

# Converting Land into Affordable Housing Floor Space

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## Abstract

Cities emerge from the spatial concentration of people and economic activities. But spatial concentration is not enough; the economic viability of cities depends on people, ideas, and goods to move rapidly across the urban area. This constant movement within dense cities creates wealth but also various degrees of unpleasantness and misery that economists call negative externalities, such as congestion, pollution, and environmental degradation. In addition, the poorest inhabitants of many cities are often unable to afford a minimum-size dwelling with safe water and sanitation, as if the wealth created by cities was part of a zero-sum game where the poor will be at the losing end. The main challenge for urban planners and economists is reducing cities' negative externalities without destroying the wealth created by spatial concentration. To do that, they must plan and

design infrastructure and regulations while leaving intact the self-organizing created by land and labor markets. The balance between letting markets work and correcting market externalities through infrastructure investment and regulation is difficult to achieve. Too often, planners play sorcerer's apprentice when dealing with markets whose functioning they poorly understand. The role of the urban planner is then, first, to better understand the complex interaction between market forces and government interventions, infrastructure investment and regulation, and second, to design these interventions based on precise quantitative objectives. Each city's priorities would depend on its history, circumstances, and political environment. But maintaining mobility and keeping land affordable remains the main urban planning objective common to all cities.

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Cities emerge from the spatial concentration of people and economic activities. But spatial concentration is not enough; the economic viability of cities depends on people, ideas, and goods to move rapidly across the urban area. This constant movement within dense cities creates wealth but also various degrees of unpleasantness and misery that economists call negative externalities—such as congestion, pollution, and environmental degradation. In addition, the poorest inhabitants of many cities are often unable to afford a minimum-size dwelling with safe water and sanitation, as if the wealth created by cities was part of a zero-sum game where the poor would be at the losing end.

The main challenge for urban planners and economists is reducing cities' negative externalities without destroying the wealth created by spatial concentration. To do that, they must plan and design infrastructure and regulations while leaving intact the self-organizing created by land and labor markets. The balance between letting markets work and correcting market externalities through infrastructure investment and regulation is difficult to achieve. Too often, planners play sorcerer's apprentice when dealing with markets whose functioning they poorly understand.

It is possible to ignore markets for a while, as in the cities of former command economies like China and the Soviet Union before the 1990s. Planners in those cities were free to design cities by allocating land among uses and deciding how these uses would be spatially related. They proceeded with full design control over cities in the same way that an architect designs a house. The result was less than optimal, with extreme pollution, severe housing shortages, and vast obsolete underused industrial land areas.

Planners, no matter how technically competent, cannot design and plan every aspect of a city, because they do not have the information that each individual land user alone possesses. The information about individual location and land consumption preferences, together with land supply responses, is bundled into real estate prices. These prices need constant monitoring and interpretation to guide planners' responses to the ever-changing equilibrium between supply and demand for land and infrastructure.

But empirical evidence also shows that, without any government intervention, markets cannot create large well-functioning cities. Large informal settlements surrounding Cairo, Kabul, and Lagos, for instance, demonstrate that indispensable primary infrastructure and public parks cannot be created by private initiative alone. In these spontaneous settlements—pure products of market forces unadulterated by regulations—the absence of sewers, storm drainage, and arterial roads impose extreme health and economic hardships on their inhabitants. And these settlements impose a cost on the entire city because their impenetrability interrupts the continuity of citywide transport and other networks.

The role of the urban planner is then, first, to better understand the complex interaction between market forces and government interventions—infrastructure investment and regulation—and second, to design these interventions based on precise quantitative objectives. Each city's

priorities would depend on its history, circumstances, and political environment. But maintaining mobility and keeping land affordable remains the main urban planning objective common to all cities.

### **Land use policies and plans: between utopia and reality**

With few exceptions, planners are asked not to design new cities but to modify existing ones. Development options are thus quite limited, and theoretical optimal land use spatial arrangements—even if they could be identified—become irrelevant when confronting the reality on the ground. Planners often have a hard time facing this reality. They lose precious time and resources in preparing utopian plans hoping to transform the structure of an existing city into a new clever optimal form.

Periodic fads focusing on a single aspect of urban development can also push planners toward “bold visions” that border utopia. Legitimate concerns for air pollution and the global warming caused by urban transport’s greenhouse gas emissions have triggered an assault on mobility. Any extension of the urban land supply often qualifies as “sprawl,” whether in a North American city with an average built-up density of eight people per hectare or in an Asian city with a density 20 times larger! Many measures to restrict sprawl restrict the land supply and usually make housing less affordable.

Desperate to reduce congestion and pollution, planners too often opt for reducing mobility rather than improving it through new transport systems. Reducing traffic by preventing cars from running on some days of the week depending on the ending digits on their license plate reduces mobility and often does not achieve lasting environmental results. By contrast, congestion pricing can reduce congestion and pollution without reducing mobility. This partial solution should expand now that technology’s high transaction costs have declined. Overall, planners should be aware that reducing environmental externalities constrains urban development and so cannot be the main objective of urban planning.

The land use of large cities is extremely resilient. Land use changes in areas already built, whether widening streets or recycling obsolete land use on a large scale, are slow and involve high transaction costs. And spatial structural changes are usually path-dependent. In large cities, population densities could change in the long run—but extremely slowly. Average urban population densities tend to go down, not up.<sup>1</sup> Dominantly monocentric cities tend to become polycentric in the long run, but once a city is polycentric it cannot return to being monocentric.

The slow evolution of existing land use does not mean that a city does not change. Incomes, technology, and relative prices may change very rapidly, as in many cities of Asia and some cities of Africa. These changes affect the supply and demand for land and transport. In Vietnamese cities, household incomes rising over 10 years have allowed commuters to shift from bicycle to motorcycle as the main mode of transport. This change affected not only traffic management but also housing. The quasi-universal use of the motorcycle in Hanoi (81 percent of

all vehicle trips in 2008) allowed firms to relocate in suburban areas—where land was cheaper than in the traditional central business district—while maintaining accessibility for its labor force and suppliers. Densified urban villages at the fringe of urbanization became a major source of cheap housing for commuters with increased mobility provided by the motorcycle.

But not all changes have positive impacts. Further increases in household incomes are already creating a demand for cars that Hanoi's existing road network cannot accommodate. The decentralization of jobs has created dispersed commuting destinations into suburbs that traditional transit solutions—bus rapid transit, buses, or subways—will struggle to reach with adequate service.

The problem facing planners is thus to maintain mobility and affordability and reduce environmental externalities—because cities' land use evolves slowly but technology and incomes change rapidly. By monitoring changes, analyzing current land use, and finding solutions for maintaining mobility and affordability, planners have plenty to do without having to redesign existing cities. The following sections concentrate on only a few aspects of land use management in an existing city, mainly monitoring land supply and looking at how land development practices, regulations, and markets allocate land among users.

### **The supply mechanism for urban land—often opaque and poorly understood by planners and city managers**

The economic efficiency and social equity of cities depend on an adequate mechanism for the supply and distribution of urban land. Governments have a crucial role in the land supply by providing transport infrastructure. The spatial pattern of the primary infrastructure network and the mix and speed of transport modes determine the potential supply of developable urban land that would be compatible with an integrated labor market.

Despite the government's well-known and accepted role in providing primary infrastructure, it is assumed that in most countries markets largely determine the allocation of developed land and the price of the floor space built on it—with the obvious exceptions of Cuba and the Democratic People's Republic of Korea. A preliminary evaluation of new greenfield development in Ahmedabad, India, shows that only about a third of the land developed in the last 10 years has been distributed through market mechanisms. While this proportion will vary greatly by city, I do not think that Ahmedabad is an outlier.

The market for urban land is unique and complex. The supply and consumption of urban land depends heavily on government investment and regulation. And as a consequence, land market mechanisms are often opaque to both land consumers and suppliers.

Land development is crucial for city development. But urban land is only an intermediary product in the construction of cities; the real end-product is the floor space built on it. We all have a tendency to focus on land use and land prices because cities are managed and monitored

mostly through maps, two-dimensional simplifications of a three-dimensional reality. What differentiates urban land from rural land is the floor space built on it.

