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The Land Market Assessment: A New Tool for Research and Policy Analysis

David E. Dowall

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1. THE URBAN LAND CRISIS

Third World cities are facing serious challenges as they attempt to cope with population growth. In most cases, urban development is overwhelming the capacity of local institutions, both public and private, to adequately respond to development pressures. As a result, policymakers throughout the world are asking questions such as: 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? If not, how can the government mobilize resources to finance the construction of infrastructure? Is the land market operating efficiently? 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?

Population and economic growth does not take place in thin air; it requires land and lots of it. As Table 1 reveals, the rate of land conversion to urban use for Asian cities is enormous. In Bangkok, for example, between 1974 and 1984 urban growth requirements in the metropolitan area required 32 square kilometers of agricultural land per year [Dowall 1989b]. In Karachi, over a similar period, 24 square kilometers of land were needed per year for urban use [Dowall 1989c]. Even in small and medium-sized Asian cities such as the rapidly growing city of Bangalore, land conversion pressures are tremendous -- about 13 square kilometers of agricultural land per year is converted [Srinivas 1989]. In Kathmandu, the pace of land conversion to urban use is substantial; between 1971 and 1981, the residential land area of the city doubled [Doebele 1987].

Table 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, 1989b and 1989c, Srinivas, 1989.

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, are important facets of overall national economic development planning [Menezes 1988]. Urban land use policy is no longer a luxury best left to wealthy nations. In fact, the massive scale of Third World urban development calls for bold action from both the public and private sector. Policymakers and both informal and formal sector private developers need to work together to solve land development problems.

In most cases, urban development is overwhelming the capacity of local institutions, both public and private, to adequately respond to development pressures. While the causes of this lack of capacity are manifold and complex, the lack of up-to-date information about land and property market conditions is a fundamental impediment. An evaluation of urban planning in Third World cities suggests that conditions are far from acceptable. While the precise causes of planning failures is a subject of debate, it is clear that the lack of accurate and up-to-date information about urban growth is thwarting effective urban planning. Without such information provided by the land market assessment (LMA), it is difficult, if not impossible, to plan for and promote urban development. Thus, planners and policymakers have been operating on the basis of assumptions or using often inappropriate standards from other countries to develop land policies. Unless these assumptions or standards are on the mark (and usually they are not), plans and policies are usually ineffectual, and may be destructive.

Private sector investors and developers also benefit from the information provided by the LMA by using it to identify development opportunities and assess demands for projects they are considering. On a broader scale, with better information provided to developers, consumers, and bankers, land markets will operate more efficiently. The objective of this paper is 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. This paper is targeted to multiple audiences. First, it is aimed at public sector officials concerned with the planning, programming, and financing of urban land development and planning who work in local, regional, and national governments. Its second audience is public sector officials responsible for programming and developing housing and residential plots. The report is also aimed at the private sector, including housing and commercial developers, and bankers lending on urban development projects. A final audience is the community of professional planners and advisors working for international donor agencies, and researchers and academics concerned with land and shelter issues in the Third World.

The report emphasizes the application of LMAs in Third World cities. However, the method is equally applicable in cities in developed countries. Most of the case examples of land market assessments focus on housing and residential land markets. This is because housing is the largest land use in cities and because the supply of land for housing the poor is critically short in most Third World cities.

2. WHY LAND MARKET ASSESSMENTS ARE NECESSARY

The purpose of the land market assessment is to provide an accurate and up-to-date database on the operation of the urban land market. Information about the operation of the land market in terms of prices, supply of serviced land, and present and projected projects provides a concrete foundation for defining appropriate strategies for improving land market performance. LMAs can be used to support four broad activities: providing information for governmental planning and decisionmaking; serving as a foundation for evaluating government policies and actions; serving as a foundation for structuring land-based taxation systems; and providing information for private sector investment and development decisions. The remainder of this section discusses how LMAs can be used.

2.1 Providing Information for Public Sector Planning and Decision-Making

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 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 that can 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 price 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?

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 requirements associated with projections of population and employment. Armed with these estimates, the adequacy of the current supply of land for urban expansion can be gauged and plans developed for expanding the supply of serviced land.

2.2 Using LMAs to Evaluate Government Policies and Actions

Governments exert a great influence, both positive and negative, over land market outcomes. Through investments in infrastructure and regulations over land development, governments powerfully shape the operations of land markets, potentially creating substantial increases in land values. In other cases, government actions are less beneficial, with plans and regulations unintentionally causing serious, negative side effects on land market operations. Given the important role that governments play in shaping land market oucomes, it is extremely important for the implications of their investment and regulatory decisions to be understood.

Unfortunately, this is usually not the case. The way planning regulations adversely affect land market outcomes is complicated and frequently difficult to estimate. The biggest impediment to gauging the effects of government regulations on land markets is the lack of information about land price, demand, and supply conditions. With the land market assessment, an information base can be established to monitor land markets so that the potential effects of new government policies and programs can be evaluated. The LMA can be used to answer questions such as: Are there specific public policies or actions which are 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?

2.3 Using LMAs for Structuring Land-Based Taxation Systems

As local governments begin to seek new approaches for financing urban development, techniques such as special assessment districts and beneficiary charges will come into currency. In order to develop these fiscal tools, accurate information about land values and the impacts of infrastructure developments on land values will be needed. The LMA, by systematically cataloging land value information, can play a critical role in supporting the application of these new financial tools. As a first step, the LMA can serve as a foundation for gauging land price trends. 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.

