a_2 are parameters reflecting the proportionate effect of large plots and developed areas respectively; h is the distance gradient coefficient; and x is distance in kilometers of the plot from the city center.

3.80 The equation is used to estimate, plot by plot, the potential revenues that could be achieved if plots were allotted at their full developed value, based on the size and location of plots actually allotted in 1980 and 1985. Table 3-6 presents the results of the regression equation, which provides an estimate of the potential market value of the allotted plots. Table 3–7 compares the actual allotment revenues with estimated developed market values of plots in 1980 and 1985. In 1980, the KDA allotted 2,477 plots by computer ballot. Based on the 1980 allotment price schedules for the schemes in which these 2,477 plots were located, the KDA received a total of Rs 81,300,000. Of this amount, Rs. 12,300,000 was from the allotment of "small plots" measuring less than 120 square yards; the remainder was from larger plots. According to the regression model developed and presented in Table 3-5, the total value of these plots, if fully developed, would be Rs 339,700,000. This is the total market value of the plots with infrastructure, taking into consideration their location and size.

3.81 According to the land disposal regulations, the allotment prices are to be set to fully recover the cost of land development. Thus, in theory at least, the Rs 81,300,000 represent the KDA's cost of developing these 2,477 plots, which comes out to an average of Rs 33,000 each. When these plots are developed and provided with infrastructure, their developed value in 1980 goes up to Rs 339,700,000, for an average of Rs 137,000 per plot. (This estimate does not consider the fact that it might take several years to actually develop these plots. However, it is not unreasonable to assume that, in an inflationary environment, people would pay the full current development value of a plot that will not be provided with infrastructure for two to three years.) Thus, the difference between the Rs 81,300,000 and Rs 339,700,000 represents the development gain created by the KDA.

Table 3–6. Regression model of plot prices by size of plot, distance, and infrastructure development 1980–1985, Karachi*

Year	Constant (c)	Large Plot** (d1)	Developed** (d2)	Gradient (h)	R	F Signif.
1980	546.1	1.314	2.244	-.04175	.372	.0000
1985	692.5	1.636	1.958	-.05767	.494	.0000

* All coefficients are significant at the 0.05 percent level.
**The constant has been converted from log basis to rupees per square yard. Developed dummy has been converted to a multiple of the constant value.

Source: Dowall (1991)

3.82 By setting its allotment prices at cost recovery, the KDA is transferring a development gain of Rs 258,400,000 to the allottees. Since there is no guarantee that the allottees are of low or moderate income, the transfer of this gain serves little social purpose. The KDA would have been better off to charge full development value prices for the allotments and use the additional revenues to build low-cost housing or to cross-subsidize the purchase of plots by accurately targeted low-income households.

3.83 The situation for 1985 is much the same in terms of the relationship between allotment revenues and actual developed market value. A total of 10,210 plots were allotted in 1985. They generated total revenues of Rs 362,700,000, or an average of Rs 35,500 per plot. Using the regression equation estimated for 1985, the projected total development value of these plots, based on their size and location, is Rs 552,300,000, or Rs 54,000 per plot. The difference between development gain and allotment price is Rs 189,600,000, or Rs 19,000 per plot. In this case, plots are being sold at a 34 percent discount of their market value.

3.84 The results in Tables 3–5 and 3–6 illustrate the possible impacts when the public sector produces and allocates land to citizens at prices below market values. The difference in values creates an enormous incentive for speculation and merely transfers the benefits of development gains from the public sector to private individuals. As a matter of public policy, the KDA should consider changing the method of disposing of plots from allotment by balloting to auctioning for all but the smallest plots, which should be carefully targeted for delivery to low-income households.

3.85 By using auctions to dispose of most of its plots, the KDA would vastly improve its financial condition and accelerate the production of schemes and serviced plots. At the same time, a portion of the additional resources could be used to subsidize the production of low-income housing. In addition, the administrative burden would be reduced, allowing the KDA to concentrate on conveying plots to low- and moderate-income groups.

3.86 This example illustrates how the outputs of the LMA can be used for setting the prices of publicly provided plots. The same method can be used to determine the total land value increase created in an assessment district by the development of public infrastructure. Such estimates provide the critical foundation for setting taxes and beneficiary charges.

Private sector applications of LMA information

3.87 There are also many ways of applying LMAs to assist private sector development. In the case of residential development, most developers attempt to estimate the demand for housing units and compare it with supply. The land market assessment, if it catalogs the location and characteristics of projects, can play an important role in helping improve private decisionmaking.

3.88 Surveys of housing and commercial property development projects can be used by developers to gauge the current level of supply by geographic area. If detailed project level information is gathered regarding the types of housing or products currently for sale and is tabulated by price and location, private as well as public developers can compare the current level of supply with demand to determine whether an additional project is feasible.

3.89 The level of housing or property demanded in the market can be determined by the rate of sales of housing units or commercial units over the past year. This level of "absorption" will suggest that so many housing units or square meters of office or commercial space can be sold in the marketplace over the next year. If the current level of units available for sale in the market exceeds a full year's amount of absorption, then the market referred to in Table 3–7 may be oversupplied. An example of a housing study conducted in Bangkok using the results of the Bangkok land market assessment illustrates this application.

Gauging housing market competition in Bangkok's northern corridor

3.90 In order to determine the level of competition in Bangkok's northern corridor market, an extensive survey was made of projects in the area. Based on a windshield survey, 110 land and housing projects were identified in the market area and a sample of 40 projects were selected for closer examination. The managers of each of the 40 projects were interviewed to determine which types of units were for sale, their prices, rate of sale, financing characteristics, project size, location, and mix of units.