The amount of floor space that can be built on a unit of land is thus a crucial variable whose value should be monitored to manage urban land effectively. Low consumption of land per person is not necessarily an indicator of household deprivation; low consumption of floor space per person always is. The amount of floor space built on a unit of land should be determined by consumer demand limited only by the obvious externality costs imposed on its neighbors. But as shown below, the ratio between land and floor space is too often constrained by inadequate infrastructure and arbitrary regulations.

In many cities, the high price of floor space prevents poor households from being able to afford housing in the formal sector—that is, to build on land that conforms to the regulated development process. So poor households can afford only land developed informally in a much simpler parallel process. Instead of having this dichotomy, there must be a way to develop land and build floor space with different characteristics that make doing so legal, affordable, and safe.

City managers and urban planners often quote the “high price of urban land” as responsible for the poor’s inability to afford formal housing.<sup>2</sup> The responsibility for the high prices is generally attributed to either the actions of speculators or the greed of land owners. Very little can be done to stop vaguely defined land speculation—and even less to prevent greed. Even so, land supply bottlenecks—the real cause of high land prices—are seldom analyzed.

What determines the supply of urban land for future development, and how is this land distributed? Urban land development is a linear process, similar to an industrial production chain. How long does it take for the primary input—rural land—to be transformed into the finished product—floor space? How much land is frozen, and for how long, during the various stages of transformation on the production chain? How much land is permanently wasted or misallocated? Because floor space is what urban firms and households consume, how many units of land have to be developed to produce one unit of floor space?

The answers obviously will vary with each city, depending on its topography and resources and the technology available to it. I will spell out the various steps of the complex process that transforms land into buildable, salable lots and eventually into floor space. This paper aims to identify when the original land fed into the supply chain is all gone. I identify what constitutes the potential supply of land—and then how this land is transformed into developed land and eventually into floor space.

### **The supply of developable urban land—constrained by the speed of daily trips**

The efficiency of large labor markets is the *raison d’être* of large cities. The daily trips by the active population from home to work and urban amenities allow labor markets to work. Spatial mobility makes cities economically viable.



As cities grow very large, travel distance increases, and traffic congestion slows commuting and increases the time spent on transport. The time spent daily moving from residences to jobs and amenities is like a tax on urban productivity, and when this time becomes too long it is also a tax on family and social life.

Some urban planners argue that it should be possible to put jobs and housing in the same location. This would reduce travel time and perhaps allow walking or cycling to work, even in very large cities. The attempts in new satellite towns in cities as diverse as Stockholm and Seoul show that this does not reduce commuting distance. In so-called self-sufficient satellite towns, the distance traveled increased, compared with the rest of the city, as people living in satellite towns usually work in the core city and people working in the satellite towns often commute from a suburb of the core city.<sup>3</sup>

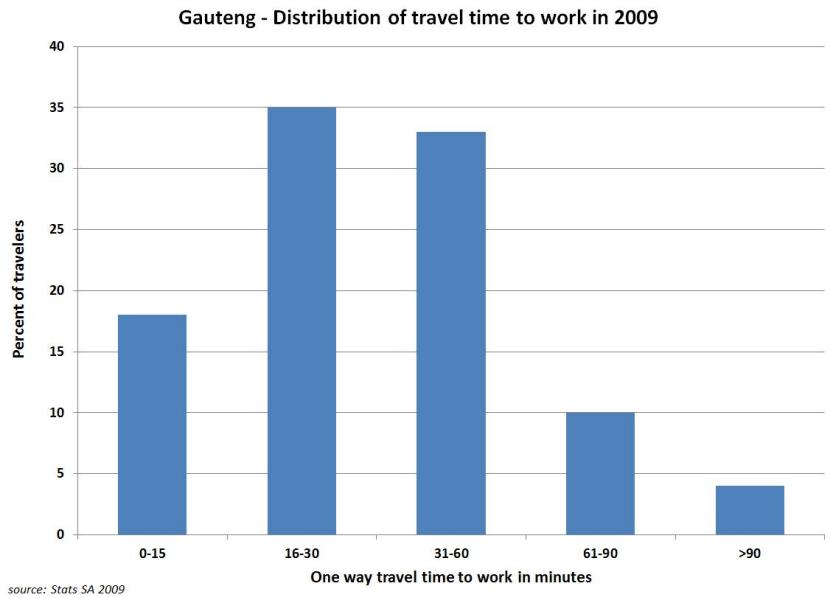
Why is it not possible to match the locations of housing and jobs in large cities? Most of the world's cities are already built with housing next to where jobs are concentrated. But people moving to a large city are unlikely to look for a job only within a short distance of their new home, and employers are not going to limit their search for workers to their firm's neighborhood. The wide choice of jobs and potential employees that large cities offer is the main motive for moving to a large city, for both individuals and firms. Firms are better off when they can select from a large number of workers; individuals are better off when they can choose from a wide range of jobs. The job market is thus citywide and cannot be fragmented into discrete neighborhoods. Labor market integration is found not in a clever land use arrangement but in better and faster transport.

In a large city, an efficient urban transport system should take a commuter from any part of the city to any other in an acceptable length of time. This acceptable commuting time multiplied by the speed of travel defines the radius of the circle reachable under the commuting time limit and thus defines the potential land supply for city extension under the current transport system.

### *Acceptable travel times*

What then is the acceptable limit to daily travel time? In U.S. and Western European cities, the mean travel time stayed about constant over the last 10 years, despite increases in population and in distance traveled (25 minutes mean travel time for U.S. cities in both 2000 and 2009).<sup>4</sup> The mean one-way travel time for large cities varies from around 25 to 35 minutes. Many large cities in emerging economies are growing much faster in both population and income than are American and Western European cities, pushing mean commuting times well beyond 35 minutes because their transport systems are unlikely to be able to adjust to the more rapid physical expansion. The median travel time in Gauteng, South Africa, is 29 minutes—seemingly similar to a European or North American city—but almost 15 percent of commuters travel more than one hour one way each day, while in the New York metropolitan area (with a population 150 percent larger than Gauteng's) only 7 percent of commuters commute more than one hour (figure 1).

**Figure 1. Commuting trip travel time in Gauteng, 2009**

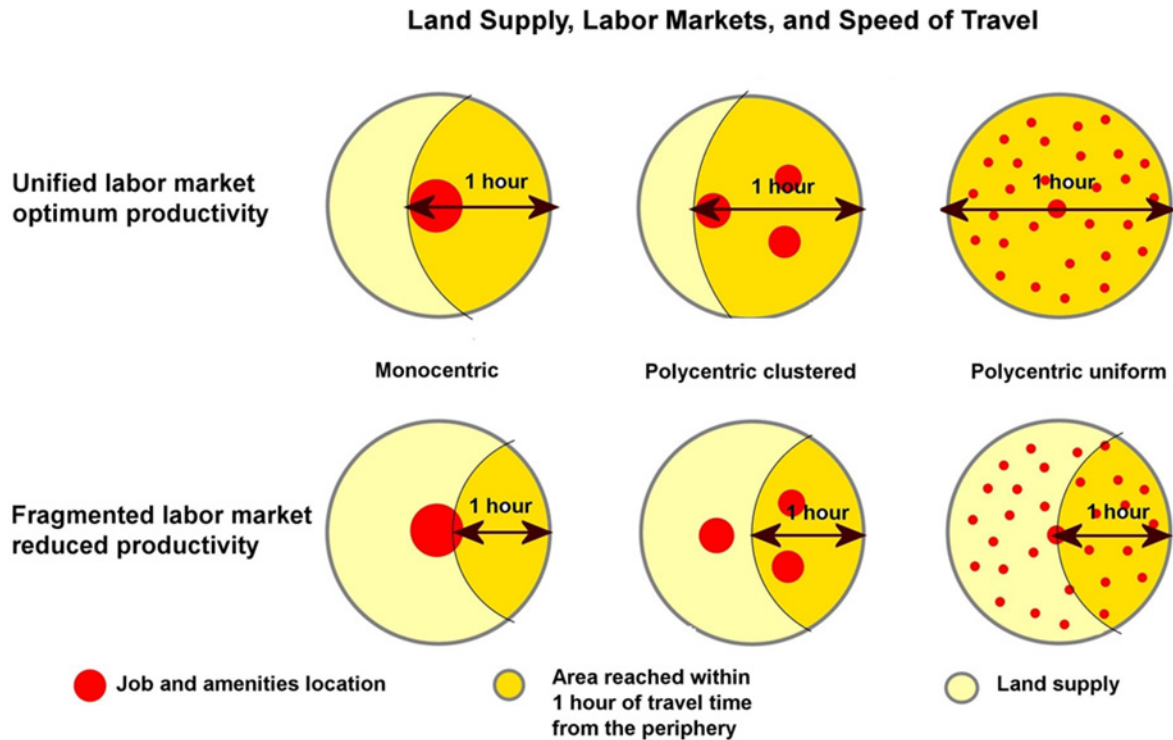


Source: Stats SA 2009.