2.4 Providing Information for Private Sector Investment and Development Decisions

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

LMAs can provide a critical role in helping to inform private investment decision-making. 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. On the other hand, LMAs can identify when the production of certain urban uses far exceeds effective demand, thus helping 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].

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.

2.5 Overall Conclusions Regarding the Benefits of LMAs

As should be clear by now, the benefits of LMAs are significant and are likely to generate widespread support among public and private sector planners and decision-makers. A key implication of these broad-ranging benefits is that support for LMAs can be generated from many quarters of the public and private sector. As will be fully explained below, when organizing for the LMA, care should be taken to involve the full participation of benefitting agencies.

3. ORGANIZING FOR LAND MARKET ASSESSMENTS

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

For example, in San Pedro Sula, Honduras, it was suggested that the city create a line agency, the Department of Land and Housing Development, reporting 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. The approach was taken because it was felt that a centralized authority reporting directly to the mayor was the only effective method for implementing the assessment. In other cases, this manner of organization may not work well. In Bangkok, for example, 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 the financial and academic communities.

Obtaining the full cooperation from the private sector is critical. To obtain support, a land market assessment steering committee should be established, containing prominent professionals from 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 increase the performance and efficiency of the private, as well as the public, sector. Agreement must be about which types of data to collect, the frequency of collection, and firm protocols should be set for preserving the confidentially of sensitive market information. Procedures for periodically disseminating land market assessment reports also should be drafted. Obviously, it is absolutely essential to address citizens' concerns that the government is prying. Here the most effective method is to take the time to explain what the surveys will and will not be used for (for example, for land use planning purposes, not for tax collection audits). Special attention is needed to 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).

Another organizational issue is to ensure that the surveys are conducted in both formal and informal areas of the city or town. The process in both areas is essentially the same. However, it may require modifying slightly 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 questions about land prices. The housing project survey discussed below will need to be modified to accurately capture relevant information about informal land and housing developments.

4. RESOURCES NECESSARY FOR SETTING UP A LAND MARKET ASSESSMENT PROCESS

To carry out the LMA, several types of professionals are needed, including a land economist with market survey research experience; a land planner with aerial photographic and satellite image interpretation experience; a statistician with computing and database management experience; two data analysts for coding, data entry, and fieldwork; a draftsperson; and a team of research assistants for conducting field surveys. In smaller towns, such a team will not be necessary. The minimum level of staffing is probably one urban planner who has been trained in applying the LMA and one to two survey assistants.

In large cities and metropolitan areas, developing the database and conducting statistical analyses will require a computer system. The minimal system is an IBM AT compatible system with 640k RAM, two disk drives, and a 20mb hard disk. The system should have graphic capabilities and 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 by using a computer mapping system. Such a system can be run on an IBM-compatible system with a type "A" multi-color pen plotter and a 12-inch-by-12-inch (30-by-30-cm) digitizing pad. The total cost for the computer equipment is between $6,000 and $7,000, or $4,000 to $5,000 without the computer mapping capability.

The software for running the computers and developing the database 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 Word Perfect, Word, or Wordstar and a graphics program such as Harvard Presentation Graphics will be needed for preparing reports. The prices of these software packages vary considerably, but should cost less than $2,000. Thus, for under $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, database management, and report production.

In smaller cities and towns, the data can be analyzed manually using a small pocket calculator and/or adding machine.

5. TIMETABLE FOR CONDUCTING ASSESSMENTS

The time required to prepare a land market assessment will depend on the size of the city, the level of analysis detail, 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, usually much of the information needed for the land market assessment has already been collected, 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.

6. DISSEMINATION OF LAND MARKET ASSESSMENT INFORMATION

A principal benefit of the land market assessment is its ability to increase 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 decision-makers.

7. DEVELOPING BASELINE INFORMATION

The first step in launching a land and housing market assessment is to review available reports and data sources which 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.

Based on 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].

7.1 Define Area

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

7.2 Establish Geographic Zones for Data Organization

For the LMA database to be useful in assessing precise land market conditions and to effectively gauge the impacts of government policies and investment decisions, it is important for the database to be spatially divided into zones.

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 in terms of 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 database and the assessment of the effects of government policies and investments. On the other hand, the greater the number of zones, the more difficult and expensive it will be to collect and update data.

Another consideration in defining zones is that their size and total number should be based on the underlying base of existing data. While it is impossible to delineate different zones from those in the database, it is possible to combine zones into larger groupings. In large metropolitan areas (over 1,000,000 in population), 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].) In Bangkok, a metropolitan region of over six million, a land and housing market information base of 344 zones was developed.

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 have ranged from 100 to over 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.