Table 3–7. Comparison of KDA allotment revenues and developed value of plots allotted by KDA in 1980 and 1985, in 1988 rupees, Karachi

	1980	1985
1. KDA plot allotment revenue		
small plots	12,300,000	142,700,000
large plots	69,000,000	220,000,000
Total KDA allotment revenue	81,300,000	362,700,000
2. Developed market value of plots		
small plots	58,400,000	171,300,000
large plots	281,300,000	381,000,000
Total developed plot value	339,700,000	552,300,000
3. Potential additional revenues (2-1)		
small plots	46,100,000	28,600,000
large plots	212,300,000	161,000,000
Total potential revenues	258,400,000	189,600,000

Source: Dowall (1991)

Table 3–8. Summary of the types of housing units on the market in the northern corridor, April 1987

Type of unit	Planned	Percent of total	Sold	Percent of total
Detached	7,996	55.0	2,395	34.2
Duplex	1,188	8.2	826	11.8
Townhouse	4,853	33.4	3,418	48.8
Shophouse	499	3.4	365	5.2
Total	14,536	100.0	7,004	100.0

Source: Bangkok Land Management Study (1987)

3.91 The 40 projects, accounted for approximately 14,500 planned units, of which 7,004 units or 48 percent have been sold (see Table 3–8). Assuming that these 40 projects accurately reflect the 110 projects currently on the market, approximately 19,300 units have been sold out of a total of nearly 40,000 planned units. These sales took place over a period of four years at an annual rate of 4,800 units per year. The number of planned units not sold, 21,000, is equivalent to about four years' supply.

3.92 The bulk of the houses sold in the northern corridor as of April 1987 are townhouse units (49 percent). Detached units were the next most frequent type of unit (34 percent). Duplexes and shophouses were less frequent, with 11.8 percent and 5.2 percent, respectively.

3.93 The typical project was well-located, averaging a mere 600 meters from a main road. The projects averaged 24 hectares with an average of 371 planned units. As of April 1987, these projects had sold an average of 196.5 units or 53 percent of their planned production. Most of the projects provided a range of units averaging four model types per project. Overall, four types of units are currently being constructed in the northern corridor: detached houses, duplexes, townhouses, and shophouses.

Table 3–9. Characteristics and features of units for sale in the northern corridor, April 1987

Characteristics	All types	Detached units	Duplex units	Townhouse units	Shophouse units
Plot size (sq. m.)	42.0	56.3	38.5	21.7	16.3
Floor area(sq. m.)	93.9	104.7	74.4	76.3	136.3
Number of stories	1.7	1.6	1.6	1.8	3.0
Bedrooms	2.5	2.8	2.3	2.3	1.3
Toilets	1.7	1.8	1.5	1.6	2.0
Percent with separate kitchens	75.8	88.9	84.2	63.3	28.6
Percent with separate living rooms	79.6	88.9	89.2	71.4	0.0
Percent with maid's quarters	10.8	18.5	10.2	0.0	0.0
Percent with covered parking	71.3	81.5	94.7	65.3	0.0

Source: Bangkok Land Management Study (1987)

3.94 Table 3–9 illustrates the characteristics of the units by type. The size of plots ranged from 65.2 to 225.2 square meters for shophouse and detached units, respectively. The most common size of plot was 86.8 square meters for townhouse units. Duplex units have plots averaging 154 square meters.

3.95 In terms of building size, the units ranged from 74.4 square meters to 136.3 square meters. These units were large, reflecting the preferences of the private sector to the middle- and upper-middle-income segment of the market. With the exception of shophouses, the units are from one to two stories high and have an average of 2.5 bedrooms, and 1.7 toilets per unit. The majority of the units (75.8 percent) had separate kitchens and covered carports (71 percent). Very few of the units had separate accommodations for maids.

3.96 Financing for the units was fairly consistent across all projects and types of units. For all projects, the average downpayment made was 27.2 percent of the purchase price. The downpayment was normally made over a five-to six-month period. Long-term mortgages averaged 176 months (14.7 years) and carried an interest rate of 11.8 percent.

3.97 The prices of the units offered for sale in the northern corridor area ranged from US$5,200 to US$25,230 (the average was US$20,360). The selling price of units (total price including land and house) ranged from US$168 per square meter for shophouses to US$241 per square meter for detached units. Table 3–10 illustrates the distribution of planned and sold units by price category.

3.98 The most striking finding illustrated in Table 3–10 is the oversupply of units in the US$16,000 to US$18,000 price range. Developers were planning more than 6,000 units in this range and as of April 1987 they had only sold 817 units, or 13.5 percent of the supply. As a result, nearly 70 percent of the unsold units were priced in this range. The units that sold well were those priced between US$10,040 and US$15,900 and over US$18,000.

Table 3–10. Distribution of planned and sold units in the northern corridor by price, April 1987

Price in category (US$)	Units planned	Percent of total	Units sold	Percent of total	Number on market	Percent of total
5,200–7,999	946	6.5	333	4.8	613	8.2
8,000–9,999	491	3.4	205	2.9	286	3.8
10,000–11,999	853	5.9	644	9.2	209	2.8
12,000–13,999	1,318	9.1	1,148	16.4	170	2.3
14,000–15,999	1,421	9.8	1,137	16.2	284	3.8
16,000–17,999	6,048	41.8	817	11.7	5,231	69.9
18,000–19,999	888	6.1	736	10.5	152	2.0
20,000–21,999	466	3.2	399	5.7	67	0.9
22,000–23,999	612	4.2	522	7.5	90	1.2
over 24,000	1,443	10.0	1,063	15.2	380	5.1
Total	*14,486	100.0	7,004	100.0	7,482	100.0

* Total reflects 50 unit non-response.

