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An Incremental Intervention in Jakarta: An Empowering Infrastructural Approach for Upgrading Informal Settlements

Christopher H. Counihan
chris.counihan@gmail.com

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**AN INCREMENTAL INTERVENTION IN JAKARTA:
AN EMPOWERING INFRASTRUCTURAL APPROACH FOR UPGRADING INFORMAL
SETTLEMENTS**

A Thesis Presented

By

CHRISTOPHER H. COUNIHAN

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degrees of

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MASTER OF LANDSCAPE ARCHITECTURE

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Department of Architecture
Department of Landscape Architecture & Regional Planning

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By

CHRISTOPHER H. COUNIHAN

Approved as to style and content by:

Kathleen Lugosch, Chair

Carey Clouse, Member

Mark Lindhult, Member

Stephen Schreiber, Department Chair
Department of Architecture

Elisabeth Hamin, Department Chair
Department of Landscape Architecture
& Regional Planning

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ABSTRACT

AN INCREMENTAL INTERVENTION IN JAKARTA:

AN EMPOWERING INFRASTRUCTURAL APPROACH FOR UPGRADING INFORMAL
SETTLEMENTS

MAY 2017

CHRISTOPHER H. COUNIHAN, B.S., SKIDMORE COLLEGE

M.Arch/M.L.A., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Professor Kathleen Lugosch

Incrementalism is a growing movement within multiple design disciplines that approaches design with sustainable, social, and resilient aims structured around participatory, infrastructural, and phased approaches to design. Carefully considered structural and independent infrastructural frameworks allow infill and accretion according to the demands and needs of individuals and communities. This paper outlines the theories, case studies, and conditions driving incrementalism. My research has informed my project proposal for an incremental upgrade of a slum located in Jakarta using a phased, soft infrastructural, resident facilitated upgrade and development strategy creating new housing units, productive landscapes, and urban form. Incremental development will foster the social aims of my project, while affordably, equitably, and efficiently upgrading the standards of living for slum dwellers within the Waduk Pluit community.

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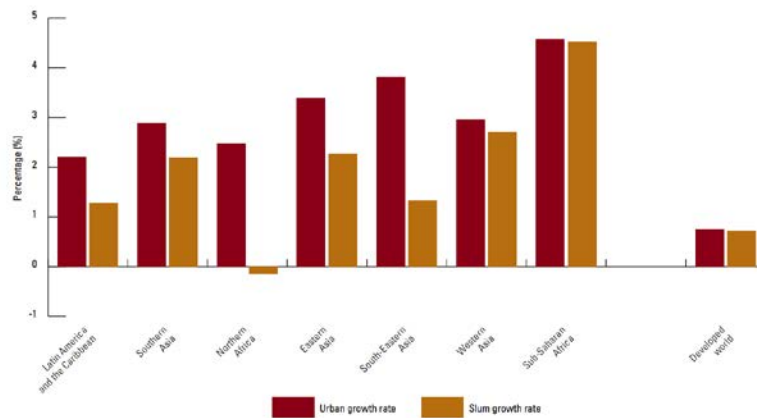
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CHAPTER I

INTRODUCTION

A. Argument for Slum Upgrading

Over the past two decades the failure of standard housing delivery methods to answer to the scale and needs of the urban poor has inspired many to revisit “incremental housing,” and S&S approaches first formulated in the 1970s and 1980s. By 2030 the urban population will double, mostly in the developing world, reaching growth rates of almost 5 percent per year in developing countries.¹ Most of this growth will occur informally. Many developing countries do not have the infrastructure, governmental support, or strong social services typically needed for more methodical growth, giving rise to the formation of informal settlements, or slums.



Sources: UN-HABITAT, Global Urban Observatory 2004.

Figure 1: Annual growth rate of cities and slums.

The implications are immense. Humans have 20 years to build as much urban housing as was built in the past 6,000 years. Humans cannot continue with the status quo; the speed and scale of rapid urbanization has become critical, leading to unsanitary, unsafe, and inequitable conditions; increasing natural disasters only add to these challenges.² UN “estimates indicate that

¹ United Nations. “The Struggle to Achieve the Millennium Development Goals will be won or lost in Cities” in State of the World’s Cities: 2006/7. UN Habitat. 52.

² Goethert, Reinhard. “Incremental Housing: A proactive urban strategy.” *Monthly Developments*, September 2010.

if governments continue with business as usual, then an additional 400 million people will be drawn into the misery of slum life as the global slum population reaches 1.4 billion in 2020.”³

Traditional “instant” housing approaches are costly, socially disruptive, (frequently) culturally inappropriate, and overtax limited administrative resources. In the rapidly growing cities of the developing world, informal construction and expansion, “pay-as-you-go,” is the de-facto growth pattern, especially in low-income neighborhoods and on the periphery of cities.⁴ This process accounts for most new housing construction and improvements in developing cities.⁵ The informal “sector” already provides about 70 percent of all urban housing in cities of the developing world, making it the leading supplier in the housing supply chain.⁶

A problem with informal development patterns is that they can be prohibitively costly to upgrade. Because informal settlements arise in areas not slated for development, they are devoid of any significant infrastructure.⁷ Infrastructure needs are handed off to the private sector, allowing the settlement’s existence, while reducing government involvement. Upgrading informal settlements is a method of providing land tenure security to those who inhabit the settlement.⁸ This gives occupants of the community incentives to upgrade their housing and provides them with better economic opportunities.⁹ “The concentration of population and enterprises in urban areas significantly reduces the unit cost of piped water, sewers, drains, roads, electricity, garbage collection, transport, health care, and schools.¹⁰ However, the cost-effectiveness of infrastructure investment is greatly reduced when these investments are made too late.”¹¹

Incremental housing involves a step-by-step process. Incremental housing goes by many names: starter home, phased-development house, or owner-driven house. All act as an integral

³ United Nations. “The Struggle to Achieve the Millennium Development Goals will be won or lost in Cities” in *State of the World’s Cities: 2006/7*. UN Habitat. 50.

⁴ IBID

⁵ IBID

⁶ IBID

⁷ IBID

⁸ Wakely, Patrick and Riley, Elizabeth. *The Case for Incremental Housing*. Washington, D.C.: The Cities Alliance. 2011.

⁹ IBID

¹⁰ United Nations. “The Struggle to Achieve the Millennium Development Goals will be won or lost in Cities.” 2006/7. 49.

¹¹ IBID

urban development processes, providing housing to individuals and communities. Incremental housing is not quick, immediate, or complete, but provides owners with choice and time. It begins with a core shelter that may be a kitchen/bathroom unit or a bare lot with the potential for utility provision. The fundamental component is a multi-purpose room with integrated, or ancillary, basic kitchen/bath facilities. Homeowners control the expansion of their home based on their needs and resources over time.¹²

Incremental housing provides an affordable way to resettle households at a simple housing and services level, linking the faculty of homeowners and community with larger-scale city planning. Incremental housing can provide secure title and maximum flexibility in housing decisions for residents. City expansion can be managed, creating a more predictable and effective use of limited funds and administrative resources. But incremental housing has functions beyond housing. It fosters the development of communities, allowing individuals to develop social networks that can support services, small-scale commercial opportunities, and social mobility.¹³

Site and services (S&S) describes a strategy tested and implemented in the 1970s and 80s. S&S provided a plot with legal title and water, sanitation, streets, and supporting services. These projects mimicked existing squatter settlements, but provided institutional support, legal title, services, and a basic shelter option.¹⁴ S&S gradually fell out of favor, partly because it was a lengthy and incomplete process, and not a typical instant-housing solution.¹⁵ Professor Pat Wakely of University College, London explains, “Site and services was deemed unsuccessful and discredited. They [projects] were evaluated too soon (after two to three years) and there was misunderstanding about the criteria and indicators in this process-based type of project.”¹⁶ S&S is being revisited by contemporary architects, urban designers, and city planners. It clearly works (when evaluated over the long term) due to the growth evident in the communities where adopted

¹² United Nations. “The Struggle to Achieve the Millennium Development Goals will be won or lost in Cities.” 2006/7. 49.

¹³ *IBID*

¹⁴ Goethert. “Incremental Housing: A proactive urban strategy.” 2010.

¹⁵ Wakely and Riley. *The Case for Incremental Housing*. 2011.

¹⁶ Goethert. “Incremental Housing: A proactive urban strategy.” 2010.

or tested. While construction quality may be marginal, and infrastructure services are lagging, standards of living and residents prospects have improved.

Incremental housing allows for housing costs to be reduced, acknowledging that poor households already build and extend dwellings incrementally in response to household needs and resources. Incremental housing took two approaches with the addition of policy and legal frameworks: upgrading existing informal settlements with potable water, sanitation, drainage, electricity, and circulation; and providing legal tenure for new plots on serviced land (S&S) where households could self-build dwelling units.¹⁷

Projects that were “evaluated” one or two years after initial development were incorrectly assumed to have failed. When revisited a decade or more later, their successes are apparent. The social and economic benefits of engaging communities and individuals in self-build projects have become clearer with time. This highlights the need to reassess incremental housing methods and approaches.¹⁸

Successful incremental housing projects build on customary practices. Projects must focus on minimal interventions, or the absolute, acceptable minimum, rather than what is ultimately desirable. Projects must establish a sense of identity and place for the homeowners and the community. This fosters resiliency, where, after a disaster, stability and a sense of support are inherent. Recent incremental housing interventions promote further development of this concept. The physical, legal, and policy framework must include support for communities.¹⁹

Three basic physical options can provide a framework for subdivision in new settlements: main streets, main streets with large-lot cluster divisions, and main streets with all lots defined. The minimal approach is a grid of through-streets and infrastructure networks. The most complete option provides a fully realized layout with individual lots, streets, and space for public amenities, utilities, and facilities. All require the main service grids be built first and then expanded upon as

¹⁷ Wakely and Riley. *The Case for Incremental Housing*. 2011.