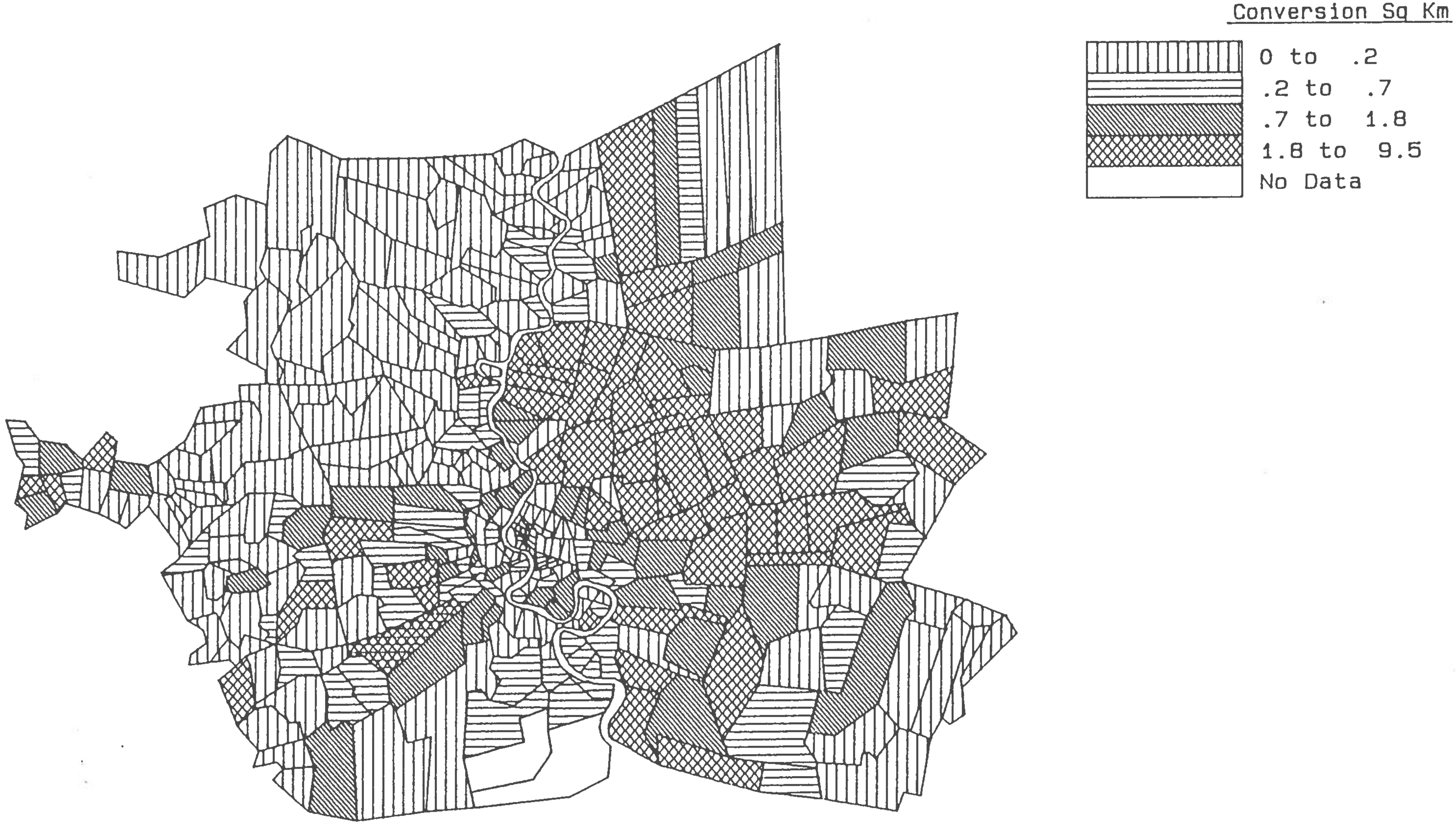
7.3 Basic Land Use and Population Data for Tabulation

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 a "current year." Ideally, the two years should span a period of between five and ten years. 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 and current year in hectares
5. total residential land area in base and current year (gross area)
6. total housing units in base and current year
7. commercial land area in base and current year (gross area)
8. industrial land area in base and current year (gross area)
9. institutional land area in base and current year (gross area)
10. vacant land area in base and current year
11. vacant land with infrastructure in base and current year
12. change in urbanized land, base-current year in hectares
13. change in residential land area, base-current year
14. change in total housing units, base-current year
15. change in commercial land area, base-current year

LAND CONVERSION IN SQ. KILOMETERS 1974-84
METROPOLITAN BANGKOK

MAP 2



16. change in industrial land area, base-current year

17. change in institutional land area, base-current year

18. change in vacant land area, base-current year

19. change in vacant land with infrastructure, base-current year

20. population in base and current year

21. change in population, base-current year

22. population density in base and current year

23. change in population density, base-current year

By providing baseline data on land use changes, infrastructure availability, and population by geographic zone over time, a very detailed assessment of the spatial patterns of urban development in a metropolitan area can be determined. The data can be tabulated from land use surveys, aerial photographs, or satellite images.

7.4 Land Value Information

The next step in terms of data collection 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. While in many instances these 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.

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. The general survey approach is as follows:

1. A survey questionnaire is prepared, containing a series of questions aimed at getting brokers to 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 is repeated for plots with different types of land tenure and levels of infrastructure. The appraisals cover only those neighborhoods in which the broker works. Once the appraisals are completed, the brokers are asked to estimate the probable selling prices of the previously appraised plots for each of the preceding two years. All prices should be tabulated in terms of price per square meter and adjusted to constant price levels.