Source: Bangkok Land Management Study (1987)

Table 3–11. Sales rate by the type of housing unit in the northern corridor, April 1987

Housing type	Sales per month
Townhouse	6.8
Duplex	3.4
Shophouse	2.8
Detached	2.4
Average (all types)	3.4

Source: Bangkok Land Management Study (1987)

3.99 The market for units below US$10,000 was just starting to emerge and few units had sold as of April 1987. In terms of the supply of units in the "pipeline," units priced below US$10,000 accounted for 8.2 percent of the market.

3.100 The project survey revealed the rate of sales of units by type and price range. Table 3–11 illustrates the rates of sales by type of unit. Overall, units sell at a rate of 3.4 per month (for a total of 136 units per month or 1,632 units per year for the 40 projects). As this table shows, the best-selling type of unit was the townhouse, which sold at an average of 6.8 units per month. Duplexes were the next best-selling model, averaging 3.4 units per month.

3.101 Table 3–12 illustrates the pattern of sales rates per month by the price of the unit. The fastest selling units were those priced below US$10,000 and between US$18,000 and US$20,000. These sales rates for the lower end of the market suggest that the demand for lower-priced units is strong.

3.102 The results of the project survey indicated a strong and demonstrated demand for housing units priced below US$10,000 in the northern corridor of Bangkok. Units produced in this price range sold well, at about twice the rate of the overall housing market. The survey helped the development community recognize the potential profitability of building houses in this price range in the northern corridor.

Table 3–12. Sales rate of units by price in the northern corridor, April 1987

Price category in $US	Sales per month
5,200–7,999	6.1
8,000–9,999	5.0
10,000–11,999	2.1
12,000–13,999	3.8
14,000–15,999	5.6
16,000–17,999	4.6
18,000–19,999	8.0
20,000–21,999	3.8
22,000–23,999	5.8
over 24,000	3.0
Average	3.4

Source: Bangkok Land Management Study (1987)

Conclusions

3.103 The land and housing market assessment is an essential first step toward making local land and housing markets more efficient. The information base generated by the assessment can be used to gauge market performance, identify future needs for infrastructure, assess housing affordability, and assess the impacts of public policies and actions.

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ANNEX A: JAKARTA BROKER SURVEY METHODOLOGY

Notes on Methodology

A1.1 The kelurahan, a governmental unit overseen by an administrative chief or Lurah, is the lowest level of local government in Indonesia. The city of Jakarta consists of 256 kelurahan (excluding the four kelurahan of the offshore islands); these range in area from less than 30 hectares in the most densely settled parts of the city to more than 1,000 hectares on the urban periphery, and in population from roughly 3,000 to more than 60,000 persons.[1]

A1.2 For studying overall trends within the residential land markets of Jakarta, we considered the kelurahan to be a sufficiently small geographical area to serve as the basis for our sample. Within each kelurahan surveyed, we sought to determine typical or average values for various types of land plots. The wide variation in sizes of kelurahan does not present a problem in this regard if one considers that the largest kelurahan are at the edge of the city, where land prices tend to be more homogeneous than in the center of the city. Nonetheless, there is generally a wide variation in land prices within any one kelurahan.[2] The particular characteristics of land which we examined in this study are intended to cover these ranges of values.

A1.3 It was decided at the outset that we would collect data on land tenure, plot size, and infrastructure, as each of these variables is generally considered to be an important determinant of land price. To keep the questionnaire manageable, it was decided to limit the number of levels or types for each of these variables to three or four. Initial selection and precise definitions of the categories of tenure, plot size, and infrastructure were arrived at after open-ended interviews with six land brokers in the outer districts of the city, followed by long discussions with the surveyors. The purpose of this was to determine categories that would encompass important aspects of the three variables as they affect market prices. Detailed definitions of the categories used for infrastructure and tenure are given below in a subsequent section. The variable plot size was not used in the analysis.

A1.4 One surprising aspect of the residential land markets in Jakarta is the general lack of a difference in land prices per square meter due to the size of plot being considered. At the outset, we chose standard sizes for our hypothetical lots to be 70, 120, and 200 square meters, representing, respectively, small, medium, and large lots such as one would find in the market. In our initial discussions with land brokers, we were told repeatedly that we would not find any difference in price within this range of plot sizes. From these interviews, we determined that, in general, one would not be able to obtain a price discount unless one bought a plot of at least 1,000 square meters in area. Therefore, for the survey, we chose 100, 1,000, and 2,000 square meters as the hypothetical sizes of the plots. In using sizes as large as these, we were stepping beyond the bounds of the residential markets per se, although one might argue that lots of 1,000 or 2,000 square meters would eventually, if not immediately, be subdivided for resale as housing lots.

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1. Population figures are taken from the 1980 Census, and land area estimates are from the DKI Jakarta Structure Plan. These data are compiled in Gardiner, Peter. 1989. *The Demography of Jakarta in the 1990's: A Review of the DKI Jakarta Structure Plan*. Jakarta: Huszar, Brammah and Associates.

2. Differences between the highest and lowest values of land per kelurahan in our sample ranged from less than 50 percent for the most homogenous kelurahan to more than 400 percent for the most diverse.

A1.5 Unlike the categories for tenure and infrastructure—which, when subjected to table analysis against ordinal categories of price proved to have statistically significant distributions at the .01 level—the categories of plot size did not exhibit good distributions. Although the values for this variable were not useful for analysis, it is at least noteworthy that all of the premia associated with smaller plots have positive signs, meaning that within none of the geographical areas covered here are per meter prices consistently higher for larger plots.