¹⁸ IBID

¹⁹ IBID

demand requires and resources permit. Infrastructure will develop incrementally alongside dwelling units.²⁰

Starter cores provide one multi-use room with kitchen/toilet facilities. Finished room starter cores offer immediate identity, habitability, and place, helping to define a neighborhood and street. Cores should be built with strict guidelines to provide a model and structure for safe and predictable expansion while encouraging good construction practices. Households value flexible expansion opportunities, local materials and skills, and vernacular appearance and aesthetics. Settlers can focus on outfitting, program, adjacencies, and finish, while professionals can focus on safety, sanitary, and economic factors including ensuring earthquake and hurricane safe construction, the provision of water and sanitation, the initial cost, and mobilization time. Many inventive, and exotic ideas have been offered, but most are unsuited for broader applications. A straightforward plan rooted in situ is best.²¹

Given the rapid urbanization occurring in the developing world and the high proportion of those settling in new and existing slums, it is important to understand slum conditions, typologies, and locations so that early interventions can be made to prevent conditions from worsening.

B. Slum Morphology

Informality is not confined to places of poverty and therefore should not only be associated with slums. Every economy has a formal and informal sector, and so do all cities. Cities are shaped by informal processes just as much as formal processes. “Informal settlements” have become defined as urban fragments or districts that form and function largely outside the formal control of the state. Informal settlements are not entirely unplanned or undesigned because they are a result of strategic and speculative decisions by the occupants.²²

²⁰ Wakely and Riley. *The Case for Incremental Housing*. 2011.

²¹ IBID

²² Martin, R. and Mathema, A. “Clash of civilizations.” *Informal Settlements*. 2006.

Most informal settlements have a range of rental, squatting, and informal entitlements. Land tenure is frequently irregular, unclear, and oftentimes contested, rather than being strictly illegal.²³ A slum is defined by the UN as “any dwelling with more than three people per room or without access to clean water, sanitation, security, or durable shelter.”²⁴ The formation of informal settlements and slums indicates growth in population and urban employment that has not been matched or anticipated by the capacity of the state or the formal market to provide affordable housing.²⁵

Three primary modes or processes of informal settlement growth have been identified.²⁶ The first is called “settling,” or inhabitation on unclaimed and unbounded land as villages and towns have done over millennia. The second has been called “inserting”: development along the uninhabited abandoned, or leftover fragments of urban space. The third mode is “attaching”: developmental accretions or growth within, or attached onto, structures of the formal city. Room by room growth patterns can be a contiguous accretion that extends horizontally and vertically to about five or six storeys. This process is driven by the slow accumulation of scarce resources over time. Construction materials are commonly recycled and can range from plastic, timber, steel, concrete, canvas, rubber, bamboo, to brick. Room types and their arrangement reflect local culture, climate, urban density, and geography.²⁷

Informal settlements and slums can be understood in eight ‘types.’²⁸ District slums are contiguous. Most notable large urban slums are large mixed-use districts that incorporate retail and industrial functions. These develop over a long period of time, and are often the site of upgrading as the informal becomes infiltrated by the formal city.²⁹

²³ Jenkins, P. “Informal settlements: infernal and eternal?” *Informal Settlements*. 2006.

²⁴ United Nations. “The Struggle to Achieve the Millennium Development Goals will be won or lost in Cities.” 2006/7

²⁵ Dovey, Kim and King, Ross. “Forms of Informality: Morphology and Visibility of Informal Settlements.” *Built Environment* 37, no. 1. 2011.

²⁶ IBID

²⁷ Dovey and King. “Forms of Informality: Morphology and Visibility of Informal Settlements.” 2011.

²⁸ IBID

²⁹ IBID

Waterfront slums are settlements on marginal land between a water body, and the formal city. Previously, this land was considered unsafe for development due to flooding. Oftentimes an ecological or economic connection exists to the water. These settlements can spread into and above the water on stilts and boats.³⁰

Escarpment slums develop on parts of urban topography that are considered too steep to build upon and are settled informally. This area is found frequently between the formal city and mountainous areas.³¹

Easement slums occur along urban infrastructure like railways, highways, power lines, and sewer lines which have buffer zones that can become the sites of informal settlements. Sometimes the settlements turn infrastructure into pedestrian pathways. Elevated infrastructure develops underneath. This slum typology occurs at a large scale or in small leftover spaces.³²

Sidewalk slums emerge when sidewalks are lined with walls or fences and are not used for access to property. Linear housing one room deep and several storeys high emerges. These are some of the most venerable informal settlements, constructed of cheap and movable materials that can be stored during the day.³³

Adherence slums attach to, or protrude from, formal public facades. Informal additions may be internal or external to the building, but relies on an existing formal building.³⁴

Backstage slum settlement occurs in between and behind existing buildings hidden from public view. Informality increases as the distance from street frontage increases. Typically, access is provided by a small alleyway on the street that leads to an irregular amalgamation in the rear of a city block. These developments are most common in conditions where a strong state authority is present.³⁵

³⁰ Dovey and King. "Forms of Informality: Morphology and Visibility of Informal Settlements." 2011.

³¹ IBID

³² IBID

³³ IBID

³⁴ IBID

³⁵ IBID

Enclosure slums are contained within a large building, lot, or compound. The formal boundary sets limits for the extension and visibility of the informal settlement.³⁶ None of the previously listed “types” are static, nor mutually exclusive. Generally, they can be grouped into three sets according to morphology: waterfronts and escarpments - dependent on topography; sidewalks - dependent on circulation; and backstages, adherences, and enclosures - related to public and private interfaces. Many informal settlements are intentionally temporary, however most become permanent with time. The incremental construction process within the urban informal sector is highly affordable and socially responsive, but develops inefficiencies and insecurities derived from its informality and illegality.³⁷

Incremental slums demonstrate a process that is both effective and efficient in responding to occupants’ changeable needs and fortunes, but are constrained by minimal institutional support that could improve the effectiveness and efficiency of incremental housing processes at larger scales.

Understanding incremental slum typologies, conditions, and formation is essential when dealing with cities of the developing world. Slums cannot be considered monolithic entities, but rather must be confronted individually to best address the unique conditions within.

³⁶ Dovey and King. “Forms of Informality: Morphology and Visibility of Informal Settlements.” 2011.

³⁷ IBID

CHAPTER II

INTRODUCTION TO INCREMENTALISM

A. Incrementalism

Current initiatives promoting incremental housing tend to be small in scale, and are executed through government, non-governmental organizations (NGOs), cooperatives, and private sector partnerships. No national, metropolitan, or municipal housing policies or strategies currently exist to support incremental housing, or to aid procurement of urban housing. Recent and current projects are often a part of larger poverty mitigation programs. Early S&S projects serve as important case studies, enhancing our understanding of informal housing processes and their poverty alleviation over the past thirty years.³⁸

Many developing world governments do not have the resources or capital required to build complete subsidized housing for all low-income residents. Individuals demonstrate the ability to ‘self-house’ informally if the formal market is too expensive or provides legal difficulties. With existing and novel informal strategies for housing and urban planning, a higher number of legal, safe, and sanitary dwellings for low-income individuals and communities can be provided when compared to conventional low-income approaches. These methods must encourage the upgrading of existing units as well as the provision of new plots to best raise these individuals and communities out of poverty.³⁹

Households and individuals are capable of raising funds by saving or borrowing. Their investment in housing and neighborhood improvements can be encouraged if the security of their investment be guaranteed. The threat of eviction due to unsecured tenure limits housing and neighborhood infrastructure because individuals are weary of investing money, resources, and time into structures they could lose to demolition or be evicted from. With the provision of land

³⁸ Wakely and Riley. *The Case for Incremental Housing*. 2011.

³⁹ IBID

tenure, property rights, and urban services, low-income households and government can share the cost of incremental improvements with communities.⁴⁰

Incremental housing initiatives rely on government to provide land, infrastructure, and services, while individuals are responsible for constructing affordable housing that meets the needs and priorities of residents. This cooperation is essential and should be created between various levels of government, private sector, civil sector, and community groups to enhance and improve the management and administration of services, utilities, and infrastructure within a community.⁴¹

Incremental housing provides opportunities to regulate ongoing informal (frequently illegal) development, and ensures infrastructure, service delivery, and efficient land use. Incremental housing facilitates developments that correspond with strategic plans for urban areas, rather than on a site-by-site basis. Incrementalism encourages development of higher-density, compact neighborhoods that utilize land, resources, and infrastructure more efficiently. Legitimizing low-income incremental housing allows governments to set strategic priorities for an entire urban area.⁴²

The organization and management of incremental development allows for the creation of a decentralized participatory decision-making and a self-governance framework. Good local governance promotes transparency and accountability when managing the financial and physical components of housing, and neighborhoods, as well as community development that supports local aims and activities. Household and community participation provides a sense of ownership and pride that encourages the maintenance and upkeep of civic services, infrastructure, and resources.⁴³

Incremental housing can foster the social and economic development of low-income households and communities. A “common cause” can unite and organize a community, especially

⁴⁰ Wakely and Riley. *The Case for Incremental Housing*. 2011.