2. Since the objective of the land price database is to comprehensively cover the metropolitan area's active land markets, interviews should be targeted in distinct neighborhoods. Within each neighborhood, at least three brokers should be interviewed. For each type of plot appraised, the median value is selected for inclusion in the database. Within each neighborhood, median values of between three and nine types of parcels should be tabulated for each year.

3. A variety of methods can be used to identify brokers. For formal sector brokers, membership lists of professional organizations are helpful. For informal sector brokers, advice from village headmen and residents should be sought.

4. The results of each interview should be tabulated on a questionnaire form and computer-coded using Lotus 1-2-3 or another spreadsheet system. The coding should be verified for accuracy.

5. The land price data should be organized according to zone, and combined with additional information on land use and population.

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

24. median land value (per square meter) for serviced residential plots located on side streets, base year
25. median land value (per square meter) for serviced residential plots located on side streets, current year
26. change in median land value (per square meter) for serviced residential plots located on side streets, base-current year
27. median land value (per square meter) for serviced commercial plots located on main streets, base year
28. median land value (per square meter) for serviced commercial plots located on main streets, current year
29. change in median land value (per square meter) for serviced commercial plots located on main streets, base-current year
30. median land value (per square meter) for serviced industrial plots located on main streets, base year
31. median land value (per square meter) for serviced industrial plots located on main streets, current year
32. change in median land value (per square meter) for serviced industrial plots located on main streets, base-current year
33. median land value (per square meter) for unserviced parcels located on side streets base year
34. median land value (per square meter) for unserviced parcels located on side streets, current year
35. change in median land value (per square meter) for unserviced parcels located on side streets, base-current year

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.

7.5 Design Layout of Spreadsheet Data Base

With the delineation of land and housing market study zones, a database system should be established for coding data. The database 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 database should be stored on a hard disk and frequently "backed up" on a diskette in case the file is inadvertently erased.

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.

8. USING AERIAL AND SATELLITE IMAGES

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 which closely correspond with the time interval of the assembled demographic data listed above should be utilized for the housing and land use analysis. Based on field surveys of the metropolitan area and preliminary assessments of the aerial surveys, a typology of housing types, including both informal and formal housing development, should be defined for detailed tabulation, differentiating slums and squatter settlements, land subdivisions, formal private housing developments, and public housing projects. Non-residential uses, including industrial areas, commercial districts, and institutional uses can also be tabulated as well.

If aerial photographs are not available, then the acquisition of satellite images should be pursued. Satellite images can be acquired for low cost -- less than $2,000. SPOT images have been available since 1986, and offer good resolution of 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].

8.1 Tabulating Housing, Commercial, and Industrial Uses

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

1. informal housing settlements
2. public sector housing projects
3. formal private sector low-density housing estates
4. formal private sector medium-density housing estates
5. formal private sector high-density housing estates

For each category of housing, an estimate of the number of habitable units should be made for the base and current year aerial photographs or satellite images. 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.

While 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], should be considered to more fully incorporate demographic factors which shape housing demand. With consistent projections of future housing need, land requirements for residential development can be determined.

8.2 Assessing Land Conversion Trends

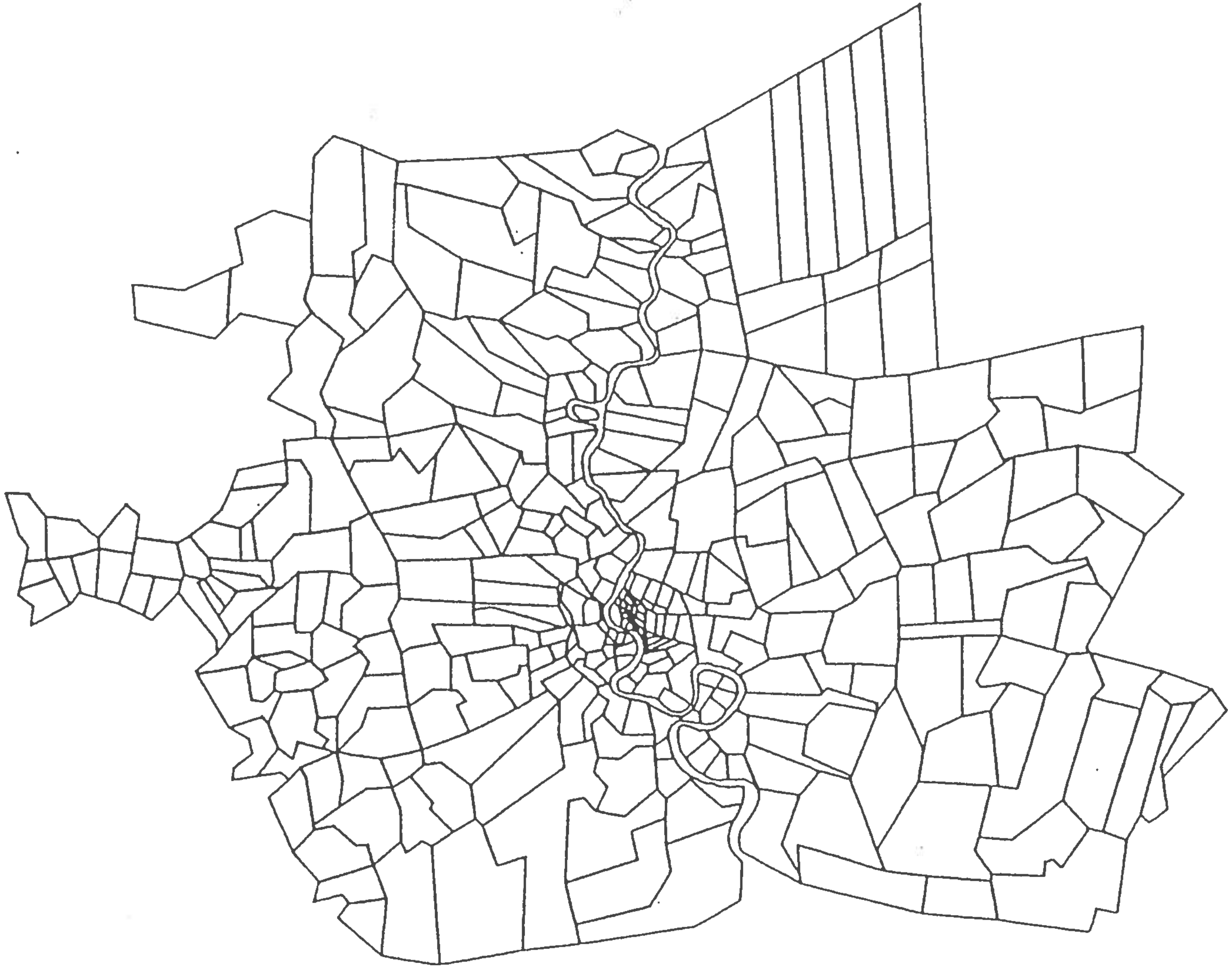
Using either aerial photographic survey or satellite image information, the rate of land conversion within each zone over time can easily be established. By calculating the area converted from agricultural to residential and other urban uses, and correlating it with housing unit changes or changes in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