A1.6 Once the variables were defined and questionnaires developed, a pretest was given, where each surveyor covered or attempted to cover one kelurahan (e.g., three qualified brokers). The pretest was undertaken not only to test the questionnaire and to accustom the surveyors to methods of interviewing, but also to determine ways of locating brokers to interview. The proper means for locating brokers was a topic of great discussion before the pretest was undertaken, as the surveyors were of the opinion that brokers might be reluctant to participate in a survey that appeared to be "official," as the status of their profession falls into a legal gray area. From the pretest, we determined that brokers were actually quite easy to locate, as they generally have a high profile in the communities they work in and are well known to most residents. We had no problems with uncooperative informants; nonetheless, we avoided asking them any questions about their actual land brokering activities other than the initial qualifying questions. We did not want the brokers to feel that their personal business activities were being scrutinized. The only significant change to the questionnaire that resulted from the pretest was a rewriting of the qualifying questions, which had previously been based on the number of transactions the broker was involved in during the course of the year, a measure that was harder to standardize across the range of participating brokers than was the proportion of their income earned from brokering work.

A1.7 The five surveyors who carried out the interviews all had prior experience administering surveys, either from working on household surveys with Jakarta's Kampung Improvement Program, or, in the case of one surveyor, through coursework and academic research in his training to become a sociologist. Nonetheless, the conversational approach to interviewing that we employed was a departure from their previous household survey work, which had generally been based on specific questions and answers. Basic instructions were given to the five surveyors in written form, although more thorough information was communicated through a series of meetings prior to administering the survey.

A1.8 Throughout the course of the interviews (from August 18 to October 6, 1989), the surveyors worked independently of each other, dividing up the four outer districts of the city (initially excluding Central Jakarta) among themselves, with two surveyors starting out in South Jakarta, as this was the area that initially had the largest number of kelurahan to cover. After the majority of the kelurahan in South Jakarta were surveyed, one of these two surveyors concentrated on kelurahan within Central Jakarta. Although the surveyors went out singly to the field, they often made contact with well-connected brokers who would accompany them to meet other land brokers. The surveyors were instructed to conduct interviews one broker at a time, in isolation from other brokers, so as to decrease the likelihood of biased appraisals.

A1.9 The questionnaire was developed for recording information. All of the interviewers, out of personal preference, chose not to take the questionnaire forms with them to the interviews, using notepads instead so as not to inhibit the conversational tone of the interviews nor to unintentionally intimidate their informants. After completing an interview, a surveyor would write up the results, transferring his information from notepad to recording sheet.

A1.10 Initial selection of the kelurahan to be covered was made by examining a standard map of the city of Jakarta and estimating the amount of open land in each kelurahan. If more than roughly 20 percent of a kelurahan was indicated on the map as being open land, it was assumed that we would have no trouble finding informants, as most likely there would be thriving land markets. The first 68 kelurahan were determined in this manner, primarily along the edges of the city. Our intention was to progress toward the center of the city from these kelurahan until we would not be able to find people knowledgeable about the price of empty land. Although at the outset we assumed that there would be areas that are built up to the point where it would be difficult to find land brokers, in practice there are enough dispersed empty lots for brokers to be able to make estimations, even in some of the inner city locations. In a few of the most central kelurahan, price appraisals were based wholly or partly on informants' knowledge of prices for properties that had been sold with buildings of negligible value.

A1.11 The survey eventually covered 128 kelurahan (50 percent of the total in the city, excluding four located on the offshore islands). Three categories each of three variables gave a possibility of 27 different types of plots to be appraised for each kelurahan. Since brokers were asked to make appraisals for current prices as well as for each of the past two years, the total number of possible values that could be determined for each kelurahan is 81, giving a total of 10,368 price appraisals to be entered into the data set. In practice, however, approximately 18 percent of these values were unobtainable, inasmuch as not all of the types of land that were examined are available in all the kelurahan.

Notes on Infrastructure

A1.12 The variable we are using as a measure of infrastructure availability (infrastructure level) is a categorization of lands that originated within the market, for it is used by land brokers themselves. From our initial interviews, it was apparent that brokers use a three-part classification, based primarily on the distance of the plot from a main road, to indicate the marketability of a plot of land. Although the definitions of these three "classes" (the term used by brokers) of land are not precisely the same throughout the whole of Jakarta, there are enough similarities in definitions from various parts of the city that we were able to define usable categories for this survey.

A1.13 Class I lands are considered in practice to be those close to a main, paved road, meaning in some parts of Jakarta less than 50 meters away and elsewhere, less than 100 meters. Definitions of Class II range from 50-300 meters to 100-500 meters, with the greater distances used in more outlying parts of the city. Class III lands are those that are more than 300 meters or more than 500 meters away from a main road. We chose as standard distances for our hypothetical plots the following values: Class I refers to a plot 50 meters from a main road, Class II is 200 meters away, and Class III is more than 500 meters away. To further distinguish the three categories, the surveyors included the possibility of flooding and poor water quality as related conditions. These are secondary aspects of land quality that brokers also include in their working definitions of the three classes of land.

A1.14 In our analysis, we took class of land quality as derived from the brokers' use of the term to be a reasonable proxy for the level of infrastructure available. Therefore, the terms used in the survey have been redefined for the analysis: "high infrastructure level" replaces "Class I," "medium infrastructure level" replaces "Class II," and "low infrastructure level" replaces "Class III."

this variable is seemingly only a measure of accessibility of a plot, in essence it is also a general measure of the quality of infrastructure provision. Types of infrastructure other than roads, which in other contexts would affect the value of a plot of land, appear not to be important considerations in Jakarta. There are a variety of reasons for this. Electricity, for example, is already available throughout the whole of DKI Jakarta (or at least in every area covered by our survey), whereas there is no closed sewerage system anywhere (households are essentially autonomous in this regard, using either pit latrines, septic systems, or the open drainage system for disposal of wastes). Household autonomy also characterizes water use, as more than 78 percent of Jakarta households obtain their water from wells. Only 14 percent rely on the public water supply for drinking water, an indication of the limited extent of this facility (Struyk, et al., 1989). Jakarta is well served by an extensive low-cost public transportation network; because access to this system is directly related to the availability of roads, the infrastructure level variable provides a reasonable measure of this.