The supply of urban land will thus be constrained by the distance that can be traveled in less than one hour to jobs and amenities from the various residential locations in and around the city (figure 2). As a city expands in population and area, the distance between jobs and amenities will likely increase, requiring higher speeds to connect in less than one hour.

The potential land supply is the yet-unbuilt area where a city can expand while avoiding the fragmentation of its labor market. Studies in Asia and Western Europe show that a 10 percent increase in travel speed corresponds to a 15 percent expansion in the size of the labor market and a 3 percent gain in productivity.<sup>5</sup> To approximate the effect of the existing transportation system on the potential land supply, assume that one hour for a one-way commute is the maximum travel time to define a city's potential land supply.

**Figure 2. Land supply corresponding to one hour commuting time for three spatial arrangements for jobs and amenities**



*Source:* Author's analysis.

*Note:* Monocentric jobs are concentrated in the central business district; polycentric-clustered jobs are concentrated in a few clusters; polycentric-uniformly dispersed jobs are completely dispersed within the built-up area.

In a labor market perfectly integrated (and thus with maximum productivity), any job should be reached in less than one hour from any part of the built-up area. This first hypothesis is shown on the top part of the figure for the three spatial arrangements for job distribution. Keeping the urban area constant, the travel length to the more distant job from any point at the urban periphery increases as the jobs move away from the center. To limit commutes to an hour, the speed of travel has to increase when jobs are more dispersed. This is what often happens in real life, because trips from suburbs to suburbs are usually faster than those from suburbs to the central business district.

A second hypothesis shows a less perfect world, where only a fraction of the jobs would be accessible in less than one hour from the city's periphery. The labor markets would then be fragmented—depending on their location, workers will have access to only a fraction of the jobs available in the city. Productivity would fall in proportion to the percentage of jobs that can be reached in less than one hour over the total number of jobs. Increasing travel speed would expand the size of the labor market, and productivity would, as a consequence, also increase.

In the real world, the means of transport—and thus the speed of travel—depend on income groups and patterns of travel. Higher income groups, which can afford faster transport, would have access to the entire labor market, while poorer households would have access to only a fraction of it, significantly lessening their earning opportunities.

The schematic representation of figure 2 shows the relationship among land supply, job spatial distribution, and speed of travel. For a given urban area with less than one hour travel time, the monocentric distribution of jobs allows the slowest travel speed, because the central location of jobs reduces distance to all households. The polycentric arrangement would require travel speeds to double, holding the land area constant, to allow one hour travel time from all parts of the city to all jobs.

So far the time spent traveling is the major constraint on urban land supply. Economists traditionally use the cost of transport from the city center as a determinant of the limit of urbanization (or by extension, to the land supply). The cost of transport includes both the cash paid for transport (gasoline, tolls, transit fare) and the opportunity cost of time spent traveling. The cost per unit of time traveled, an opportunity cost, is different for travelers belonging to different income groups—higher for higher income and lower for lower income.

The direct costs of commuting trips in large modern cities—by individual vehicles or by public transit—are often heavily subsidized, directly or indirectly. The failure to include the economic price of carbon emissions in the cost of the fuel consumed, for example, further removes the incentive to use direct transport costs to influence travel behavior. In assessing the supply of land, I am using current behavior influenced by the actual price paid for transport and not the economic price, which reflects the real economic cost of commuting.

However, for the lowest income households, who can afford only to walk, the cost of travel is even more important than travel time in limiting their choice of residential location. In some cities, the poorest inhabitants spend more than two hours a day commuting from home to work (box 1). The extreme commuting hardship in Gauteng might be exceptional (about 4 percent of commuters in Gauteng are estimated to commute more than 90 minutes one way), but it may become more common with increasing income disparities in even larger cities. There would certainly seem to be a correlation between the high cost in time and money commuting in Gauteng and the 26 percent unemployment rate.<sup>6</sup>

**Box 1. The five-hour commuting burden in Gauteng, South Africa**

“A single mother of four children ages 3–12 lives in Tembisa with her mother. She spends nearly five hours each day commuting to and from work in the Pretoria suburb of Brummeria, where she is an office cleaner. The journeys cost nearly 40 percent of her monthly salary of 1,900 rand. She leaves home at 05:00 to be at the office at 07:30, starting with a 2-kilometer walk to the taxi stand, which takes her to the train station. In Pretoria, she takes another taxi to Brummeria. After leaving work at 16:00, she may not get home until 19:00, as the trains are often late. She spends over 700 rand a month on transport and nearly 100 hours on the road.”

— *National Development Plan Vision 2030*, Presidency’s National Planning Commission, South Africa, November 2011.

The length of the trip for the woman commuting to her work: 47 kilometers. Her average commuting speed is only about 19 kilometers an hour, very low due to the many changes in the mode of transport she must use. She must first walk to a taxi stand, then wait for a collective taxi that takes her to a railway station, then wait for a train that takes her to a station, and then wait for a collective taxi that takes her to her job. If she could afford a motorcycle, she could do the trip in less than one hour and would gain three hours every day.

The area where this person is living—two and a half hours from her job—would be considered outside the urban supply area with a maximum of one hour commute time. But a different mode of transport would put her residence inside the land supply zone. Clearly, in defining the land supply area the real issues are speed and mode of transport, not distance.

The negative impact of more than two hours total daily travel time on the life and welfare of poor people causes their real income to be far lower than the already low level measured in monetary terms. Trips longer than one hour disrupt family life, with serious long-term social consequences on employment and on children’s education. Too often, the proponents of transport systems fail to evaluate the door-to-door users’ time of transport, considering the viability of the proposed transport system from only the view of the operator, not the user. As a consequence, travel time by different transport mode is seldom monitored. Robert Cervero, in his otherwise comprehensive and authoritative book in advocacy of urban transit, devotes only a few lines to travel time by different mode.<sup>7</sup> He admits that the usual faster travel time by car, even in transit-based European and Japanese cities, is the main challenge in shifting the transport mode from car to transit. Indeed, this is a major challenge!

***The mode and length of the transport network determines the supply of land***

Assuming that one hour each way is the maximum commuting time acceptable in a city, we can calculate the area that can be accessed in less than one hour from a central point. The part of this area yet to be built corresponds to the supply of land that can be developed for city expansion without imposing significant and unmeasured welfare costs on long-distance commuters. The size of this area will depend on the speed of different transport modes and the pattern of the road network. Figure 3 illustrates the steps that can help derive the supply of land from the speed of different transport modes. The distance covered during one hour’s travel time depends on the

speed of transport. The speed of transport depends on the mode of transport. Transport modes are divided into two categories: individual and collective.

**Figure 3. The potential supply of land depends on the speed of different transport modes**

Land area that could be reached in less than 1 hour travel time by different means of transport under various assumptions

Mode of transport	Assuming:		Effective average door to door speed (km/hour)	Assuming:		Potential land area reached in less than one hour travel time (km <sup>2</sup> )
	Distance to station (km)	Headway (Minutes)				
individual door to door road based transport start on demand	walk	na	na	4.5	homogenous	41
	Bicycle	na	na	12.0	continuous grid patterned network of roads	288
	Electric scooter	na	na	25.0		1250
	Car & motorcycle	na	na	45.0		2450
public transport network based dependent on timetable	Bus	0.5	5.0	14.0	continuous grid like transit network at 1km distance	282
	Minibus	1.0	5.0	18.0	and stations or stops at 1 km intervals	411
	BRT	1.0	5.0	25.0		1250
	Rail Mass Transit	0.5	5.0	30.0		1281

Sources: author's estimations

Source: Author's estimates.