⁴¹ IBID

⁴² IBID

⁴³ IBID

if focused on the construction of infrastructure and housing. Enterprises, cultural activities, and empowerment result, stimulating the economic and social development of a community.⁴⁴

Support for incremental housing processes can provide a basis for the wider social and economic development of low-income households and communities. It requires, however, the cooperation of many government and municipal departments responsible for housing. These departments must develop their capacity to provide social and economic support, requiring the acquisition of new skills and professional competencies.

Patrick Wakely and Elizabeth Riley's "The Case for Incremental Housing" outlines the six components that can be used to make incrementalism strategies possible and sustainable. They include land, finance, infrastructure and services, site planning and building controls and supports, community organization and asset management, and strategic planning.

Land is the primary component of government support for housing of low-income groups. When making it available for incremental development, location, price, and title require consideration. Land proposed for incremental, low-income housing requires careful cost and benefit analysis beyond the initial price and the cost of servicing, as well as any potential social and economic costs. Acquisition of desirably located private land typically is beyond the means of government funds, requiring political will and risk-taking. Governments must negotiate with private landowners with incentives, including trading development advantages, and land-sharing schemes. Freehold ownership of land and property is the most secure, but can lead to profiteering. Long and renewable land leases are possible, but less appealing to residents. Collective title, co-operatives, and condos can provide low-income households security while protecting them from market pressure.⁴⁵

Incremental housing requires flexible, short-term loans that respond to the changeable needs and demands of resident fortunes and priorities. Loans can be distributed incrementally to

⁴⁴ Wakely and Riley. *The Case for Incremental Housing*. 2011.

⁴⁵ IBID

ensure financial security and effective spending. Financial credit has been swapped with bulk construction materials in many cases. When organized and stored in one location they can create a depot for materials, advice, loans, and employment. Independent financial loan agencies are more efficient and effective than government finance programs. Microfinance, aided by NGOs or banks, is an effective means for dispersing money to low-income residents.⁴⁶

Infrastructure and service provision timing, standard, and level are essential for supporting housing initiatives. If infrastructure and services are provided beyond resident and community needs, the price can become unaffordable. If services and infrastructure are provided too scarcely, plots and land will go undeveloped or underdeveloped. The best way to assess needs is to engage the community to understand cost benefits and usage potential. Low standards are not always best. High standards can promote high quality development and pride in ownership. Cost recovery is possible through user tariffs, district cost distribution, or local taxation. Community labor used for construction is essential to reducing costs (sweat-equity). Prioritizing services and implementing them with appropriate timing is key to affordable development.⁴⁷

The distribution of land use, plot sizes, and layouts are usually determined by norms and regulations. Incremental housing can be used, however, to test and demonstrate new planning standards. Planning regulations and building constraints should be minimal in order to encourage incremental development, while also ensuring the health and safety of occupants. Regulations should be shifted from development constraints to development facilitation.⁴⁸

A sense of ownership of local facilities encourages the community to commit to long term maintenance and management. This requires participation at all stages of the project and should be introduced as a high priority from the outset of the project.⁴⁹ Accounting for these elements in broad project plans is critical for the successful implementation of incremental housing initiatives. National policies must seek to reduce poverty in urban areas and must

⁴⁶ Wakely and Riley. *The Case for Incremental Housing*. 2011.

⁴⁷ IBID

⁴⁸ IBID

⁴⁹ IBID

acknowledge architecture and planning plays a significant role in reducing it. Placing housing initiatives in the broader housing market context is essential if incrementalism is to have an impact of significant scale.⁵⁰

B. Incremental Housing History

The first incremental housing plans and policies were developed and implemented relatively recently, largely by NGOs, non-profits, and experimental governments. The World Bank built one of the first S&S projects in Africa, Latin America, and Asia in the early 1970s. This was the first time the World Bank focused on urban environments. During the same period, a progressive government in Peru was implementing large-scale, “least-cost” urban housing near Lima. Rebuilding was needed after a large earthquake, and an innovative surveyed plots system was employed. S&S projects sought to provide “affordable” housing to low-income households, which usually put them out of reach of the poorest urban dwellers.⁵¹ Both the S&S and the surveyed plots system were inspired by John F.C. Turner. While working on the earthquake reconstruction project in Peru in the early 1960s, Turner observed, “when left to their own devices people produce the most efficient possible housing solutions for themselves, over time and through self-help and mutual aid.”⁵²

Turner served as a professor at MIT and influenced several practitioners. The first settlement that stemmed from his academics was CUAVES, or Comunidad Urbana Autogestionaria Villa El Salvador outside of Lima, Peru. Villa El Salvador was notable for its urban design and that it initially consisted of surveyed plots. The design was a large-scale grid of adjoining neighborhoods of 400 x 400 meters. Villa El Salvador has since become the second

⁵⁰ Wakely and Riley. *The Case for Incremental Housing*. 2011.

⁵¹ Chavez, Roberto. “Incremental Housing: The Past and Future Dwelling Solution for the Poor.” Special Interest Group in Urban Settlement, Massachusetts Institute of Technology, School of Architecture and Planning.

⁵² IBID

largest city in Peru, now fused with Lima. The slums have evolved into one-to-three storey, brick and mortar dwellings, with small businesses located on the ground floor.⁵³

Another successful surveyed plot program supported by the World Bank was designed in Ouagadougou, Burkina Faso in the mid-1980s. The government launched a large-scale surveyed plot program that followed a master plan. Poor families arriving from rural areas were directed to future residential neighborhoods, where they were provided a plot of land. As in Peru, essential services such as water and cooking fuel, were provided by the informal sector. The Bank-supported project eventually provided communal water fountains to the development.⁵⁴ In addition to surveyed plots, street addresses were provided. This was an important improvement, allowing the government to collect a very small tax to cover the cost of operating and maintaining the address system, but it also offered new residents a sense of belonging. It also enabled services and utilities the ability to quickly provide infrastructure such as electricity, garbage collection, and road maintenance without having to establish their own numbering system.⁵⁵

Noukchott, Mauritania utilized a street addressing system, combining it with S&S, and a preliminary “City Development Strategy.” The master plan designated low-income residential areas, and helped prevent the formation of squatter and future slums. A large existing slum was slated for upgrading, where a 400x400m grid would overlay the squatter settlement and the main avenues would be bulldozed. In the interior of the grid, they preserved the organic and informal layout of the plots of varying sizes. Water fountains were situated at the intersections of the streets. Dwellings that were removed from the main thoroughfares were relocated nearby and integrated into the grid and beyond to the road network of the city. The design of the surveyed plot settlement included clusters and cul-de-sacs, as in the Caminos.⁵⁶ This project focused on

⁵³ Chavez.. “Incremental Housing: The Past and Future Dwelling Solution for the Poor.”

⁵⁴ IBID

⁵⁵ IBID

⁵⁶ Caminos, Horacio and Goethert, Reinhard. *Urbanization Primer: Project assessment, site analysis, design criteria for site and services of similar dwelling environments in developing areas*. Cambridge: MIT Press. 1978.

incrementalism across scales, dealing with existing slums and squatter settlements as well as the flow of new residents to the community at a national scale.⁵⁷

Recent projects have focused on upgrading existing informal neighbourhoods in cities. Strategies that include the provision of appropriately located, affordable, serviced land. S&S projects geared towards new low-income urban households and communities are less common and often limited in scale due to political, organizational, and social conditions.⁵⁸

⁵⁷ Chavez. "Incremental Housing: The Past and Future Dwelling Solution for the Poor."

⁵⁸ **IBID**

CHAPTER III

JAKARTA

A. Background

Jakarta is located in Southeast Asia, to the south of Malaysia and north of Australia. The country is an archipelago made up of seventeen thousand islands, many volcanic. Indonesia has a square area of 735,358 square miles, making it the fourteenth largest country by land area.⁵⁹ With 260 million people, Indonesia is the world's fourth most populous country.⁶⁰ The island of Java contains more than half of the total population of Indonesia and is the world's most populated island.⁶¹ Jakarta is located on the island of Java to the northwest. It is the second most populous metropolitan area in the world with a population of 30,214,303 as per the 2010 Indonesian census.⁶² The city has been the capital of Indonesia since Indonesian independence in 1945 and drives a significant portion of the Indonesian economy.



Figure 2: Jakarta's location in the world and Indonesia

Jakarta grew steadily through the mid-20th century. Its rapid growth and urbanization began in earnest in the early 1960s, resulting in today's sprawling capital city. Jakarta has

⁵⁹ Central Intelligence Agency. "Rank Order Area." *The World Factbook*. Washington, D.C.: U.S. CIA. October 17, 2006.