A1.15 In order to test whether the variable of infrastructure level is adequate as a broad measure of infrastructure provision, we also asked the brokers whether certain types of infrastructure or urban services would be available at the various types of hypothetical plots we were asking about. For this question we used nine types of facilities: piped water, garbage collection, drainage, sanitation (actually a second measure of the quality of drainage), electricity, paved roads, sidewalks, neighborhood security system, and proximity to public transportation. By breaking down the answers to this question by the infrastructure level variable (Table A–1), we were able to arrive at a more detailed understanding of this variable.

A1.16 In general, each of the three values (high, medium, and low) represents a lower level of neighborhood services relative to the preceding level. Piped water and sidewalks stand out as the only two services that are not available at the majority of high infrastructure level plots, whereas electricity and security are available everywhere, irrespective of infrastructure level. For the low infrastructure level category, the striking drop-off in the availability of transportation, paved roads, and sidewalks relative to both of the other categories is its strongest distinguishing characteristic.

A1.17 The nine types of infrastructure or services were also examined in a series of regression analyses to determine their relative contribution to an estimation of land price. One result of these regressions is that only three facilities—paved roads, sidewalks, and public transportation—are

Table A-1. A comparison between infrastructure level and specific types of infrastructure services

Percentage of surveyed Kelurahan where services are available			
	Infrastructure level		
Infrastructure service	High	Medium	Low
Piped Water	48	44	35
Garbage Collection	96	84	66
Drainage	94	76	55
Sanitation	85	70	51
Electricity	100	100	100
Paved Roads	98	62	12
Sidewalks	30	11	3
Security System	100	100	99
Public Transport	100	88	37

useful as predictors of price. Differences in the accessibility of these facilities are already contained within the infrastructure level variable.

Notes on Tenure

A1.18 A variety of forms of land tenure claim are used in Jakarta. In addition to the five types of primary land rights established by the Basic Agrarian Law (BAL) in 1960, other categories are used in practice to distinguish lands that have yet to be registered with the National Land Agency (Badan Pertanahan Nasional or BPN). In this survey, we sought to reduce this variety of land rights to three principal categories, designated here as "registered" (i.e., registered with BPN), "tax receipt" ("Girik," in Indonesian), and "weak claim." These categories were arrived at after initial consultations with land brokers in various parts of the city and are intended to reflect the most significant aspects of tenure claim as they affect land price and market activities.

A1.19 The distinctions between these three categories reflect the primary differences between the types of land claim that exist in practice; nonetheless there was some unavoidable variation in how these categories were used in the survey. For example, "registered" is meant to convey the idea of the most secure obtainable claim to land by individual landowners, and for most of Jakarta this means a claim of Hak Milik (right of ownership) under the BAL. In certain kelurahan in the center of the city, however, the high degree of governmental ownership of land (Tanah Negara) means that the highest available right for individuals is Hak Guna Bangunan (HGB, right of building), which in relative terms is a weaker claim of ownership than Hak Milik. This is the case in seven of the 128 kelurahan in our sample. We cannot speculate as to whether land prices in these areas would increase if Hak Milik were available, but since these are also the kelurahan with some of the highest prices in the city, it is reasonable to assume that differences in premia between Hak Milik and HGB would be minor relative to the price differential between registered and unregistered lands.

A1.20 A method that is often used for proving continuity of tenure when applying for an official land registration certificate is the tax receipt. Because of this, it is common for people in Jakarta to use tax receipts as de facto proof of ownership. Brokers even use the term "Hak Girik"—literally, "tax receipt right"—when speaking of lands that are secured in this manner. Our working definition of this category is that a buyer of such land would have a strong enough claim to ownership through the accumulation of land tax receipts that he could apply to register the land with BPN.

A1.21 Our third and lowest tenure category, "weak claim," is intended as a catch-all category for a variety of tenure claims that are weaker than tax receipt (i.e., proof of ownership is insufficient for directly applying for a certificate from BPN). An example of such a claim is the common case where the only proof of ownership of a property is a sales receipt between buyer and seller. The use of this category presented a problem in 17 of the kelurahan in Kecamatan Pasar Rebo (East Jakarta), where land brokers insisted that lands could not change hands without there being a claim at least as strong as Girik.

Instructions for Surveyors

JAKARTA LAND MARKET STUDY

I. The Research Process

A. Methodology

The purpose of this research is to determine the distribution of market prices of residential land in DKI Jakarta over the past three years. The purpose of this research is to compile as large a distribution of market prices as possible so as to be able to analyze the prices of land relegated specifically for housing development. The areas targeted for study are the locations for housing development in the newly developing parts of DKI Jakarta. These locations will be chosen from the various kelurahan of the city.

The people we will be questioning are those who have wide experience with prices, land quality, and the administration of land sales, that is, market intermediatries or brokers. Brokers usually maintain connections with each other within specific locations of their work, such as one kelurahan or more. Every kelurahan office contains land transaction records; however these stated prices are usually lower than the true market prices. At these offices you may also be able to obtain a list of names and addresses of brokers from the Lurah.

Kelurahan will be selected for study on the baseis of an examination of maps, visual surveys, and information from the people being interviewed. Criteria for the selection of kelurahan will b ewhether they show signs of recent development of housing and whether empty land may still be found for the development of settlements.

After a list of kelurahan is selected and the names of brokers are obtained for each kelurahan, the surveyor will contact the first person on the list and ask him the set of qualifying questions. If his answers to these questions are satisfactory (indicating that he has worked as a land broker for a sufficient length of time, etc.), he will then be asked to appraise typical land plots with certain characteristics. If the broker's responses to the qualifying questions are unsatisfactory, he will not be asked the appraisal questions, and the next broker on the list will be contacted. This process will continue until three land brokers have been independently interviewed in that kelurahan. The process will be repeated until more than 100 kelurahan are studied.