Individual means of transport—walking, bicycling, motorcycling, and driving a private vehicle—provides access to any area along a road network at any time and without the need to walk to a station or bus stop. By contrast, collective transport—minibuses, buses, bus rapid transit, and rail—provides access only along a transit network that is usually a fraction of the length of the road network. It depends on the frequency of transport and the network's operating hours (for instance, buses operate at, say, 10 minute intervals, between 6 in the morning and midnight).

Figure 3 shows the distance that can be covered in one hour using different transport modes and their corresponding door-to-door speed. The various supply areas are based on the distance covered in one hour by different transport modes at the door-to-door speed and on an assumption that the urban area is covered by a continuous road network and that the transit network covers the existing network at 1-kilometer intervals. These areas would measure the potential land supply corresponding to various transport modes in a monocentric city, where most jobs and amenities are concentrated in a central location. In a polycentric city, the supply area would have to be divided by about two.<sup>8</sup> However, the speed of motorized individual transport would be faster for suburb-to-suburb trips than for suburb to urban core trips. See box 2 for an example of the door-to-door speed of public transport.

**Box 2. Door-to-door speed of public transport**

Commuting time is the total time it takes to go from trip origin to final destination, called the door-to-door commuting time. Commuting speed is the distance from origin to destination divided by the door-to-door commuting time. It is usually significantly lower than the speed of the means of transport itself. When collective means of transport are used, the difference in speed is significant, because it requires walking to and from transit stations, and the differences become even larger when there is a need to transfer between transit lines and larger still when the transfer is between different transport modes (bus to subway, or train to collective taxis).

Suppose that to catch a bus a passenger has to walk on average about 500 meters at 4.5 kilometers an hour, taking about 7 minutes. If a bus arrives every 10 minutes the average waiting time will be 5 minutes before boarding. The bus runs at 25 kilometers an hour between stops. Assume that stops are spaced every 500 meters and that the bus stops for 30 seconds at each stop to let passengers board and alight. Over 10 kilometers, the real speed of the bus will be 17.6 kilometers an hour because of the time waiting at stops. Finally, after arriving at his or her stop, the passenger will still have to walk an average of 500 meters to final destination.

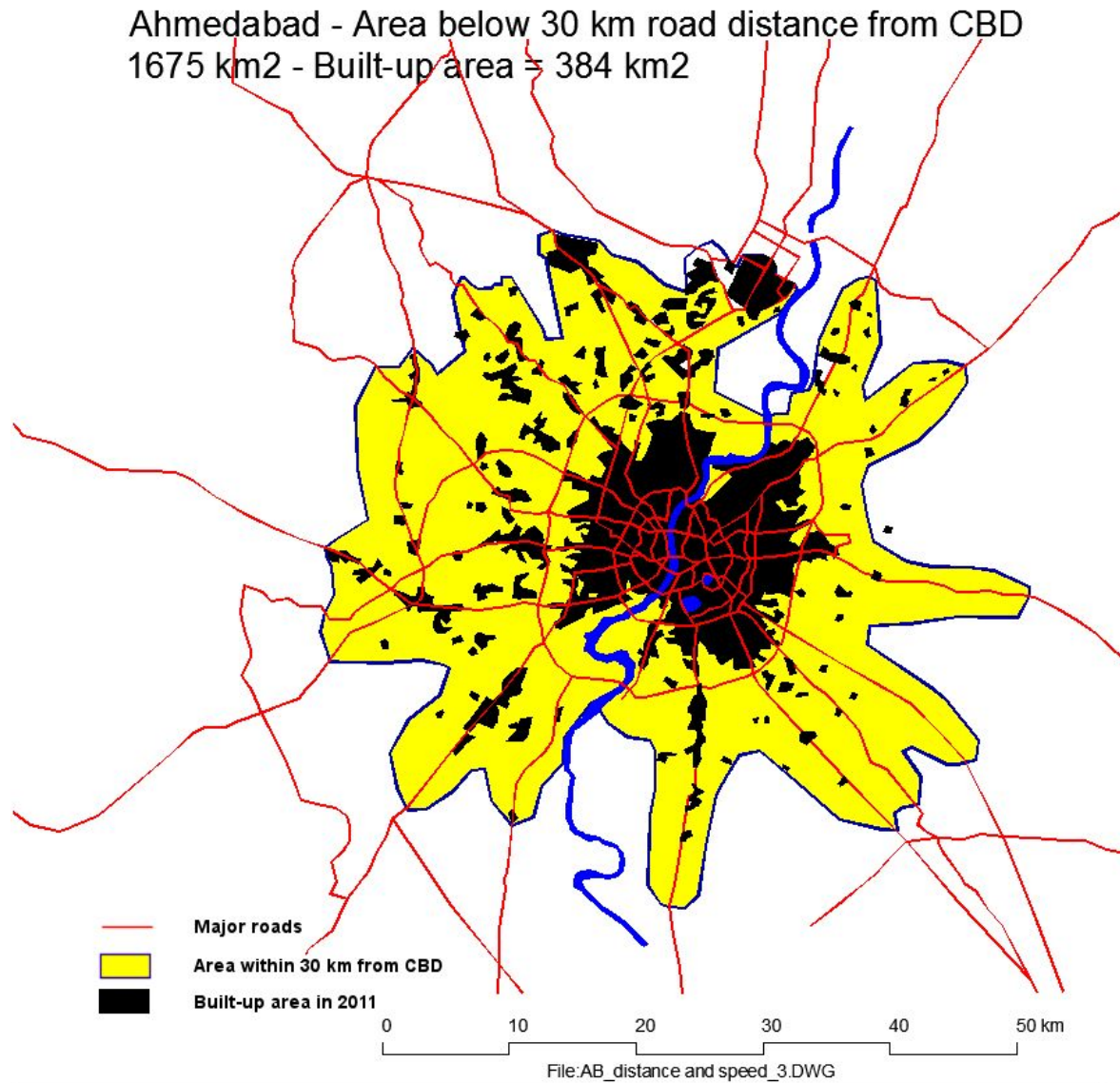
Using the above parameters, the door-to-door commuting speed of the bus is only 12.6 kilometers an hour. If a transfer is necessary to another bus line and the headway or time between buses is 10 minutes, an average of 5 minutes will be added and the door-to-door speed will drop to 11.5 kilometers an hour.

For individual means of transport, the average speed of the vehicle is usually very close to the door-to door-speed, except for car trips to downtown areas where the distance from car parking to workplace destination might be significant and must be walked.

In a city where the road network is idiosyncratic, as is typical, the area accessible through the road network in a given time can be measured directly on a map (figure 4). In Ahmedabad, a scooter runs at about 30 kilometers an hour. The total area accessible in less than one hour from a central location (1,675 square kilometers) using the existing road network represents the land supply under current infrastructure for somebody using a scooter as transport and working in central Ahmedabad. Part of the area accessible in less than one hour is already built—in this case 384 square kilometers of area available for development. So, the new potential land supply is 1,291 square kilometers, but it is available only to users of scooters or faster vehicles.



**Figure 4. Ahmedabad's land supply within 30 kilometers of the city center**



*Source:* For area within 30 kilometers of central business district, author's calculations; for built-up area, Annez and others (2012).

Ahmedabad has also a network of city buses and a newly built bus rapid transit network. The supply of land for people using the public transport system—bus, bus rapid transit, or a combination of the two—would be different and certainly much smaller than the area accessible by scooter. In addition, the use of auto-rickshaws, common in India, would expand the reach of the bus or bus rapid transit network and, as a consequence, the land supply for users of public transport who can afford the supplemental cost of an auto-rickshaw.