⁶⁰ World Bank. "Indonesia – Data"

⁶¹ IBID

⁶² "Data Jumlah Penduduk DKI Jakarta." Jakarta Open Data. Pemerintah Provinsi DKI Jakarta, Dinas Kependudukan dan Catatan Sipil. 2014. Retrieved December 5, 2015.

experienced rapid population growth over the past 50 years, growing at an average of 2.4% per year.⁶³ By 1961, Jakarta's population was 2.9 million, and by 2010 the population had surged to 9.6 million inhabitants.⁶⁴ During the work hours, the municipal population swells to over 12 million people with the influx of commuters each day.⁶⁵

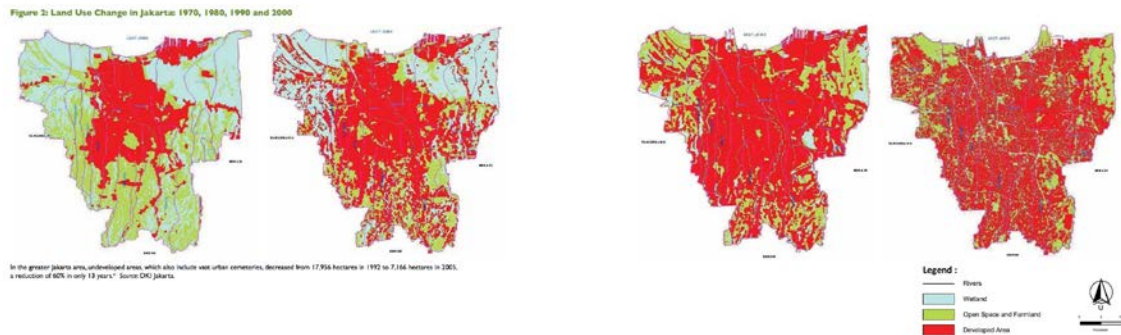


Figure 3: Developed area expansion 1970, 1980, 1990, and 2000⁶⁶

Jakarta is located in the northwestern coast of the island of Java and serves as the capital of the country of Indonesia. The Special Capital Region of Jakarta (DKI Jakarta; Daerah Khusus Ibukota) covers an area of ca. 662 km².⁶⁷ Population pressure and economic development has caused extensive land use change throughout Java,⁶⁸ and is most pronounced in Jakarta.⁶⁹ During the past three decades, the periphery of the urban area has converted from prime agricultural land to new urban and industrial areas.^{70 71} In the urban core, many former residential districts have been converted into offices and businesses, while open and green spaces in Jakarta have decreased from 28.8% of the Capital Region in 1984 to an estimated 6.2% in 2007.⁷²

⁶³ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. Jakarta: Mayor's Task Force on Climate Change, Disaster Risk & the Urban Poor, Jakarta. 2011.

⁶⁴ IBID

⁶⁵ IBID

⁶⁶ IBID

⁶⁷ Firman, T. "The continuity and change in mega-urbanization in Indonesia: a survey of Jakarta-Bandung Region (JBR) development." *Habitat International* 33 (2009): 327–339. doi:10.1016/j.habitatint.2008.08.005.

⁶⁸ Verburg PH, Veldkamp TA, Bouma J. "Land use change under conditions of high population pressure: the case of Java." *Global Environmental Change* 9 (1999): 303–312. doi:10.1016/S0959-3780(99)00175-2.

⁶⁹ Firman, T. "The continuity and change in mega-urbanization in Indonesia: a survey of Jakarta-Bandung Region (JBR) development." 2009.

⁷⁰ Firman, T. "Rural to urban land conversion in Indonesia during boom and bust periods." *Land Use Policy* 17 (2000):13–20.

⁷¹ Verburg PH, Veldkamp TA, Bouma J. "Land use change under conditions of high population pressure: the case of Java." 1999.

⁷² Firman, T. "The continuity and change in mega-urbanization in Indonesia: a survey of Jakarta-Bandung Region (JBR) development." 2009.

Year	Population	Increase over previous decade
1961	2,906,500	28%
1971	4,546,500	56%
1980	6,503,400	43%
1990	8,259,300	27%
2000	8,385,600	2%
2010	9,588,200	14%

Source: Badan Pusat Statistik Provinsi DKI Jakarta, 2009.

Table 1: Population growth in Jakarta

The urban agglomeration, or metropolitan area of Jakarta, is referred to as Jabodetabekjur (derived from the names of the city and surrounding provinces – Jakarta, Bogor, Depok, Tangerang, Bekasi and Cianjur), and has a population exceeding 27 million people (according to the 2010 census), making it the second most populous metropolitan area in the world after Tokyo. DKI Jakarta itself is densely populated exceeding densities found in Jabodetabekjur and the rest of Indonesia.

Rank	City	Country	Population	Definition	Area (km ²)	Population density (/km ²)
1	Shanghai	China	13,831,900	Core districts + inner suburbs	1,928	7,174
2	Mumbai	India	13,830,884	Municipal Corporation	603	22,937
3	Karachi	Pakistan	12,991,000	City District	3,527	3,683
4	Delhi	India	12,565,900	Municipal Corporation	431	29,149
5	Istanbul	Turkey	12,517,664	Metropolitan Municipality	1,831	6,211
6	São Paulo	Brazil	11,244,369	Municipality	1,523	7,383
7	Moscow	Russia	10,508,971	City proper (incl. Zelenograd)	1,081	9,722
8	Seoul	South Korea	10,464,051	Special City	605	17,288
9	Beijing	China	10,123,000	Core districts + inner suburbs	1,368	7,400
10	Jakarta	Indonesia	9,588,200	Special capital district	662	14,483
11	Tokyo	Japan	8,887,608	23 Special Wards	617	14,400
12	Mexico City	Mexico	8,873,017	Federal District	1,485	5,973
13	Kinshasa	D.R. Congo	8,754,000	City-Province	2,016	4,342
14	New York City	United States	8,363,710	City proper	789	10,452
15	Lagos	Nigeria	7,937,932	Statistical Area	1,000	7,938

Source: Various municipal data agencies and reports, (see end note 3).

Table 2: World city populations (municipal)

Jakarta's geographic location is along the Java Sea coast in one of the most seismic and volcanic areas in the world. Therefore, it is vulnerable to geologic disasters as well as hydrologic phenomena. The city lies on a coastal plain north of hilly territory that drains into the plains to the Java Sea. Within its political boundaries are beaches, swamps, mangroves, and deltaic land. Thirteen rivers drain from south to north, coursing through the city; additionally, hundreds of

man-made drainage canals and tertiary drainage systems have been added with urbanization. Approximately 40% of Jakarta lies below sea level, and a large portion of this low-lying land is found in the north of the DKI near the sea.⁷³

Area (Ha)			
1980	1996	2002	2007
770	2,259	16,778	23,832

Source: Pengolahan Data Peta Wilayah Banjir, DPP DKI Jakarta,

Table 3: Jakarta area affected by flooding

The greatest disaster vulnerability facing Jakarta is flooding due to water inundation from the Java Sea and increased rainfall due to climate change. Jakarta’s floods are frequent and large in scale. The resulting traffic, productivity loss, and property damage costs the city more than 400 million USD per year.⁷⁴ By 2002, one quarter of Jakarta’s land area was affected by flooding.⁷⁵ The most significant flood occurred in February 2007, which killed 57 and displaced more than 422,300 inhabitants.⁷⁶ 1,500 homes were destroyed and countless others suffered damages.⁷⁷ Property and infrastructure losses were estimated at 695 million USD.⁷⁸ Flooding of this magnitude occurs relatively infrequently and is not the principal issue facing Jakarta; flooding occurs with regularity, stalling traffic, damaging houses, and disrupting business. Even a moderate rain can substantially impact vehicular mobility in the city for hours.

⁷³ Mirah Skethi, PT. *Why Are There Floods In Jakarta? Flood Control by the Government of the Province of Jakarta*. Jakarta: Mirah Sakethi. 2010.

⁷⁴ IBID

⁷⁵ IBID

⁷⁶ IBID

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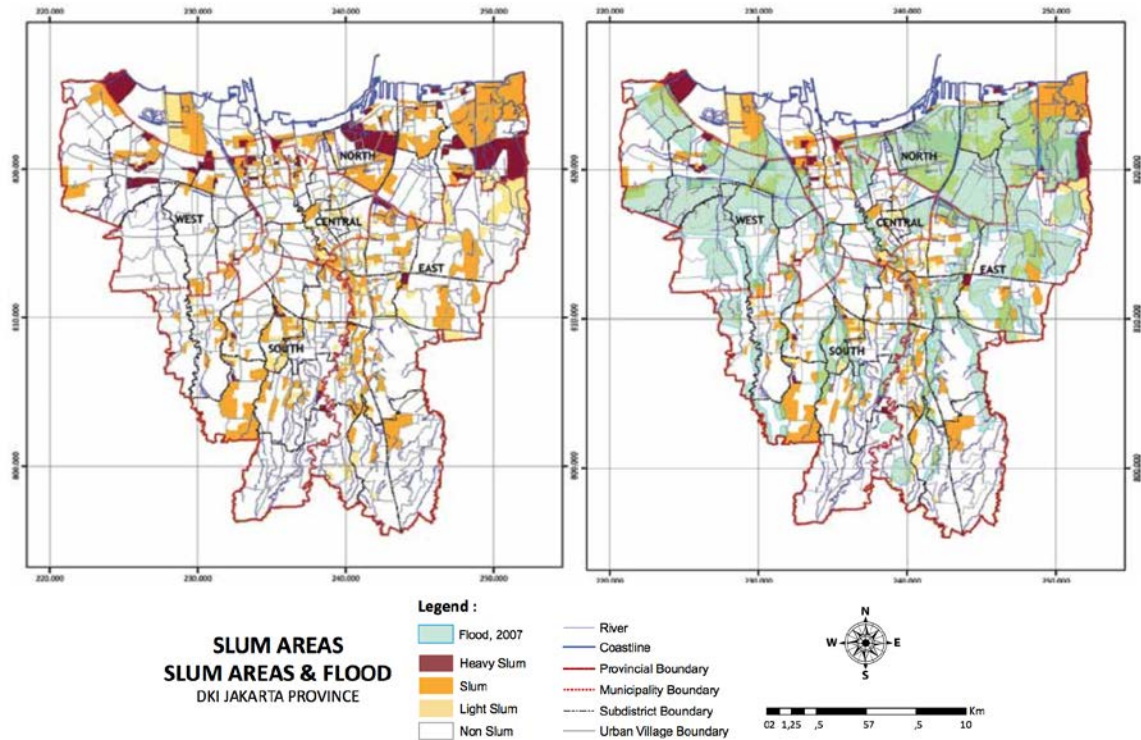