8.3 Estimating Current and Future Developable Land Supply

The most critical element of the assessment is an estimate of the current and future supply of developable land. Developable land is defined as having reasonable access to roads and other critical infrastructure systems such as

METROPOLITAN BANGKOK KWAENG LOCATION

MAP 1



water and electricity, and is not constrained by physical impediments such as steep slopes, or by governmental limitations on development. To determine which lands are potentially developable, assessments of parcels according to physical constraints, governmental policies, and the location of current infrastructure must be made. Additional assessments should be made of the potential for the redevelopment of urban areas. While difficult to precisely gauge, 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 one-half to one kilometer of existing infrastructure should be classified as developable, assuming there are no physical and governmental constraints. By combining this information with land use data on vacant parcels, the potential supply of serviced land can be estimated [Dowall 1980, 1981, and 1989c].

To estimate future supply conditions, proposed infrastructure programming by local government must be assessed and mapped. If a parcel will receive road and water system access within the next five years, and has no other constraints, it should be classed as developable in the future estimates.

In determining land supply, it is extremely important to consider vacant and underutilized parcels in built-up areas. Although many vacant plots 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 older low-rise buildings should be evaluated and estimates made of the net urban development potential.

By comparing the land supply estimates with future demand, assessments of future land market conditions can be made. 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.

The land supply inventory 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 high-demand areas of the metropolitan region.

9. ADDING PROJECT INFORMATION TO LAND MARKET DATABASE

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

9.1 Drawing a Sample of Projects

To gauge current market activity, a compilation of housing projects, both formal and informal, currently offering units should be made. The universe of projects should be assembled from newspaper ads, and interviews with bankers, community organizers, government officials, real estate brokers, and other key informants. All of the identified projects should be grouped 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 for further research [Malpezzi, Bamberger, and Mayo 1982].

9.2 Project Surveys

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:

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

9.3 Combining Project Surveys with Market Information

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

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

10. USING LMAs FOR STRATEGIC PLANNING

Many governments, when they create plans to guide future development, do not base them on 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 begin to help set an agenda for government action to make the metropolitan area's land and housing markets more efficient.

To determine whether the markets are performing efficiently, there are a variety of questions that should be answered and evaluated. To illustrate the usefulness of LMAs for planning, an example is provided of the San Pedro Sula, Honduras, strategic land use planning process.

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

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. It is projected that 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 upwards to 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.

Since 1985, there have been clear signs that the land and housing markets of the city have come under increased pressure resulting from 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.

In 1989, a land market assessment of the San Pedro Sula metropolitan area was conducted [PADCO 1989]. The result of the assessment 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.

The overall picture 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. Effectively coping with these growth pressures requires that clearly focused policies and action be developed and implemented.

10.1.1 Projections of Land for Housing Development

Estimates of land for housing development have been made for San Pedro Sula based on 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. Using these patterns of housing density and plot sizes, the additional demand for housing will generate a demand for land from 700 to 840 hectares between 1989 and 1993. Over the period between 1994 and 1997, the total demand for residential land will range from 440 to 620 hectares for the low- and high-growth scenarios respectively. During the final period between 1998 and 2001, the demand for residential land will range from 530 to 800 hectares. As shown in Table 2, the total demand for residential land will range from 1,670 to 2,260 hectares over the next thirteen years from 1989 to 2001.