The potential supply of land where a city can expand is dependent on the city's transport system, and each income group is limited to its own potential land supply dependent on the affordable transport mode. For people who can afford only to walk, the land supply area is very small (about 40 square kilometers). In cities where jobs are dispersed, as in Gauteng, low-income walkers have access to only a fraction of the job market and are likely to face either high unemployment or much lower real income due to the implicit taxes they pay through transport costs.

### *Increasing the supply of land through faster transport would have more positive impact on the housing of the poor*

One frequent reason for the high cost of land is an inadequate transport system. Transport networks should be planned to expand the land supply area for the lowest income urban groups. Expanding the land supply would hold down housing costs by putting more land on the market. Increasing transport's door-to-door speed by allowing fast and efficient transfers between transport modes could have more impacts on the quality of housing of the poor and on their employment rate than many more traditional low-income housing programs.

In the large cities of Vietnam, where household incomes are sufficient to afford a motorcycle for every worker, the land supply has become very large, and the quality of housing is thus generally high. Motorcycles allow access to undeveloped areas with narrow roads or even unpaved rural trails. In these areas, low-income households do not have to compete for land with higher income groups, who generally require car accessibility for their housing location. The land area accessible only by motorcycle becomes a parallel land market "reserved" for lower income households. In most of the world's cities, the rich, because of their superior mobility, have access to a much larger land supply area than the poor. In Vietnamese cities, because of the quasi-universal social acceptability and affordability of the motorcycle, this advantage is reversed, and the poor, by accepting to live in areas accessible only by motorcycle, have a larger and more affordable land supply than the rich.

### *A costly obstacle course: the transformation of potential supply of land into residential floor space*

Basing the land supply area on the speed of transport modes is only the first step in getting land to its final urban user. It measures only accessibility—it does not mean that the land is available for use. The transformation of the potential land supply into buildable land and eventually into floor space is nearly always long and costly.

Transforming rural land into urban developed land differs by country, and it is not possible to provide a general description of the process. In some market economies, land development is a state monopoly, even though the developed land is eventually sold on the free market, as in Singapore and the Republic of Korea. In China, the local government has also a monopoly on land development, though most of the land, once developed, is auctioned on the free market.

As an example, consider Ahmedabad. India is a market economy with a well-established legal system that supports property rights. But the country's often overreaching government often slows land development to a halt, reducing the potential land supply.

The state of Gujarat, where Ahmedabad is located, has the peculiarity of having perfected over the last 30 years a land readjustment system that in principle would greatly simplify and rationalize the transformation of rural land into urban developed land. In reality, the administrative hurdles created by several levels of government make this transformation lengthy and expensive. In India, as in most countries, land development is an obstacle course with many players, many rules, and many referees who often do not even realize that their actions or principled obstructions are the major causes of the shortage of developed land.

The undeveloped area within less than one hour travel time from Ahmedabad's city center is potentially part of the land supply only for people with access to a car or a motorcycle (see figure 4). Before this land area can be developed, it will be subjected to time- and money-consuming controls, permits, and regulations. And it will require the coordinated construction of tertiary infrastructure to enable access to individual lots. In Ahmedabad, which is not exceptional, being able to build legally on a lot in a greenfield development requires 14 steps involving the federal revenue department and multiple offices of the state and local government. The process would normally take several years, with no guarantee of success.

In emerging economies, household incomes are rising quickly, and financial services are becoming more available. This creates a large increase in demand for housing and office buildings and thus for land. Because of the time lag in getting the necessary permission, the land supply response to increasing demand is always very slow, resulting in rapid land appreciation. In Ahmedabad, the theoretical supply of land accessible to the population will be adequate for many years to come, but the time required for getting from greenfield to developed plot is so long that it has already created an artificial shortage of developed land.

Only a very small part of the land within the theoretical accessibility supply area will end up "on the market" for development. The ability to develop enough land in time to accommodate the demand coming from an increasing population and increasing incomes is the major challenge of modern urbanization. As shown below, more land could be put on the market faster by simplifying the administrative system and reducing the amount of land allocated administratively.

### **Only a fraction of the land developed each year is submitted to market forces**

The economic efficiency of cities rests on the assumption that land is valued at market prices and that it is periodically recycled to its best and highest use as determined by market forces. Land owners, under this assumption, periodically review the value of their land assets and change to a different use if the return net of the sometimes significant transaction costs is not optimum under the current use. That is why tall office buildings in some locations replace old townhouses, and

why detached houses on large lots are replaced by townhouses. The high transaction costs of land use readjustment explain why this process does not happen quickly. When land becomes more expensive, developers substitute capital for land by building taller buildings, using less land per unit of floor space. This constant creative destruction is what allows cities to adapt to changing consumer demand and to new technology.

Because adjusting to a new use is expensive, only a small fraction of the developed urban land is ever submitted to the market forces just described. A large part of the urban land supply is allocated each year by regulation or by government acquisition through eminent domain. The majority of this administratively allocated land is used for roads, parks, railways tracks, utilities, government buildings, and more. As a consequence, the possibility of rapid changes in land use and density, which could improve the productivity of cities, would happen very slowly.

I am not arguing that the value of the land on which roads and parks are built should be constantly updated and that alternative, more financially rewarding uses should be constantly explored. Obviously, large areas of a city have to be devoted either to public goods, which should escape the rigors of the market, or to potentially private goods, such as roads, which are almost everywhere treated as pure public goods. But calculating what proportion of the land area developed each year is submitted to market forces could be a good indicator of how the scarce land is used, underused, or wasted.

I have tentatively tried to measure how the 2,682 hectares of land developed in Ahmedabad over 2000–10 had been allocated (figure 5). Not perfect, the measure is probably accurate enough to help guide future land policy. It is based on existing statistics, interpretations of Google Earth imagery, and the preliminary results of an ongoing study on public land use.

Ahmedabad is probably typical of land use in large Indian cities and reflects Indian land development practices and regulations. The analysis of the flow of land developed in cities outside India would certainly show different results. The purpose of measuring Ahmedabad's greenfield land allocation is to show a method for comparing across cities the transformation of land from agricultural to urban use and the transformation of developed land into floor space.

How many hectares of rural land have to be developed to produce 1 hectare for building housing, industries, and commerce? Every mayor and urban planner should know this ratio for their city. From the preliminary land study in Ahmedabad, the ratio between developed land and salable land is 3.3. That is, under current development practice in Ahmedabad, 3.3 hectares of rural land have to be developed to allow 1 hectare to be used at its highest and best use (this includes land developed by the informal sector). On this 1 hectare of land, 1.7 hectares of floor space would be allowed to be built by current regulations. That is, roughly 2 hectares of developed land are required to produce 1 hectare of floor space.

I am not implying that the land allocated for roads, utilities, and government buildings is being wasted—far from it. I am just distinguishing the land set aside for permanent public use from the