It is important that when a land broker is questioned, he understands that the plots he is appraising are only typical plots that he is asked to imagine, and not real plots. If the broker believes that the interviewer wants to know the price of real lots, he may assume that the interviewer is interested in buying the land, and therefore the price the broker gives may be inflated.

A number of characteristics distinguish the types of plots that will be asked about (as discussed below). However, for the sake of keeping to a minimum the variables that may affect the price of land, we should explain to the broker who is being interviewed that all plots that are asked about share the following standard characteristics:

1. They are located on streets that only have residential uses, and no businesses.
2. They are located in the middle of a block and not at a more expensive corner location.
3. The street width for all plots that are asked about is assumed to be approximately 3 meters.
4 There are no buildings existing on the plots.
5. A plot is purchased in a single payment and not bought on credit extended by the seller.

After three brokers have been interviewed in a particular kelurahan, the middle value of the three responses will be chosen as the representative land price for that kelurahan, rather than calculating an arithmetic mean. The reason for this is that we can assume that in at least a few cases one of the broker's responses may be exceptionally high or low (i.e., outliers). By choosing the middle value of the three brokers' responses, we avoid the negative effects that such outliers have upon the data, whereas calculating an arithmetic mean would include such biases.

B. Variables

Values for the following variables are to be obtained from these questions:

Y = Price of land (rupiah per square meter).

X1 = Location (distance from city center—Monas). This is a variable that will be based on the list of the selected kelurahan, that is, the location (kelurahan) where the broker operates. This information will be checked in the qualifying questions. The distance will be measured from a map of the city.

X2= Plot Size. Values chosen for plot size are:

1. 100 square meters
2. 1000 square meters
3. 2000 square meters

X3= Land Quality. From initial interviews, it has been determined that the quality of infrastructure that is available at a particular plot is by and large not a consideration in determining price. The major exception to this is the accessibility of the plot (i.e., the distance to a paved road); to some extent the quality of the plot is also determined by the plot's susceptibility to flooding and the quality of water available on the plot. Three classes of quality are used here; these generally correspond to classes of land quality that are used by land brokers in Jakarta. These classes are used informally by the brokers and undoubtedly the precise definitions of each will not be consistent throughout the city. Nonetheless, if we base our definitions of categories on those used by the brokers, communication during the interviews will be enhanced. The categories are defined as follows:

Class I: The plot is located within 50 meters of a paved road, and is near other plots that have already been developed. There is a low probability of flooding and good-quality water may be obtained on the plot.

Class II: The plot is located approximately 200 meters from the road, and there are fewer developed plots nearby. There is a greater likelihood of flooding (although it is still low), and usable water may still be obtained on the plot.

Class III: The plot is more than 500 meters from the main road and there are rarely other developed plots nearby. There is a good likelihood that the plot will flood during the rainy season, and the quality of obtainable water may be less than satisfactory. (Note: this class of quality may not apply in all of the areas being surveyed.)

X4= Tenure Type. Three categories of tenure type will be examined here. The distinction between the three categories is the strength of the buyer's ability to claim freehold (i.e., Hak Milik) status for the land. Among the various claims to land rights that exist in Indonesia, the official recognition of Hak Milik status may be surmised to be the claim to land that has the greatest effect on the price of land. The first category is a certificate from Agraria (BPN), which gives the buyer the most secure claim of Hak Milik status. The second category includes sufficient Girik (tax receipt) certificates in the transfer of land to allow a claim of Hak Milik status to be made on the land. This is referred to here as Hak "Girik." The third category consists of all other claims to land that are weaker than Hak Milik. In brief, the categories are:

1. Hak Milik, which is guaranteed by a certificate from Agraria.
2. Hak "Girik," which is sufficient to attain Hak Milik status.
3. Less than Hak Milik status.

II. Questions

Instead of asking a series of specific questions, the interviewer is to have a conversation with the land broker. There are too many different types of plots to ask for information on each one separately. Not all of the combinations will make sense to the land broker (i.e., there may be no such thing as a 100-square-meter, Class III lot with an Agraria certificate in that kelurahan). Furthermore, we are asking for an appraisal of land value, and not an opinion; the answers that the land brokers give must be based on knowledge derived from experience. Do not press the broker for an answer that you or they do not feel sure of. It is acceptable for squares on the recording sheet to be filled with "Doesn't Know.")

Here is an example of a conversational approach to the interview: Since you are familiar with the prices of plots in (name of area of study), you are a good person to ask about the prices of certain types of plots for building houses on. If a typical buyer, one without connections such as family ties, came to a land seller in this area and wanted to buy a 100-square-meter plot of empty land with a Class III quality of land (give definition of quality classes as explained above), how would he be expected to pay if he was not able to make a claim of Hak Milik? How much would he pay if he received sufficient "Grik" to make a claim of Hak Milik status? Or an Agraria Class II quality, but the buyer was not able to claim Hak Milik status? (This line of questioning would be repeated for each plot size, and then for each of the past two years, 1988 and 1987). The broker would then be asked about other kelurahan that he had said he had experience in.)

Jakarta Land Price Survey Recording Sheet

Qualifying questions (concerning Broker's Expenses)

Interview date _____ Name of Interviewer _____

Number _____ Name of Kecamatan _____

	Yes	No
1. How long have you worked as a land broker? More than five years?		
2. Approximately what percentage of your income was derived from your work as a broker within Jakarta between July 1888 and July 1989? More than 50 percent?		
3. Approximately what percentage of your income was derived from your work as a broker within Jakarta between July 1887 and July 1988? More than 50 percent?		
4. Approximately what percentage of your income was derived from your work as a broker within Jakarta between July 1886 and July 1987? More than 50 percent?		
5. Are the majority of lands you deal with used for building houses or for other uses? Majority for building houses?		
6. Are the majority of lands you deal with empty land or plots with buildings or houses? What percentage of the land sales you have been involved in involve truly empty land? More than 50 percent?		