Figure 4: Jakarta slums with 2007 flood superimposed⁷⁹

Jakarta's location in a river delta led to the development of an intricate and vast drainage network of canals more than 14,000 km long.⁸⁰ The entire system is close to inadequate even when the canals and pumps are functioning at optimum levels. Garbage and debris clog pumps and canals, preventing proper operation. Informal settlements along the canals contribute to these blockages. Sediment build-up within the drainage system is substantial and persistent due to a lack of maintenance and weak solid waste disposal regulations and provisions.

Land subsidence is a main factor contributing to Jakarta's flooding vulnerability.⁸¹ In North Jakarta more than 60% of land is below sea level and some areas are sinking at a rate of 4-6 cm per year.⁸² North Jakarta has high concentrations of poverty and has limited piped public water infrastructure and provision. Major land loss will occur by the end of the 21st-century in Jakarta as land subsidence is compounded by sea level rise despite its gradual nature.

⁷⁹ Department of Land and Mapping, DKI Jakarta Province. 2000.

⁸⁰ World Bank. *Climate Risks and Adaptation in Asian Coastal Megacities: A Synthesis Report*. Washington, D.C.: The World Bank, Asian Development Bank and Japan International Cooperation Agency. 2010.

⁸¹ IBID

⁸² World Bank. *Climate Risks and Adaptation in Asian Coastal Megacities: A Synthesis Report*. 2010.

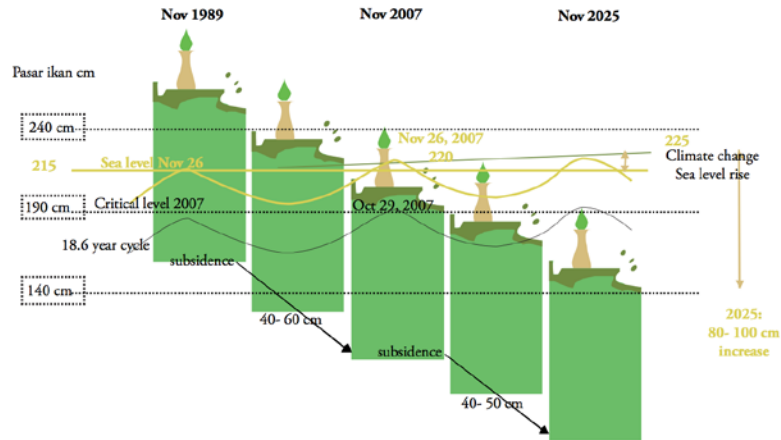


Figure 5: Land subsidence and sea level rise⁸³

Land subsidence is the result of rapid and unchecked urbanization that encourages unregulated and under-monitored groundwater. This causes loss of hydraulic pressure in the water table, leading to subsidence also driven by the weight new high-rise buildings of the Jakarta skyline. Jakarta's residents, from small, informal communities to large, multi-use developments, are resorting to drilling deep wells to access water. The public and private sectors, due to both budgetary (and other resource) limitations, are failing to meet the rapidly growing demand for piped water supply. Only about 60% of the total population gets its water from the municipality.⁸⁴

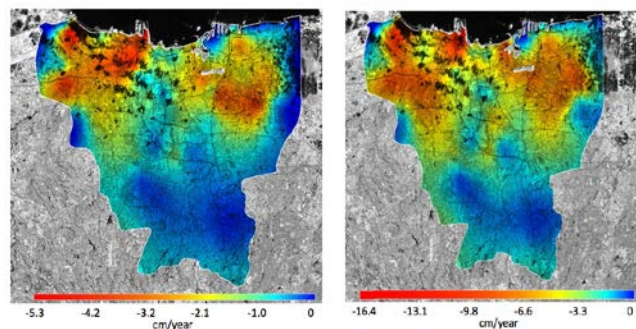


Figure 6: Land subsidence in Jakarta 1974–1991 (left) and 1991–2010 (right)⁸⁵

Land subsidence impacts in Jakarta are already visible: cracking; damage to housing, buildings and infrastructure; expansion of flooding areas; drainage system malfunction; changes

⁸³ Brinkman, JanJaap and Hartman, Marco. *Land Subsidence and Urban Development in Jakarta*. 2010.

⁸⁴ Koran Tempo. July 20, 2010

⁸⁵ Irwan Gumilar of Geodesy Research Group of ITB

in river canal and drain flow systems; and increased inland sea water intrusion are all evident in Jakarta, especially to the North. Impacts can be categorized into infrastructural, environmental, economic and social.⁸⁶



Figure 7: Subsidence along Jakarta waterfront

Many poor residents in Jakarta rely on well water that is non-potable, and thus must purchase and carry drinking and cooking water to their homes. As a result of poor water provision, washing, bathing, and defecation take place in the rivers, contributing to pollution and the spread of disease. The time and cost of searching for water and transporting it are a tremendous physical and economic burden for poor residents. Women are particularly burdened, as the responsibility for finding water usually falls to them.⁸⁷

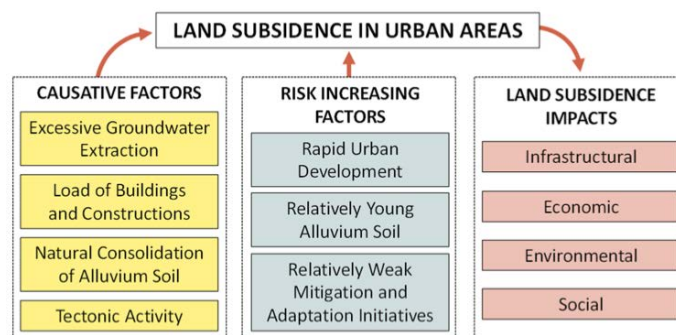


Figure 8: Causation, risks, and impacts of land subsidence in Jakarta⁸⁸

⁸⁶ Abidin, H.Z.; Andreas, H.; Gumilar, I.; and Brinkman, J.J. "Study on the risk and impacts of land subsidence in Jakarta." *Proceedings of the International Association of Hydrological Sciences* 372 (2015). 115-120.

⁸⁷ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

⁸⁸ Abidin, H.Z.; Andreas, H.; Gumilar, I.; and Brinkman, J.J. "Study on the risk and impacts of land subsidence in Jakarta." 2015.

Because of Jakarta's tropical location, heavy monsoon rains affect the city for half the year. Jakarta and the area of West Java have experienced an increase in rainfall with climate change.⁸⁹ The intensity of rainfall events has also increased, raising maximum daily rainfall and average daily rainfall values. Table 4 shows the increase in total rainfall, as well as the increase in intensity, during Jakarta's two most significant flooding events in 2001-2002 and 2006-2007. Although mean annual precipitation in Jakarta is projected to increase by only 2% in the period 2030-2040,⁹⁰ the intensity variability will increase further.

	2001 - 2002	2006 - 2007
Total rainfall for five stations (mm)	7,100.0	7,483.9
Maximum rainfall upstream (mm/day)	168.1	247.0
Maximum rainfall downstream (mm/day)	172.0	234.7
Average rainfall intensity (mm/day)	21.1	25.8
Average rainfall intensity upstream (mm/day)	20.6	24.8
Average rainfall intensity downstream (mm/day)	21.9	27.3
Percentage of days with rainfall	69.9	67.0
Duration of event (days)	121.0	88.0
Water level at Manggarai (cm)	1,050.0	1,061.0
Flood level at Bukit Duri (m)	2.3	3.4

Table 4: Rainfall during past flooding events⁹¹

Jakarta has slopes ranging between 0 and 2 degrees in the northern and central parts of the DKI, while slopes of 0 and 5 degrees are found in the South DKI. The southern-most area has an altitude around 50m above mean sea level.⁹² The increase in the intensity and frequency of rainfall is exacerbating existing drainage issues, and contributes to flooding across the city. Urbanization and changes in land use have reduced permeable surface areas that allow for inundation. Rainfall on impermeable surfaces generates peak-flow runoff that flows directly into at-capacity rivers and canals, causing flooding in streets and neighborhoods.⁹³

Jakarta is located in a lowland coastal area, composed by young and soft alluvium soil. Five landforms makeup Jakarta: alluvial landforms (southern part), landforms of marine-origin (northern part adjacent to the coastline), beach ridge landforms (northwest and northeast parts),

⁸⁹ World Bank. *Indonesia and Climate Change: Current Status and Policies*. Washington, D.C.: The World Bank. 2007.