Table 2

Residential Land Requirements
San Pedro Sula

Period	Low Growth	High Growth
	ha.	ha.
1989-1993	700	840
1994-1997	440	620
1998-2001	530	800
Total 1989-2001	1,670	2,260

Source: PADCO [1989] San Pedro Sula, Honduras Land and Housing Market Study. Washington, D.C.: PADCO.

10.1.2 Economic Growth and Non-Residential Land Needs

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

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 rapid rise in the labor force indicates that the labor force participation rate (the ratio of economically active persons to the total population) increased from 34.6 to 54.7 percent. In the future it is not likely that this rate will increase much more, indicating that the labor force's gain will closely parallel population growth rates. Thus, the requirements for non-residential activities will grow at the same rate as the residential ones, and the relationship between residential and non-residential land uses will remain about the same.

According to the 1988 land use survey of San Pedro Sula, non-residential land uses accounted for approximately 36 percent of all urban land uses. Commercial, service, and institutional uses comprise 75 percent of all non-residential land uses. Based on these land use proportions, estimates of future non-residential land use requirements have been developed and are presented in Table 3.[1]

As Table 3 illustrates, between 1989 and 1993 the total demand for non-residential land ranges from 400 to 480 hectares. During the 1994-1997 and

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[1]During the years 1989-1992, 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" pattern in the commercial and industrial property 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

Non-Residential Land Requirements
San Pedro Sula

Period	Low Growth ha.	High Growth ha.
1989-1993		
Comm., Institutional, & Services	300	360
Industrial	100	120
TOTAL NON-RESIDENTIAL	400	480
1994-1997		
Comm., Institutional, & Services	190	265
Industrial	60	90
TOTAL NON-RESIDENTIAL	250	355
1998-2001		
Comm., Institutional, & Services	225	345
Industrial	75	115
TOTAL NON-RESIDENTIAL	300	460
1989-2001		
Comm., Institutional, & Services	715	970
Industrial	235	325
TOTAL NON-RESIDENTIAL	950	1,295

Source: PADCO [1989] San Pedro Sula, Honduras Land and Housing Market Study. Washington, D.C.: PADCO.

1998-2001 periods, the need for non-residential land will range from 250-355 to 300-460 hectares. Overall, between 1989 and the year 2001 the total demand for non-residential land will range from 950 to 1,295 hectares. These projections are gross land requirements, and they do not consider whether actual non-residential development will take place on land that is currently developed.

10.1.3 Total Land Requirements for Urban Development 1989-2001

By combining residential and non-residential land requirements, the total land needed to support urban development can be calculated. Table 4 illustrates the total land requirements for the 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 occurring over the past two to three years, but it is likely to be the rate which is clearly sustainable.

Over the next 13 years, a total of 2,620 to 3,555 hectares of urban uses will be developed. Based on 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 between one-half and two-thirds. This implies that the physical development of San Pedro Sula during the remaining years of the century will be at a rate 3.5 to 4.6 times faster than its historical average growth rate.

These substantial land requirements pose an enormous challenge for planners. Unless the growth is accommodated, high land and housing price inflation will persist and the housing affordability crisis will worsen.

10.1.4 The Strategic Land Development Process

Based on the results of the land market assessment, a strategic land development process was proposed for San Pedro Sula. The process is based on

Table 4

Total Land Requirements for Urban Development
San Pedro Sula

Period	Low Growth ha.	High Growth ha.
1989-1993		
Residential	700	840
Comm., Institutional, & Services	300	360
Industrial	100	120
TOTAL	1,100	1,320
1994-1997		
Residential	440	620
Comm., Institutional, & Services	190	265
Industrial	60	90
TOTAL	690	975
1998-2001		
Residential	530	800
Comm., Institutional, & Services	225	345
Industrial	75	115
TOTAL	830	1260
1989-2001		
Residential	1,670	2,260
Comm., Institutional, & Services	715	970
Industrial	235	325
TOTAL	2,620	3,555

Source: PADCO [1989] San Pedro Sula, Honduras Land and Housing Market Study. Washington, D.C.: PADCO.

three and one-half months of fieldwork and analysis, and reflects numerous discussions with city officials, housing developers, bankers, businessmen, and citizens. (The Phase I Report provides full documentation of the findings of the fieldwork [PADCO 1989].) The seven steps are:

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.

10.1.5 Implications of the San Pedro Sula Example

The overall result of the San Pedro Sula LMA was that it helped to identify the critical issues affecting the performance of the land market. The assessment revealed that the land market was becoming overheated and that real land prices were increasing rapidly. 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, the establishment of a powerful land development agency was proposed for San Pedro Sula, and is now under consideration.

10.2 Case Study: The National Housing Authority of Thailand

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 database of the Bangkok residential land market. Some of the objectives of the study, related to the land and housing market assessment, were:

1. Assess the current performance of the NHA's land acquisition and housing development programs in order to improve 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 which 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.

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 between 11 and 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. On the other hand, recent NHA projects in Bangkok were much more remote and 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 $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 of a hectare, considerably smaller than the average size of NHA projects.

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 directly compete with private developers as long as they are moving "downmarket."

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 vis-a-vis private sector projects. The LMA played a critical role in illustrating the need to alter government housing and land development programs.