INTERVIEWER: If all the questions were answered YES, proceed with the interview. If there was a question which was answered NO, do not continue the interviews.

Jakarta Land Price Survey Recording Sheet

Questions for ascertaining the location of brokers operations.

Interview date _____ Name of Interviewer _____

Number _____ Name of Kecamatan _____

Name of Kelurahan _____

1. In which kelurahan in Jakarta did you work as a land broker between July 1988 and July 1989. Please list below.

_____

_____

_____

2. In which kelurahan in Jakarta did you work as a land broker between July 1987 and July 1988. Please list below.

_____

_____

_____

3. In which kelurahan in Jakarta did you work as a land broker between July 1987 and July 1988. Please list below.

_____

_____

_____

INTERVIEWER: Proceed with a set of appraisal questions for each kelurahan which is listed for all three years.

Jakarta Land Price Survey—Recording Sheet

Interview date _____ Name of Interviewer _____

Number _____ Name of Kecamatan _____

Name of Kelurahan _____

Plot Size 100m^2 Price: x Rp. 1,000

1989	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

1988	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

1987	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

Jakarta Land Price Survey—Recording Sheet

Interview date _____ Name of Interviewer _____

Number _____ Name of Kecamatan _____

Name of Kelurahan _____

Plot Size 1,000m^2 Price: x Rp. 1,000

1989	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

1988	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

1987	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

Jakarta Land Price Survey—Recording Sheet

Interview date _____ Name of Interviewer _____

Number _____ Name of Kecamatan _____

Name of Kelurahan _____

Plot Size 2,000m^2 Price: x Rp. 1,000

1989	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

1988	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

1987	Land Quality		
Tenure (Land Right)	Class I	Class II	Class III
Agraria Certificate			
Girik Receipts			
Weak Claim			

Jakarta Land Price Survey—Recording Sheet

Interview date _____ Name of Interviewer _____

Number _____ Name of Kecamatan _____

Name of Kelurahan _____

I would like to ask about the types of infrastructure and facilities which are available at the location of these plots of land.

Type of Facility	Land Quality	Yes	No
1. Piped water (public supply)	Class I Class II Class III	_____ _____ _____	_____ _____ _____
2. Organized garbage collection	Class I Class II Class III	_____ _____ _____	_____ _____ _____
3. Sanitation	Class I Class II Class III	_____ _____ _____	_____ _____ _____
4. Electricity	Class I Class II Class III	_____ _____ _____	_____ _____ _____
5. Paved roads	Class I Class II Class III	_____ _____ _____	_____ _____ _____
6. Sidewalks	Class I Class II Class III	_____ _____ _____	_____ _____ _____
7. Sufficient drainage	Class I Class II Class III	_____ _____ _____	_____ _____ _____
8. Neighborhood	Class I Class II Class III	_____ _____ _____	_____ _____ _____
9. Nearby public transportation	Class I Class II Class III	_____ _____ _____	_____ _____ _____

ANNEX B: The Use of Satellite Images for Urban Planning

B1.1 Effective urban planning requires access to accurate and continually updated information concerning the changing conditions of urban areas. Unfortunately, in most cities of the developing world accurate and up-to-date data on land use are not available, making the planning and programming of infrastructure difficult. Originally, remote sensing using satellite media was not suitable for urban applications because of the relatively poor resolution provided (80 meters by 80 meters). Satellite images such as LANDSAT, have been generating land resource data over the past 16 years for such purposes as agriculture, forestry, and mining, **but until** recently the resolution was not sharp enough for urban use. A new generation of remote sensing systems with resolutions equal to 10 meters by 10 meters in pan chromatic mode and 20 meters by 20 -meters in multispectral mode has now made urban applications possible. Since 1989 Spot I, a satellite financed by France, Belgium and Sweden, has been sending images with eight times the spatial resolution of LANDSAT and other civilian satellites. Spot's resolution is generally adequate for urban planning applications as it roughly captures most urban features of concern: such as streets, buildings, and plot layout boundaries.

B1.2 In addition, advancements in microcomputers and related hardware and software have made the urban applications of remote sensing much more affordable and accessible to urban planners, engineers, and policy makers. These new technological advances now provide a relatively inexpensive solution to some of the problems of charting urban change in fast-growing cities of the developing world.

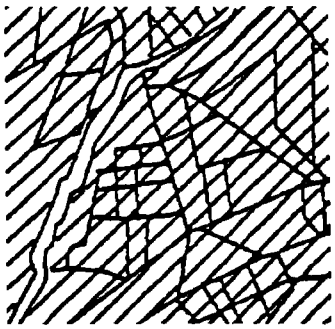
B1.3 The SPOT satellite is in continuous orbit and provides up-to-date images of cities around the world. Changes can be detected by purchasing two images covering two points in time. The images can be accessed commercially without the lengthy security clearances needed for aerial photography. It normally takes about 30 days to obtain a satellite image. One image covers about 60 square kilometers. In some cases, the satellite can be programmed to obtain special images such as stereographic pairs and composite images of an area normally requiring two separate images.

B1.4 Film or transparency of an image can be enlarged through normal photographic processes to scales of 1:100,000 down to 1:20,000. The cost of one pan chromatic (black and white image) is approximately US$1,600, far less than a set of aerial photographs.

B1.5 Prints of SPOT images at 1:100,000 scale can be used to identify major road networks. At a scale of 1:25,000, dense and loose grid patterns of various types of housing settlements can be differentiated, such as those illustrated in Figure B1–1. Industrial and commercial areas can also be identified as well.