⁹⁰ World Bank Climate Change Knowledge Portal, based on IPCC GCMs. <http://sdwebx.worldbank.org/climateportal/>

⁹¹ Badan Meteorologi dan Geosika, Ciliwung Cisadane Project and Tempo. Adapted from Pauline Texier "Floods in Jakarta: when the extreme reveals daily structural constraints and mismanagement." *Disaster Prevention and Management* 17, no. 3 (2007).

⁹² Abidin, H.Z.; Andreas, H.; Gumilar, I.; and Brinkman, J.J. "Study on the risk and impacts of land subsidence in Jakarta." 2015.

⁹³ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

swamp and mangrove swamp landforms (coastal fringe), and former channels (perpendicular to the coastline).⁹⁴ Thirteen rivers and two canals flow across Jakarta from its southern territory and lead to estuaries in the Java Sea along 35 km of coastline. The Jakarta basin consists of a 200–300m thick sequence of quaternary deposits which overlies tertiary sediments, in which the top sequence is thought to be the base of the groundwater basin.⁹⁵

Land subsidence in Jakarta is driven by excessive groundwater extraction, construction loads (i.e., settlement of high compressibility soil), natural consolidation of alluvial soil, and tectonic activity.^{96 97 98 99} Land subsidence is usually caused by combination of those factors and depends on location within the DKI. Tectonic activities appear to be the least dominant factor in land subsidence, while excessive groundwater extraction is the dominant factor.

The rapid urban development of metropolitan Jakarta has been in the sectors of industry, trade, business, transportation, housing, and hotels. These industries have introduced several negative environmental problems,^{100 101} such as: conversion of agricultural areas into residential and industrial areas; disturbance of ecological and hydrological functions of the upland area and river catchment areas; and increased groundwater extraction due to more intensive industrial activities and increases in population.¹⁰²

Land subsidence mitigation and adaptation initiatives in Jakarta are being implemented in a limited or ineffectual way. The land subsidence hazard is not currently being considered in the urban development and spatial planning, groundwater extraction regulation system, and building

⁹⁴ Rimbaman and Suparan, P. "Geomorphology, in: Coastplan Jakarta Bay Project, Coastal Environmental Geology of the Jakarta Reclamation Project and Adjacent Areas" Jakarta, Bangkok, CCOP COASTPLAN Case Study Report No. 2 (1999): 21–25.

⁹⁵ Yong, R. N., Turcott, E., and Maathuis, H. "Groundwater extraction-induced land subsidence prediction: Bangkok and Jakarta case studies." *Proceedings of the Fifth International Symposium on Land Subsidence*. IAHS Publication no. 234 (1995): 89-97.

⁹⁶ Murdohardono, D. and Sudarsono, U. "Land subsidence monitoring system in Jakarta." *Proceedings of Symposium on Japan-Indonesia IDNDR Project: Volcanology, Tectonics, Flood and Sediment Hazards*, September 21-23, 1998, Bandung, Indonesia, 243–256.

⁹⁷ Rismianto, D. and Mak, W. "Environmental aspects of groundwater extraction in DKI Jakarta: Changing views." In *Proceedings of the 22nd Annual Convention of the Indonesian Association of Geologists*. Bandung, Indonesia. 1993. 327–345.

⁹⁸ Harsolumakso, A. H. "Struktur Geologi dan Daerah Genangan." *Buletin Geologi* 33 (2001): 29–45.

⁹⁹ Hutasoit, L. M. "Kemungkinan Hubungan antara Kompaksi Alamiah Dengan Daerah Genangan Air di DKI Jakarta." *Buletin Geologi* 33 (2001): 21–28.

¹⁰⁰ Firman, T. and Dharmapatni, I. A. I. "The challenges to sustainable development in Jakarta metropolitan region." *Habitat International* 18 (1994): 79–94.

¹⁰¹ Hudalah, D. and Firman, T. "Beyond property: Industrial estates and post-suburban transformation in Jakarta Metropolitan Region." *Cities* 29 (2012): 40–48.

¹⁰² Abidin, H.Z.; Andreas, H.; Gumilar, I.; and Brinkman, J.J. "Study on the risk and impacts of land subsidence in Jakarta." 2015.

codes of Jakarta. Although regulations have been introduced to limit groundwater extraction subsidence prone areas of Jakarta, enforcement is lacking.¹⁰³

The potential losses due to land subsidence in Jakarta are significant.^{104 105} Infrastructural, social, and environmental costs due to direct, and indirect, impacts of land subsidence are economically significant and should not be underestimated for sustainable urban development. The planning, development, and maintenance costs of building and maintaining infrastructure in affected areas are much higher than in normal circumstances. Collateral impacts of coastal subsidence in Jakarta causing coastal flooding during high tides that are quite damaging.¹⁰⁶ Repeated coastal flooding in several areas along the coast will deteriorate the structure and function of buildings and infrastructure, as well as contribute to reductions in the quality of life, environment, health, economy, and social activities.

Rising sea level is a long-term climate change challenge for Jakarta. Figure 10 illustrates the anticipated rise in global sea level until the year 2100 from thermal expansion of the oceans, and melting of polar ice caps and glaciers. Climate change is also expected to increase the frequency and severity of climatic extremes such as storm surges and violent tides.¹⁰⁷ North Jakarta, which borders the Java Sea and is home to a wide range of income levels, businesses, industry, and the port, is especially susceptible.

¹⁰³ Abidin, H.Z.; Andreas, H.; Gumilar, I.; and Brinkman, J.J. "Study on the risk and impacts of land subsidence in Jakarta." 2015.

¹⁰⁴ Ward, P. J., Marfai, M. A., Yulianto, F., Hizbaron, D. R., and Aerts, J. C. J. H. "Coastal inundation and damage exposure estimation: a case study for Jakarta." *Natural Hazards* 56 (2011): 899–916.

¹⁰⁵ Viets, V. F. "Environmental and Economic Effects of Subsidence." Publication of Lawrence Berkeley National Laboratory, LBNL Paper LBL-8615. 2010.

¹⁰⁶ Abidin, H. Z., Andreas, H., Gumilar, I., Fukuda, Y., Pohan, Y. E., and Deguchi, T. "Land subsidence of Jakarta (Indonesia) and its relation with urban development." *Natural Hazards* 59 (2011): 1753–1771.

¹⁰⁷ Yusuf, Arief Anshory and Francisco, Herminia. *Climate Change Vulnerability Mapping for Southeast Asia*. Singapore: Economy and Environment Program for Southeast Asia. 2009.

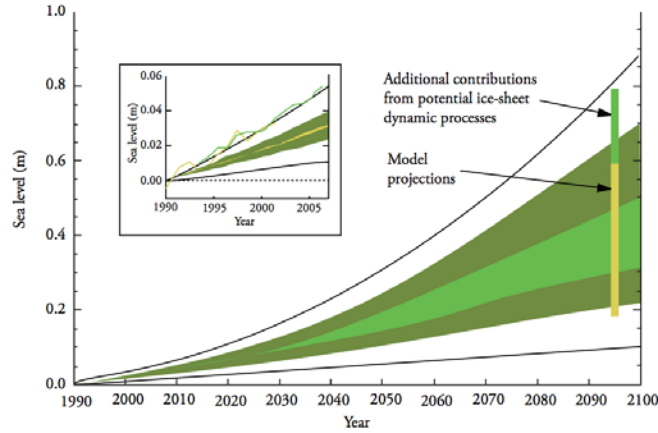


Figure 9: Rainfall during past flooding events¹⁰⁸

The area that could be inundated by a coastal flood with a return period of 100 years is ca. 3,400 ha, with a corresponding damage exposure of ca. €4.0 billion.¹⁰⁹ Both the inundated area and damage exposure increase by a factor of ca. 1.3 under current conditions for a coastal flood with return period of 1,000 years.¹¹⁰ Each scenario includes a total inundated area made up of approximately one-third business and one-third residential (combined uniform and non-uniform settlement) areas.¹¹¹

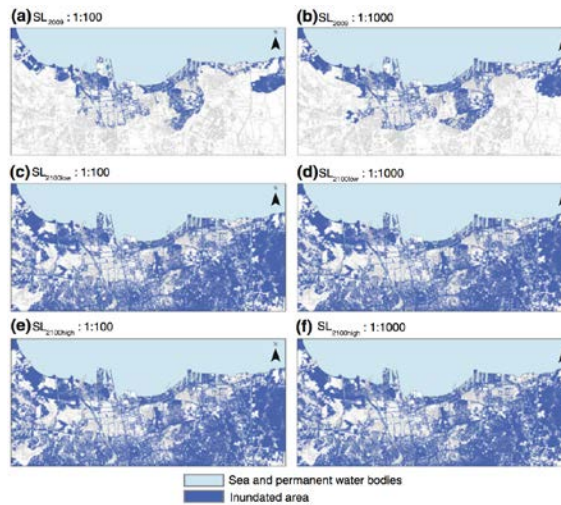


Figure 10: Inundation maps for extreme scenarios of flooding¹¹²

¹⁰⁸ Surbakati, Indra M.; Idroes, Izhar C.; Simarmata, Hendricus A. and Firman, Tommy. *Jakarta City Report: Information Relating to Climate Change in Jakarta City*. Prepared for the Workshops of Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities, Rose Garden Sampran Riverside, Nakorn Pathom, Thailand, 22 – 28 August, 2010.