11. USING LMAs TO EVALUATE THE IMPACTS OF GOVERNMENT ACTIONS

The land price database developed by the LMA can be used to gauge the impacts of government policies, investments, and actions. In this section, a series of techniques for assessing impacts will be discussed. An example of how infrastructure investments increase the economic value of residential plots will be presented based on the Karachi case study.

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.

11.1 *Ex Post* Impact Assessments

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 major problem encountered by all efforts is the difficulty of isolating public actions from the myriad of factors affecting land values. As Bahl, *et al.*, 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" [Bahl, *et al.*, 1973, pp. 182].

Two approaches to estimating 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 is 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.

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 upwards, and the second biased downwards.

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.

Another method for estimating the effects of a 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.

As in the econometric approach, regression equations are run. Significant differences in land values that cannot be explained by the non-project 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, used to isolate effects. The regression equation can take the following form:

$$\text{proj}^{PV}t - \text{control}^{PV}t = a + bD_t$$

where $_{proj}PV_t$ is the land value in the project area at time t, $_{control}PV_t$ is the 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:

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

Both the econometric and case comparison approach can be utilized 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.

11.2 Predicting Land Value Impacts of Future Public Actions

Attempting to predict the likely impacts of public actions on future land values is difficult. 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 $25 per square meter, then this figure is applied to the new project (adjusted for inflation). Obviously this approach is crude, but it provides planners and finance specialists with some estimation to use.

The second approach, which applies only to land use and development regulations, estimates the potential impacts 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, these impacts can be assessed by calculating how the regulatory changes will alter the financial performance of hypothetical projects.

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

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

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.

The level of infrastructure development plays a critical role in determining land prices. 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 areas fully developed with infrastructure as defined above. To measure the effects of infrastructure, the following log form equation was estimated:

$$V_x = e^{c} * e^{d} * e^{hx}$$

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 the distance in kilometers. For all years, the regression estimates are highly significant, and all independent variables have the correct sign. The results provide 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 infra

Table 5

Estimates of Plot Prices
by Level of Infrastructure and Distance,
1988 Rs. per sq. yd.,
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 presented above.

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

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, D.E. [1991] "Karachi Development Authority: Failing to Get the Prices Right," Land Economics, forthcoming.

structure doubles land values, after holding constant for distance from the city center. Table 5 illustrates these patterns for 1988 by calculating plot price by distance for developed, developing, and undeveloped plots for selected distances. These results suggest that the Karachi Development Authority (KDA) is creating substantial increases in land values through its scheme development programs. By pricing its plots at the cost of land development and by not charging market prices which reflect the added values of infrastructure, the KDA is giving the "development gain" away to allottees. Given the patterns of actual development of plots and the rapid increase in plot transfers as reflected in the KDA transfer and non-utilization 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 KDA-constructed infrastructure [Dowall 1991].

12. USING LMA INFORMATION FOR TAXATION AND FISCAL PLANNING

Until recently, many local governments relied on central government subventions to finance water, sewerage collection and treatment, and roadway projects. But now, spurred by the Third World debt crisis, many central governments are extremely hard-pressed to fund the construction of infrastructure to support land development. Now 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. This section illustrates how the LMA can be applied to determine the potential benefits of public investments, giving examples of its application in Karachi [Dowall 1991], Jakarta [Dowall and Leaf 1991], and Bangkok [Dowall 1990].

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

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. Based on the information gathered by the Karachi land market assessment, the market value of fully serviced plots was estimated 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.

A specific regression model, similar in form to the one presented above, 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:

$$V_x = e^{c} * e^{d1} * e^{d2} * e^{hx}$$

where V_x is the estimated plot price in 1988 rupees per square yard at distance x from the city center; d1 is the dummy variable for plots larger than 120 square yards; and d2 is a dummy variable for developed areas.

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 6 presents the results of the regression equation which provides an estimate of the potential market value of the allotted plots. Table 7 compares the actual allotment revenues with estimated developed market values of plots allotted 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

Table 6

Regression Model of Plot Prices by Size of Plot,
Distance, and Infrastructure Development, 1980 and 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, D.E. [1991]. "Karachi Development Authority: Failing to Get the Prices Right," <u>Land Economics</u>, November.

Table 7

Comparison of KDA Allotment Revenues and Developed Value of Plots Allotted by KDA in 1980 and 1985, in 1988 Rs., 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, D.E. [1991] "Karachi Development Authority: Failing to Get the Prices Right," Land Economics, forthcoming.

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" below 120 square yards; the remainder was from larger plots. Based on the regression model developed and presented in Table 6, 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.

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 figure represents the KDA's cost of developing these 2,477 plots, an average of Rs. 33,000 each. By developing these plots and providing them with infrastructure, the developed value of these plots in 1980 is 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.

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 cross-subsidize the purchase of plots by accurately targeted low-income households.

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, 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 off their market value.

The results presented in Tables 6 and 7 illustrate the impacts associated with the public sector producing and allocating 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 gain from the public sector to private individuals. As a matter of public policy, the KDA should consider shifting the disposal of plots from allotment by balloting to auction for all but the smallest plots, which should be carefully targeted for delivery to low-income households.

By using auctions to dispose of most of its plots, the financial condition of the KDA would be vastly improved; production of schemes and serviced plots would accelerate. 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.

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.