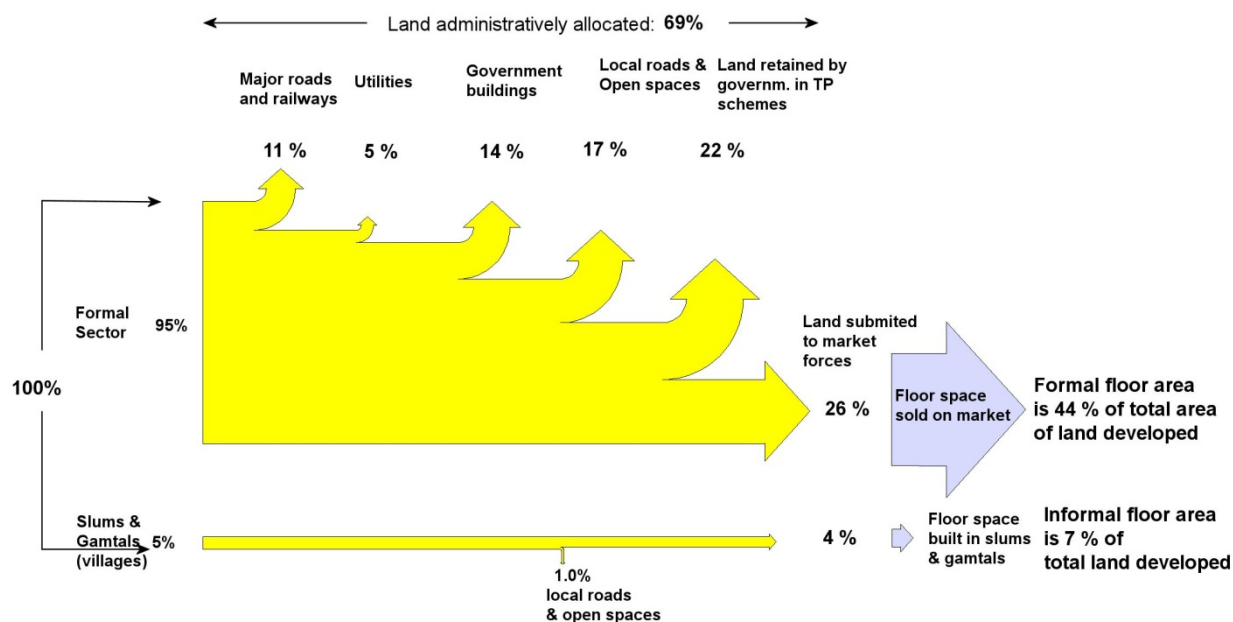
land that will be on the market—and determining which type of use can be changed depending on its market value and consumer demand. Roads, railway tracks, and sewer plants almost never change their use over the years. The land used by government buildings could theoretically change its function over the years, and the floor space built on it could be expanded. Such changes seldom happen, however, because governments are not in the habit of carrying in their books the capital value of the land they occupy.<sup>9</sup> There is thus no incentive to use the capital value of government land more efficiently. Just ask any ministry or municipality the total area of their land holding. Nobody knows, unless a study is specially designed and financed to find out (such a study is currently being conducted in Ahmedabad).

### The land allocation for the extension of Ahmedabad over 2000–10

The 2,682 hectares of land developed over 2000–10 are of two types: land developed formally (95 percent) and land developed informally (5 percent), including slums and additions to villages absorbed into the new urbanization.

**Figure 5. The land allocation process in new areas in Ahmedabad over 2000–10**

2,682 ha of land were developed in Ahmedabad municipal corporation between 2000 and 2010 - the land use was distributed as follows:

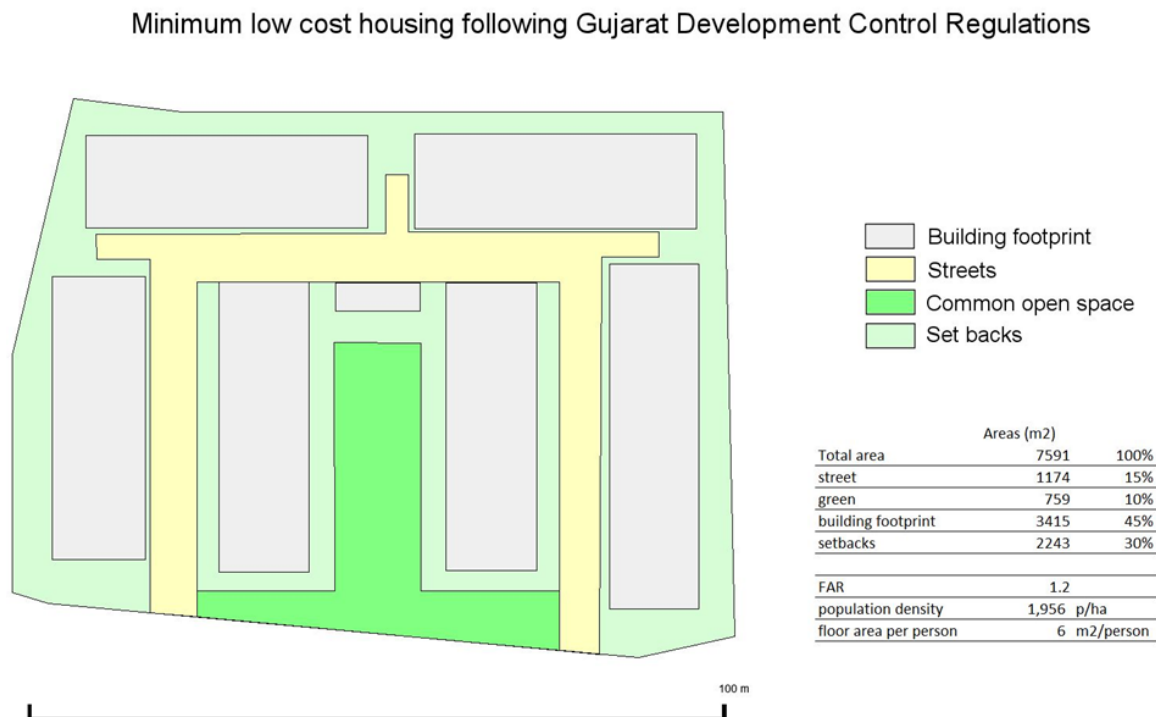


Source: Author's calculations.

Before private development can take place, some land areas are typically allocated by the master plan to various uses. These include major road and railway right of ways (11 percent) and utilities (5 percent). The land allocated to major roads depends on norms and regulations for right of ways. The land allocated to utilities depends on engineering standards and technology.

The next allocation, 14 percent of the land developed, concerns government administrative buildings and major public facilities, including schools, government hospitals, police stations, and large parks. The allocation is sometimes through the master plan but often through ad hoc eminent domain acquisitions. This land is usually acquired at below-market prices.<sup>10</sup> Once allocated, its use tends to become permanent. The low intensity of use shown by the small footprint of buildings and the low floor-area ratio—compared with adjacent privately used land—shows a frequent disconnect between the value of land and the intensity of its use in administrative buildings. This should be no surprise because land’s value, once acquired by government, rarely if ever figures as an asset in government financial accounts.

**Figure 6. Typical low-cost housing layout according to Gujarat Development Control Regulations**



*Source:* Author’s redrawing based on Annez and others (2012).

The land used under “local roads and small open spaces” (17 percent) is not acquired but is set aside by Gujarat Development Control Regulations, which define minimum street width, open space, setbacks, and parking (figure 6). The allocation is similar for all areas of the city, whether near the center where the land is expensive or in a faraway suburb where the land is cheap. The cost of land for internal streets and common open space is paid for directly by the developers and eventually by individual end-users.

“Land retained by government in town planning schemes” (22 percent) is specific to the State of Gujarat and includes the land retained when the government creates “town planning schemes,” land readjustment projects that now extend to all of urban Gujarat. The government retains land for special purposes when implementing land adjustments. This land could be used for any public purpose the government sees fit, including parks and public buildings, large infrastructure, or a utility. It can also be allocated to public housing or even sold to finance the construction of infrastructure.

Over 2000–10, 69 percent of the total land developed was administratively allocated by acquisition or regulations. Not enough information is known about its use to know if some areas have been overallocated or are underused. There may be an underallocation in some categories (major roads, storm drainage) and an overallocation in others (government buildings). This arbitrary land allocation sharply limits the land available for private development, particularly for housing. And it increases the likelihood that most of this land will be frozen under uses largely not dictated by the market.

The residual land not included in the categories described—26 percent of the total—is developed as private plots and bought and sold at market prices. This 26 percent is the only part of the land developed likely to change use or intensity of use according to consumer demand.

The floor space that can be built on this land is, however, severely limited by floor-area ratio regulations. In Ahmedabad, the floor-area ratio is uniformly limited to 1.8 square meters of floor space per square meter of land (with some areas as low as 1) in most of the city. This limit is imposed on residential and commercial areas alike, whether in the city center or in faraway suburbs.

Slums and villages account for only 5 percent of the developed land. But they serve a much larger populace. For example, the ratio of slum area over total area built before 2000 was 7 percent—but people living in slums in 2000 represented 35 percent of Ahmedabad’s population.

Villages are not bound by the development regulations constraining formal residential areas. The land within informally developed areas—slums and village extensions—is allocated purely through markets. Whether the original settlers in slums were squatters or paid for the land, a market was immediately created, and properties are now constantly traded. Change of land use, from residential to commercial, for instance, is also dictated by market forces. So is the allocation of land for street and open space.