¹⁰⁹ Ward, P. J., Marfai, M. A., Yulianto, F., Hizbaron, D. R., and Aerts, J. C. J. H. “Coastal inundation and damage exposure estimation: a case study for Jakarta.” 2011.

¹¹⁰ IBID

¹¹¹ IBID

¹¹² IBID

These maps show that the coastal areas of North Jakarta are the most susceptible to coastal flooding. For the scenarios in 2100, the inundation maps (Figure 10) show an increase in the inundated area for both low and high-flood water level scenarios, and for flood events with a return period of 100 and 1,000 years, when compared to those under current conditions. In contrast, maps show minimal differences in flood extent between the four 2100 scenarios. This is evident in the results shown in Figure 11, where the inundated area in the scenarios for 2100 ranges between 14,900 and 15,100 ha. Corresponding damage exposure ranges from €16.7 to €16.8 billion. The estimated maximum value of venerable assets in Jakarta to a 1:100 year coastal flood event is 1.2 percent of the country's national GDP, while the estimated maximum value of venerable assets to a 1:1,000 year flood event would be 1.5 percent of total national GDP.¹¹³

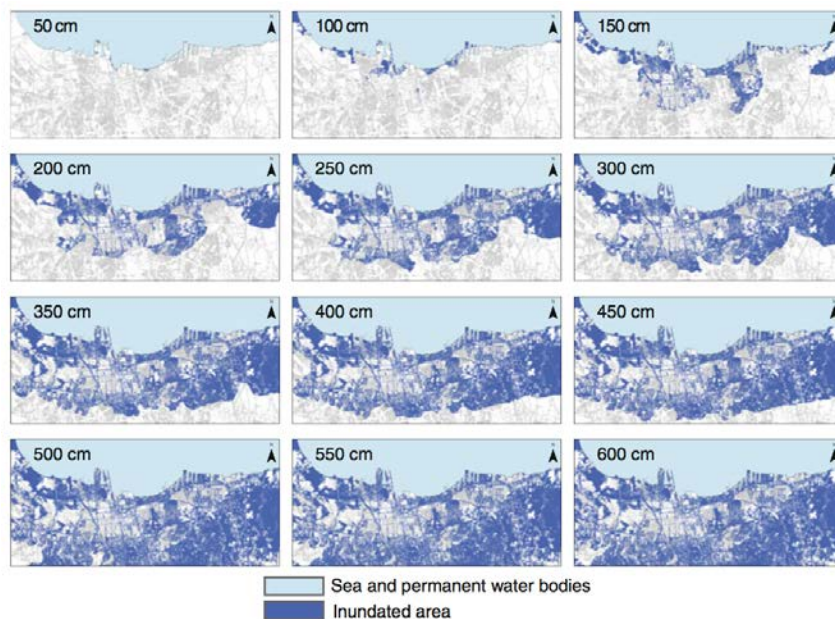


Figure 11: Inundation map for flood events¹¹⁴

Jakarta is also vulnerable to a combination of rising global temperatures and the urban heat island effect. Figure 12 shows record average temperatures in Jakarta from 1881-1991. An increase of more than 1.5 degrees celsius occurs over this hundred-year period. The effect of

¹¹³ Ward, P. J., Marfai, M. A., Yulianto, F., Hizbaron, D. R., and Aerts, J. C. J. H. "Coastal inundation and damage exposure estimation: a case study for Jakarta." 2011.

¹¹⁴ IBID

global warming will only increase average temperatures in Jakarta. Temperatures will rise by 1 degree celsius by 2030, and by as many as 3 degrees by 2100.¹¹⁵ The urban heat island effect, resulting from the absorption of heat caused by the materials present in a highly dense urban environment, will only contribute to higher temperatures as the metropolitan area becomes increasingly urbanized and deforested.¹¹⁶

Currently, communities in Jakarta self-organize to cope with flooding and extreme weather events. The high number of risk prone urban poor contributes to the susceptibility of Jakarta to the effects of climate change, and thus require consideration in any plans and actions used to address city-wide vulnerabilities. The poor in Jakarta contribute minimally to climate change, and therefore require no significant effort to mitigate their contribution, because this population’s contribution to greenhouse gas emissions is negligible. Given their income levels and humble lifestyles, they are not large per capita consumers of energy.¹¹⁷

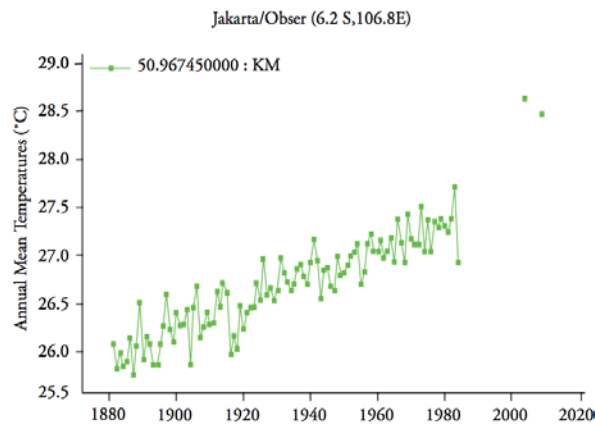


Figure 12: Mean surface temperature in Jakarta, 1880-1990 (2000 and 2010 projected)¹¹⁸The poorest communities in Jakarta are informally organized and largely undocumented. The exact quantities of the slum population within Jakarta is unknown. Official statistics from the DKI government in 2010 report a poverty rate of 3.5 percent, or 312,180

¹¹⁵ World Bank Climate Change Knowledge Portal, based on IPCC GCMs and Japanese High Resolution GCM. <http://sdwebx.worldbank.org/climateportal/>

¹¹⁶ Ward, P. J., Marfai, M. A., Yulianto, F., Hizbaron, D. R., and Aerts, J. C. J. H. “Coastal inundation and damage exposure estimation: a case study for Jakarta.” 2011.

¹¹⁷ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

¹¹⁸ Goddard Institute for Space Studies, NASA. Columbia University. New York, NY.

people, based on a poverty line of per capita monthly income of IDR 331,169 (about 1.23 USD per day at current exchange rates).¹¹⁹ While this percentage is lower than many rural and other urban areas in Indonesia, it includes a significant number of people and households in Jakarta due to its size and scale. If one were to raise the threshold of poverty, this number would rise dramatically.

Municipality	Population Total	Population in informal settlements	% population in informal settlements	Area (km ²)	Area affected by 2007 floods (km ²)	% total area affected by floods
North	1,452,285	167,920	11.56%	139.88	71.22	50.92%
West	2,130,696	20,409	0.96%	125.32	50.02	39.91%
Central	891,788	3,912	0.44%	48.66	24.76	50.88%
East	2,413,875	20,292	0.84%	186.32	20.1	10.79%
South	2,053,684	17,114	0.83%	145.32	16.73	11.51%
TOTAL JAKARTA	8,942,328	229,647	2.57%	645.5	182.83	28.32%

Table 5: Correlation of percentage of slums and of flooded area in Jakarta¹²⁰

Informal communities subsist on fewer resources than their more privileged counterparts. Unmonitored immigration into the city also contributes to the growth of the informal population, at rates that are not measured or quantified. Consistent migration of new residents into Jakarta is estimated at 250,000 per year, fuelling housing demand and scarcity leading to cost escalation. Skyrocketing land prices and rampant private sector development has created a booming real estate market that excludes the poor.¹²¹ As a result, many large informal settlements have grown over relatively short periods of time along waterways, rivers, and reservoirs, contributing to pollution, overcrowding, and flood risk. The greatest concentrations of slum dwellers can be found in North Jakarta. The large and dense informal settlement at Waduk Pluit in North Jakarta is said to comprise more than 70,000 inhabitants.¹²² Pressures from migration into Jakarta, the lack of available and affordable official and formal housing options, and the lack of vacant land availability and management, have caused the establishment and growth of large informal communities.¹²³

¹¹⁹ Berita Resmi Statistik Provinsi DKI Jakarta No. 21/07/31/Th. XII. July 1, 2010.

¹²⁰ Mercy Corps Indonesia. Data from 2004.

¹²¹ World Bank. "Climate change, disaster risk and the urban poor: Cities building resistance for a changing world." Washington, D.C.: The World Bank, 2011.

¹²² Hahm, Hongjoo. "Project Sites, Urgent Maintenance Dredging." Presented to the World Bank Office Jakarta. 2010.