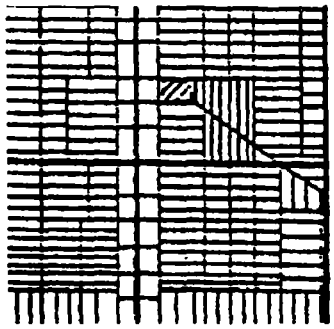
B1.6 For further information on using SPOT images for land use planning, see Bertaud (1989).

Figure B1–1. Different types of residential development in Karachi, Pakistan.



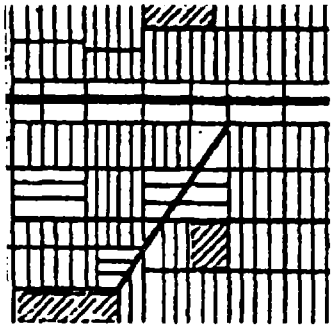
Type A (Katchi Abadi)
Squatter Settlement

Average plot size(m^2)	75
No. of persons/plot	6.5
Percent circul. & open space	25
Density persons/ha	650



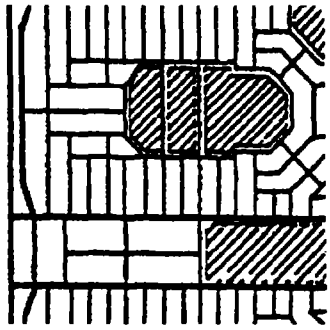
Type B (City Center)
HIGH DENSITY

Average plot size(m^2)	90
No. of persons/plot	8.5
Percent circul. & open space	25
Density persons/ha	625



Type C (North-East Karachi)
MEDIUM DENSITY

Average plot size(m^2)	150
No. of persons/plot	6.5
Percent circul. & open space	40
Density persons/ha	260



Type D (North Karachi)
LOW DENSITY

Average plot size(m^2)	350
No. of persons/plot	6.5
Percent circul. & open space	45
Density persons/ha	102

ANNEX C: BANGKOK HOUSING PROJECT SURVEY

1. Name of Surveyor _____

2. Date of Interview _____

3. Project Name _____

4. Project address (street name and/or intersection) _____

_____

5. Name of project person interviewed _____

6. How many years has interviewee worked at project? _____

7. Telephone number of person interviewed _____

8. Location of project (name of district and kwaeng) _____

_____

9. What is the size of the project in rat? _____

10. What is the total number of housing units to be built in the project? _____

11. Will the project contain commercial and office uses? If yes, please describe them in terms of use and constructed area (square meters). _____

_____

_____

_____

12. Describe the features of the project. What amenities does the project contain?: >tennis courts, swimming pools, other sports facilities, parks, fishponds, schools, temples, shopping areas, post offices, etc. List each feature.

_____

_____

_____

13. What is the source of drinking water for the project? Deep tube wells for entire project? Municipal water? Individual wells for each house? _____

_____

14. What kinds of infrastructure are provided for the project? In terms of electricity, telephone, sewerage treatment (sewer lines to municipal system of septic/cesspools) _____

_____

15. How far is the project from the center of Bangkok (Hua Lampong railroad station) in kilometers? _____

_____

16. How far is the project from the nearest major road (Thanon)? _____

_____

17. Is there public transportation from the project to major employment and industrial centers in Bangkok?

_____

18. If there is public transportation, how far is the nearest bus stop from the project?_____

19. In what month and year did the project start marketing housing units in the project? (use western calendar)

_____

20. What are the sources of mortgage financing available to buyers? List banks providing mortgages to project buyers.

_____

21. What are the terms of mortgage financing?
    A. Minimum down payment percentage _____
    B. Interest rate _____
    C. Length of time for mortgage to be repaid in months (for example, 180) _____

22. Provide a detailed breakdown of the types of housing units offered for sale in the project.

Type 1	Type 2
Bedrooms/Baths	Bedrooms/Baths
Stories	Stories
House size m^3	House size m^3
Plot size wa^2	Plot size wa^2
Detached/condo/townhouse	Detached/condo/townhouse
Number of units in type	Number of units in type
Sales price of type	Sales price of type

Type 3	Type 4
Bedrooms/Baths	Bedrooms/Baths
Stories	Stories
House size m^3	House size m^3
Plot size wa^2	Plot size wa^2
Detached/condo/townhouse	Detached/condo/townhouse
Number of units in type	Number of units in type
Sales price of type	Sales price of type

Type 5	Type 6
Bedrooms/Baths	Bedrooms/Baths
Stories	Stories
House size m^3	House size m^3
Plot size wa^2	Plot size wa^2
Detached/condo/townhouse	Detached/condo/townhouse
Number of units in type	Number of units in type
Sales price of type	Sales price of type

Type 7	Type 8
Bedrooms/Baths	Bedrooms/Baths
Stories	Stories
House size m^3	House size m^3
Plot size wa^2	Plot size wa^2
Detached/condo/townhouse	Detached/condo/townhouse
Number of units in type	Number of units in type
Sales price of type	Sales price of type

23. Since the start of marketing, what is the total number of units sold for each type of unit?

Type 1 _____
Type 2 _____
Type 3 _____
Type 4 _____
Type 5 _____
Type 6 _____
Type 7 _____
Type 8 _____

24. During the past month, how many units of each type have you sold in the project?

Type 1 _____
Type 2 _____
Type 3 _____
Type 4 _____

Type 5 _____
Type 6 _____
Type 7 _____
Type 8 _____

25. Based on your experience, what is the average age of the head of household buyer?

_____

26. Based on your experience, what percentage of the buyers are buying their first house?

_____

27. Based on your experience, where do most of the heads of the household buyers work?

_____

28. Based on your experience, since the beginning of the project what percentage of buyers have purchased units more than one unit? _____

29. In your opinion, what percentage of the buyers have purchased units for investments, not for their own personal occupancy? _____

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