### *The allocation of land submitted to market forces*

For urban land submitted to market forces, commercial and business users will usually outbid residential users in the most accessible location. The higher income groups will in turn outbid lower income groups in the more environmentally desirable locations. The lowest income group that can still afford formal housing will be able to afford only the residual areas. And the

households that are too poor to afford the minimal regulatory norms defining formal construction will have to settle in informal areas.

Low-income residents may be able to outbid higher income groups by consuming less land per household, as in many U.S. cities, but this possibility declines when low-income residents cannot afford the higher construction costs of multistory building—that is, they cannot substitute capital for land. Poorly designed regulations often prevent low-income households from reducing their land consumption and therefore cause them to be systematically outbid by higher income groups. Their only alternative is to move into the slums in the informally developed areas. While the density in slums is produced by market forces, the total area developed informally and its location depend more on historical accidents than on consumer choices and market forces.

### *The transformation of land into floor space*

A city is defined by its buildings and by the economic activities or consumption in them. The end-product of urbanization is therefore not land but floor space. This truism is often ignored because of the difficulty of representing the third dimension on a map. Perhaps the three-dimensional images of cities constantly updated on Google Earth will change that.

Land use regulations usually restrict the floor space that can be built on each parcel of commercial and residential land. Typically, regulatory limits on floor-area ratios prevent higher income groups and commercial users from building as tall a structure as they would like (reducing their ability to substitute capital for land), forcing them to consume more land than they would in the absence of regulations. This regulatory constraint, by increasing the land area used by commercial users and high-income groups, indirectly reduces the area of land available for lower income groups.

In the informal areas, the lack of regulation leads to intensive land use, but the lowest income households either cannot afford the cost of sturdy concrete construction required to build several floors or their property rights are so ambiguous that they are reluctant to make the investment. They compensate for the inability to build multistory buildings by minimizing plot size, open space, and road areas, even reducing further their consumption of land.

In Hanoi, where even poor households can afford to buy or rent multistory buildings, informal areas have buildings with up to five floors, multiplying the floor space affordable to low-income households. The examples of Hanoi and Bangkok suggest that a key factor in creating affordable housing is removing the regulatory constraint on floor-area ratios.

Removing constraints on land supply—be they imposed by deficient transport systems, poor land allocation practices, or arbitrary normative regulations—has two main objectives: improving urban productivity and improving the housing quality of the poor. Housing affordability is thus linked directly to land supply.



## The demand side: rethinking affordability

The traditional method for evaluating housing affordability is to measure the ratio between the median housing price and the median household income. It does not work well in cities with wide income disparities and a large informal housing stock.

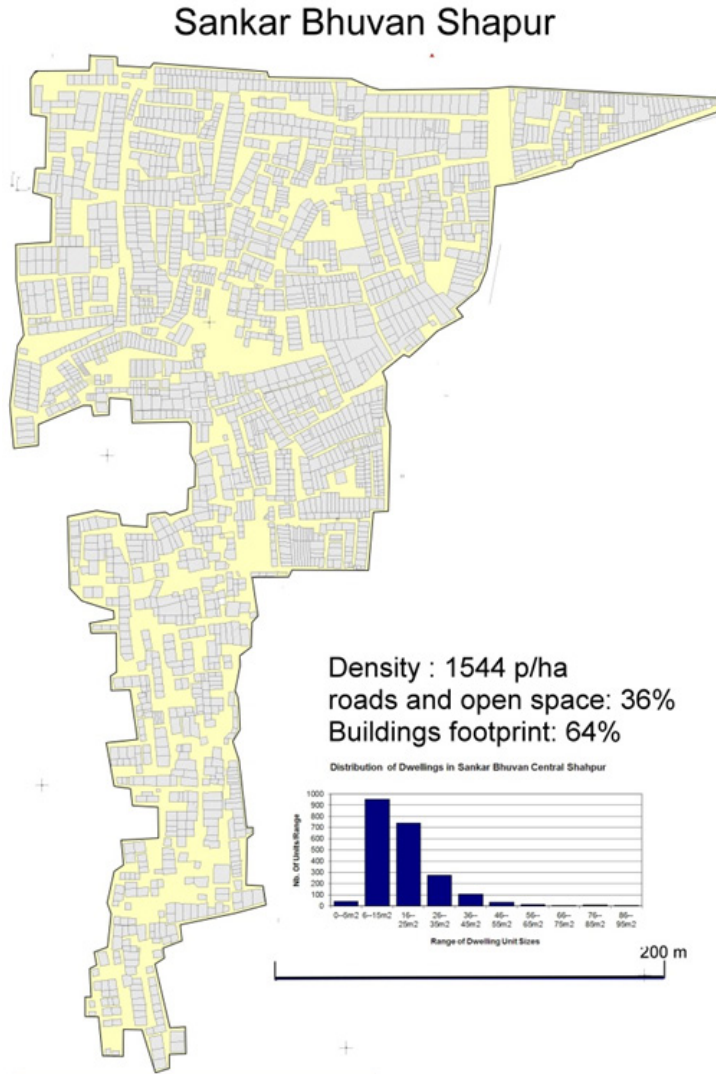
Rapid changes in income distribution, as seen in India and in many East Asian cities, further reduce the usefulness of the traditional normative approach. Government institutions usually define “affordable housing” by minimum lot size, minimum floor size, and minimum water and sewer infrastructure. The price of land becomes the only dependent variable in the traditional “affordable housing” equation, the values of all other variables having been fixed by norms as rigid as they are arbitrary.

Under the traditional approach, the government promotes the building of so-called “affordable housing” on the cheapest land possible—housing in the distant periphery of cities or in very undesirable locations. In Gauteng, a massive state-subsidized housing program had spacious individual houses with well-designed infrastructure and social services but—to save money on land—they were built in distant locations that would have been considered outside the land-supply area defined by the transport mode that the beneficiaries could afford. The result has been costly and lengthy commutes, chronic unemployment, or both. The study of land supply thus needs to be complemented by an understanding of the land consumption for each income group.

Every urban dweller consumes some urban land. In the same city, some consume very little land, others a lot. Consuming very little urban land is not in itself a bad thing and is not necessarily caused by poverty. For instance, people living in luxury apartments along Old Peak Road in Hong Kong SAR, China, consume about 4.5 square meters of land per person while slum dwellers in Sankar Bhuvan Slum in Ahmedabad consume just a little more, or about 6.5 square meters per person (figure 7). The real difference? The luxury apartment dweller in Hong Kong can build 35 square meters of floor area per person on this 4.5 square meters of land by living in a high-rise building. But the slum dweller in Ahmedabad can build only 4.1 square meters of floor area on her 6.5 square meters of land—because the light construction she can afford can support only a roof.



**Figure 7. Ahmedabad—typical slum layout: Sankar Bhuvan Shapur**



*Source:* Author’s drawing and calculations based on 2010 survey conducted by the Self-Employed Women’s Association of India.

Because Hong Kong SAR, China, apartment dwellers can spend enough to leverage the little land they consume into a large area of floor space, they enjoy high environmental quality while consuming very little land. By contrast, Ahmedabad slum dwellers lack the capital to build multistory dwellings on the little land they can afford. As a result, the environmental quality of the dwelling of the slum dweller is extremely low while consuming the same amount of land as a high-income city dweller.

The possibility of leveraging a small area of land into a large area of floor is restricted in three ways: by income, by regulation, and by access to finance. Only households that can afford to pay or borrow for the minimum capital investment—represented, say, by the minimum cost of about 25 square meters of concrete construction—can leverage a small area of land into a spacious

floor. This minimum varies by country: it is around \$5,000 in Ahmedabad and about \$30,000 in Hong Kong SAR, China. Poorer households that cannot afford this cost have to live in dwellings whose areas are often even smaller than the plot of land they can afford.

Various government regulations fix minimum land consumption per households, either directly by fixing a minimum plot size or indirectly by fixing a maximum floor-area ratio (the proportion between the land area and the floor area that can be built on it).

Arbitrary regulations fixing minimum land consumption affect the poor differently than the rich. Poor households that cannot afford the minimum land consumption fixed by regulations are forced to live in informal housing. More affluent households are often forced by regulations to consume more land than they would in the absence of regulations.