12.2 Case Study: Determining the Potential Benefits of Public Investments in Jakarta, Indonesia

To gauge the impact of infrastructure and secure tenure on plot prices in Jakarta, the following log form regression model, similar to those presented above, was estimated for 1989, 1988, and 1987:

$$V_x = e^c * e^{d1} * e^{d2} * e^{d3} * e^{hx},$$

where V_x is the estimated plot price at a distance of x kilometers from the CBD in rupiah per square meter; and d1, d2, d3 are the dummy variables for plots with high infrastructure, registered title, and tax-receipt-secured tenure respectively. For all years the regression estimates are highly significant and all independent variables have the correct sign (see Table 8). The results are quite good for such spatial models. The model explains between 69 and 70 percent of the variation in plot values for the three years.

The model estimates that the availability of complete infrastructure adds between 50 and 60 percent to the value of a residential plot, independent of location and tenure. This finding is important in that it clearly establishes the beneficial impact of infrastructure on residential property values. The measured effect is consistent to recent results of the benefits of infrastructure in Karachi.

The impact of having registered title to a site is reflected in the estimated coefficients for dummy variable d2. Here the results suggest that having a registered title adds between 45 and 60 percent to the value of a residential plot, independent of its location or level of infrastructure. The benefit of tax-receipt-secured ownership, dummy variable d3, adds between 20 and 25 percent to the value of a typical residential plot with a weak claim. The benefit of registered title over tax receipts is considerable, adding between 20.7 and 28.0 percent to the value of plots secured with tax receipts. This differential

Table 8

Jakarta Land Price Model 1988, 1989, 1990

Year	Constant (a)	High Infra-structure (b)	Registered Title (b)	Distance Gradient(c)	R^2
1989	368,573	1.50	1.31	-.168	68.2%
	(217.4)(d)	(18.8)	(12.7)	(-74.4)	
1988	326,409	1.54	1.37	-.1735	69.2
	(211.4)	(19.7)	(14.4)	(-76.0)	
1987	281,069	1.61	1.42	-.1812	69.4
	(195.1)	(20.0)	(15.3)	(-75.2)	

(a) Intercept value in rupiah per square meter.
(b) Infrastructure and title values are a multiple of constant.
(c) The gradient value is the proportional change in each value for each one kilometer change in distance from the city center.
(d) t statistics in parenthesis; all values are statistically significant at 0.001 confidence level.

Source: Dowall and Leaf, 1991.

reflects the measure of benefits that would flow from a land titling and registration system.

Overall, the regression model underscores the importance of providing infrastructure and registration. The provision of both of these services can increase a residential plot's value by 118 to 157 percent.

12.3 Case Study: Determining the Potential Benefits of Public Investments in Bangkok, Thailand

The availability of infrastructure service adds considerably to the value of a typical residential plot. The precise benefit will vary according to the location of the plot. This section presents the results of a study of land prices and infrastructure delivery in Bangkok.

Land price data were fitted to a non-linear logarithmic function similar to the ones used from Karachi and Jakarta.

The equation takes the following log form, and the results are presented in Table 9 for 1988, 1989, and 1990:

$$V_x = e^{c} * e^{d1} * e^{hx}$$

where V_x is the estimated plot price at a distance of x kilometers from the city center in constant 1990 baht per square wah;[2] and d1 is the dummy variable for serviced plots. For all years the regression estimates are highly significant, and all independent variables have the correct sign. The results are quite good for such spatial models. The model explains between 79 and 81 percent of the variation in plot values for the three years.

The model estimates that the availability of complete infrastructure increases residential plot values by an additional 165 to 221 percent, independent of location. This finding is important because it clearly establishes the

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[2]A square wah equals four square meters.

Table 9

Bangkok Land Price Model 1988, 1989, 1990

YEAR	CONSTANT (a)	SERVICED (b)	DISTANCE GRADIENT(c)	R^2
1990	23,401	2.652	-0.0538	79.2
	(138.99) (d)	(15.01)	(-27.91)	
1989	16,708	3.120	-0.0558	80.5
	(130.96)	(17.09)	(-28.14)	
1988	13,844	3.206	-0.0574	79.2
	(121.94)	(16.47)	(-27.94)	

(a) Intercept value in baht per square wah.
(b) Serviced value is in multiple of constant.
(c) The gradient value is the proportional change in each value for each one kilometer change in distance from the city center.
(d) t statistics in parenthesis; all values are statistically significant at 0.001 confidence level.

Source: Dowall, 1990.

beneficial impact of infrastructure on residential property values. The measured effect is consistent with recent results of studies of the benefits of infrastructure in Karachi and Jakarta. In Karachi it was estimated that the availability of services added 195.8 percent to the value of a residential plot in 1985. In Karachi, where desert conditions make it impossible to drill individual water wells, such a substantial impact is logical. In Jakarta, on the other hand, where wells can be drilled almost anywhere, the impacts are less, with infrastructure provision adding between 50 and 60 percent to residential plot values.

13. PRIVATE SECTOR APPLICATIONS OF LMA INFORMATION

In addition to its application to the public sector, there are ample opportunities for using 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 to improve private decision-making.

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 product types currently for sale, and 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.

The level of 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 for sale in the market exceeds a full year's amount of absorption, then the market is over-supplied.

14. CONCLUSIONS

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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