Evaluating current household land and floor space consumption standards and the prices corresponding to these standards in different locations is the only way to evaluate housing demand and current affordability. The search for affordable housing should include measures to improve the existing low-income housing stock and to increase the supply of new low-cost housing. The flow of new low-cost housing might come from developing new greenfields, recycling older housing stock, or densifying existing residential areas.

Housing is a continuum: different income groups with different mobility compete for the same land. So it is necessary to have a complete view of the current consumption characteristics of all income groups. Detailed housing consumption surveys by income group should be conducted yearly to provide an updated overall view of the market. On the supply side, the regulatory constraints on the richer households, obliging them to consume more land than they demand, have a negative effect on the poorest.

Over the years, the income distribution of households will be constantly changing. Some who were poor will become middle class, but they might be partially replaced at the bottom of the income scale by poor people moving into the city.

The stock of housing units will also change each year because of new additions (often at the top of the income scale), while some of the older stock will be demolished. The inability to increase the supply of new units, usually because of land supply bottlenecks, will raise housing prices and reduce housing consumption for all, with more dramatic consequences for the lowest income groups. Due to new land and housing flows, it is essential as part of the land supply quantification to project the change in housing stock and to compare it with the changes in the number of households in each income group. Cities usually monitor the number of new formal units being built each year, but they often fail to monitor the drop in the existing housing stock due to demolitions or land use changes and the growth or contraction of the informal sector.

## **Housing policy should be based on a complete understanding of the land supply process and the current pattern of land consumption among income groups**

We have seen the complexity of the land supply process in Ahmedabad. Over the years, different cities have developed different ways of transforming rural land into urban floor space. No “best practice” in supplying urban land can be relevant to all the traditions, culture, and topography that make the world’s cities so different and attractive. It is possible, however, to recommend a method for analyzing quantitatively the land supply process and defining the limits of the potential land supply based on existing transport modes and their speed. This quantitative analysis could help establish priorities and eliminate the practices and regulations that have fewer benefits and higher costs.

### ***Get the numbers right on supply and demand***

On the supply side, most cities are now using GIS technology to map existing land use, making it possible to extract fairly accurately the area of land consumed by different users. GIS and satellite imagery allow establishing a complete “land accounting” system that can detect the inefficient and costly leaks in the land development process. The unresponsiveness of land supply to demand caused by identifiable bottlenecks is the major obstacle to land development, reducing housing consumption for all and especially the poor.

Establishing the potential supply of land based on the commuting speed of income groups is also essential. Many housing policy failures have been caused by the notion that the cheapest land, whatever its accessibility, is the best location for the poor.

The patterns of land consumption for business, industries, and housing also have to be analyzed. Both technology and rising household incomes can dramatically change these patterns of consumption.

### ***Audit regulations and discard ones that impose high constraints but few benefits***

Land use regulations are the result of years of government action reacting to the perceived problems of the moment. As the city economy changes and the understanding of what makes a city productive evolves, many regulations lose their rationale. But nothing is more resilient and long-lived than an obsolete regulation.

Many land regulations contradict each other. Some increase land consumption: minimum plot size, maximum floor-area ratio, minimum number of parking spaces per dwelling. Others reduce land supply: green belt, restriction of land conversion from agricultural to urban.

The combination of regulations that boost land consumption with those that reduce land supply greatly increases the price of land to the detriment of all households, more dramatically for the lowest income households.

Weeding out obsolete land regulations would itself go a long way toward improving the housing consumption of lower income groups. Other actions will be needed, of course, such as investing in infrastructure and transport to increase the supply of land accessible from any point in a city in less than one hour.

### ***Define a supply-side policy program***

Housing standards could be dramatically improved for the poor if many supply-side barriers were removed—or at least reduced—and if the spatial aspect of housing, particularly the transport cost for each location, is taken into account when designing a land and housing policy. Several actions are available in different sectors:

*Transport.* Increase the land supply by expanding the reach of infrastructure and the speed and convenience of transport. Calculate current land supply based on the dominant mode of transport used by income groups.

*Management of public land holdings.* Audit and map government land holdings, and eventually reconvert some underused government land into salable land or use it as a public good (parks, for instance).

*Regulatory reform.* Remove some of the regulatory constraints on commercial and high-income groups that artificially increase their land consumption. Remove some regulatory constraints mostly affecting low-income groups to increase the number of households that can afford formal housing (reviewing minimum plot sizes, apartment sizes, parking requirements, and so on).

*Informal areas and slums.* Monitor the areas, densities, growth rates, and land use standards of informal areas. Consider formalizing these areas as parallel markets where land use rules are purely demand-driven instead of normative.

### **Urban planners need to take full responsibility for the timely delivery of buildable land to markets**

Urban planners have the merit of playing an operational role in city management; they are key actors in the design of infrastructure and urban regulations. They often consider their role as “designer” of more efficient and more “livable” cities. But they also often ignore the role of markets—and in particular the demand from households and firms for land and floor space. As a result, the plans they prepare lose relevance and fail to be implemented, particularly when they fail to monitor the growth of informal land markets that are the only source of land for the poor.

To play a more efficient role, planners should monitor the supply and demand for land and floor space. They should monitor the supply of developable land, defined by the area accessible through the transport network in less than one hour. They should ensure the elasticity of the supply of land by expanding the reach and the speed of the transport network when prices and household incomes are rising. Failure to do this inevitably results in high land prices that become unaffordable to the poor and even the middle class.

Mapping, monitoring, and eventually expanding the developable land supply is of course not sufficient to make it readily buildable. Developable land is a raw input that needs to be processed before it can be used and built on. In the great majority of cities, the responsibility for processing undeveloped land into developed buildable land is fragmented among multiple departments, acting in successive sequence and with few time constraints and no sense of urgency. Municipal services having to give their approval for land development often prefer to prevent or slow down land development to avoid potential problems rather than to try to solve problems as rapidly as possible. They tend to see developers as mostly greedy creators of negative externalities, rather than as necessary intermediaries in the delivery of land and floor space to households and firms.

So, to increase the yearly flow of land put on the market, it is necessary to infuse municipal services with a sense of urgency. In rapidly developing cities, mayors should publicly fix a yearly target area for developed land delivered to users. To implement the land supply target, a municipal land manager should be in charge of following up the stream of land being transformed from developable to fully developed. This would include the preparatory infrastructure work completed by the municipality as well as the various regulatory approvals. The land manager should become the equivalent of a factory manager—fully responsible for the output of a factory. To my knowledge, no official fulfills this role in any city. In most cities, the numerous planning officials involved in the transformation of land have the power to slow down the process; none has the power to accelerate it.

The absence of municipal accountability in the supply of urban land made available to the market contributes to the inelastic supply of land when prices increase, making land and eventually housing unaffordable for a large portion of the urban population. Only when the monitoring and delivery of developable land would become a normal municipal task will cities see a decrease in the share of the total population that have to rely on the informal sector to have access to land and housing.

## Notes

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<sup>1</sup> Angel 2011.

<sup>2</sup> An economist would argue that the land price can qualify as high only when compared with something else, such as the price of construction or the median household income. But for most urban planners land price is always too high.

<sup>3</sup> For Stockholm, see Cervero (1998); for Seoul, new towns see Lee and Ahn (2005).

<sup>4</sup> McKenzie and Rapino 2011.

<sup>5</sup> Prud'homme and Lee 2009.

<sup>6</sup> OECD 2011.

<sup>7</sup> Cervero 1998.

<sup>8</sup> In a polycentric city, all else equal, the maximum travel distance of a worker located in the periphery would have to equal the diameter of the built-up area (assumed to be a circle), rather than the radius, if jobs are concentrated in the center. Alternatively, speeds would have to double to cover the same area.

<sup>9</sup> To my knowledge, only the government of South Africa taxes itself for the land it occupies (see figure 2).

<sup>10</sup> The acquisition price for eminent domain is fixed at “jantri rates,” which are administrative land values fixed by the Gujarat state government for tax purposes. It is usually much below the market value, even with the 30 percent bonus usually added to it.

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