¹²³ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

The poorest communities in Jakarta live in self-constructed informal dwellings, usually on land without legal title, and subsist on informal jobs in the informal economy. Jakarta has a long history of large informal settlements, featuring areas where individuals and households have lived in what are considered “slums” for decades. While individuals may have homes and livelihoods that are risk prone and difficult to quantify, there are well established social networks and cultural identities found within each of Jakarta’s slums. The informal social and economic networks are one of the most adaptive and resilient strengths of Jakarta’s urban poor. Appreciating, harnessing, and formalizing these informal networks is one of DKI’s biggest challenges. Figure 13 shows the percentage of land tenure across Jakarta’s kampungs. A large percentage of the city shows that 50% or more of land parcels are not registered with the government entities and have unclear or no title.¹²⁴

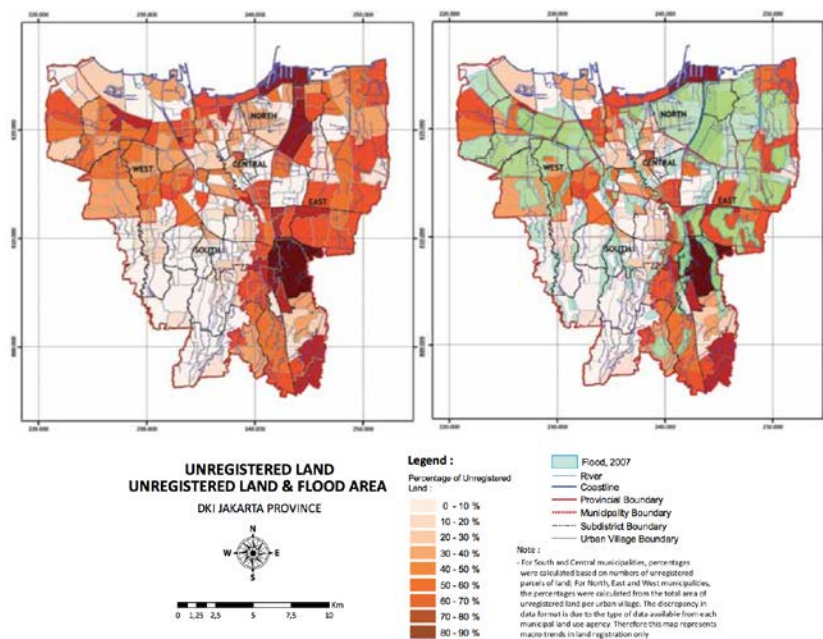


Figure 13: Percentage of unregistered land in Jakarta, 2007 flood superimposed¹²⁵

The urban poor of Jakarta are disproportionately vulnerable and affected by disasters and climate change impacts, because their settlements exist near bodies of water prone to flooding.

¹²⁴ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

¹²⁵ BPN Departments of North, South, East, West and Central Jakarta Municipalities

This exposes residents to flooding and related hazards caused by rain and tidal floods (locally known as “rob”). These hazards, when combined with the economic and physical fragility of low-income residents, exposes them to property loss, illness, economic suppression, social disruption, and physical displacement. Most of these high-risk areas were intended to remain vacant, but weak enforcement by local government, and informal subletting and divisions within the private sector have promoted growth.¹²⁶

The urban poor of Jakarta are vulnerable to health risks and property loss because of where they live. Many also experience socio-economic vulnerabilities because their livelihoods are tied to risk areas as well. The ability of the urban poor to adapt is limited due to a lack of access to basic services like potable water, healthcare, and education. North Jakarta experiences the highest rates and concentrations of poverty in flooding areas. The communities of Kampung Melayu and Bukit Duri experience regular neighborhood wide evacuations due to flood events. Coastal communal wells experience saline intrusion, as well as inland garbage and sewage flow into these communities, leading to the spread of illness stemming from unsanitary conditions.¹²⁷

Weak government regulation of settlement and development are compounded by the lack of basic services including housing, clean water and garbage collection. Informal physical structures spill into waterways and block the already limited drainage capacity of canals and rivers, leading to major issues and poor performance within the at-capacity system. Communities utilize the rivers for disposal of their solid waste, refuse, and human waste, because disposal options are inadequate or non-existent throughout most of Jakarta. There is currently no citywide solid waste management plan or disposal method for Jakarta. Waste collection is dealt with by private companies, with wealthier areas paying more to receive better service. In many areas, waste is collected and picked over by an efficient, but informal, waste picker and recycling community.¹²⁸

¹²⁶ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

¹²⁷ *IBID*

¹²⁸ World Bank. “Climate change, disaster risk and the urban poor: Cities building resistance for a changing world.” 2011.

Consideration of the urban poor is essential when addressing issues of risk vulnerability in Jakarta, especially when dealing with government implementation of city-wide spatial planning initiatives and flood alleviation interventions.¹²⁹ Housing, land use, and zoning laws exist, but are mostly unenforced, aiding the development of informal settlements. Although laws and building code require easements of ten to fifteen meters along waterways, these zones are where informal settlements settle and flourish. Eviction policies and demolition have been a main strategy for managing informal settlements, not without protests from NGOs, community organizations, and other civil rights groups. When implemented, communities and households are moved into apartment blocks in the relative vicinity of their informal settlements at very low costs, many do not remain, however. Within a few years, informal housing reappears along the under regulated cleared easements along the waterways, and are settled by new immigrants or returning residents.¹³⁰ When rapid resettlement occurs it oftentimes includes previous residents returning to the neighborhood, but can also indicate scarce or expensive land, inadequate public housing, a lack of government policies to deal with migrants, as well as the desirability of a given slum's location.

The residents of Jakarta's informal settlements contribute to a large informal economy, and support the functioning of the formal economy. While quantifying its contribution is difficult, up to 38% of Jakarta's economy is considered informal. In most areas, residents of informal settlements work as maids, janitors, security guards, and parking attendants, or run small local businesses like food stalls and retail kiosks.¹³¹ Coastal settlements employ fishermen and provide larger and small businesses with fish to sell across the city.¹³²

Mitigation and adaptation programs, projects, and actions have been implemented at all scales in Jakarta. These measures rely on large scale projects and initiatives, leaving individuals and communities responsible for site specific adaptations. Individual measures include moving to

¹²⁹ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

¹³⁰ United Nations Settlements Programme. *Housing Finance Mechanisms in Indonesia*. Nairobi: United Nations, 2008.

¹³¹ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

¹³² IBID

the second story to avoid frequent flood events, reconstruction of housing on stilts to avoid flooded terrain, as well as community driven dredging and waste collection to reduce the impacts of stormwater runoff and flooding due to sedimentation. Recent NGO projects relating to climate change adaptation and the urban poor indicate a lack of program interest and investment in understanding how low-income communities are adapting, as well as how the government can support them locally. A mismatch exists between the sustainability of adaptation measures, and the magnitude of possible future disasters.¹³³ Successful provision and management of services by the government lags in most cases. In spite of a rapidly expanding economy, private sector property development, spatial planning and infrastructure, as well as service distribution and provision (transportation, green space, affordable housing, clean water, healthcare, and education) have not kept up with demand.¹³⁴

B. Jakarta Slum/Informal Conditions

Most of Jakarta's urban poor cannot afford to buy housing provided by the State Housing Provider Agency (PERUMNAS) or private developers. This has forced them to seek individual solutions that include self-built housing units and squatter settlements that eventually lead to slum establishment and growth.¹³⁵¹³⁶

Most poor residents of Jakarta live in spontaneous informal settlements called kampungs. These are scattered throughout the city and consistently have substandard infrastructure, small plots, and low quality buildings. Most dwellings in kampungs are constructed incrementally by residents from permanent and non-permanent materials, based largely on what they can afford.¹³⁷

¹³³ World Bank. *Jakarta: Urban Challenges in a Changing Climate*. 2011.

¹³⁴ World Bank. "Climate change, disaster risk and the urban poor: Cities building resistance for a changing world." 2011.

¹³⁵ Sudarmo, Sri Probo. "Recent Development in Indonesian Urban Development Strategy." In *The Challenge of Sustainable Cities: Neoliberalism and Urban Strategies in Developing Countries*, Eds. Rod Burgess, Marisa Carmona and Theo Kolstee. London: Zed Books. 1997.

¹³⁶ Tunas, Devisari and Peresthu, Andrea. "The Self-help Housing in Indonesia: The Only Option for the Poor?" *Habitat International* 34 (2010): 315-322.

¹³⁷ Tunas and Peresthu. "The Self-help Housing in Indonesia: The Only Option for the Poor?" 2010.

Kampung residents occupy state land such as disposal sites, riverbanks, and railway tracks, and private unoccupied land, where they illegally construct their dwellings.¹³⁸

Indonesia has initiated three types of housing policies: self-help housing policy such as the Kampung Improvement Program (KIP), Community-based Housing Development (P2BPK), and Self-help Housing Assistance (BSPS). PERUMNAS is the national program for public housing development.¹³⁹ According to the National Indonesian Socioeconomic Survey (SUSENAS), the dominant type of new housing in Indonesia is self-built, which accounts for more than 70 percent of new housing produced between 2002 and 2007.^{140 141} Its prevalence in Indonesia is due to the informal housing sector.^{142 143 144} The informal housing sector takes place mostly in Indonesian kampungs.^{145 146} A kampung is an unplanned, incrementally developed area frequently associated with slums.¹⁴⁷ Informal and self-built housing in these kampungs constitutes the majority of new housing construction in Indonesia.¹⁴⁸

In order to address the issues found within Kampungs, KIP upgraded roads and footpaths, improved drainage, water supply, sanitation, and solid waste disposal; and also supported the construction of new schools and health clinics.^{149 150} In the 1980s, KIP was redesigned to work in the Community Infrastructure Program as part of the Integrated Urban Infrastructure Development Programme (IUIDP). KIP was redesigned to include the coordinated improvement

¹³⁸ Winayanti, Lana and Lang, Heracles C. "Provision of urban services in an informal settlement: a case study of Kampung Penas Tanggul, Jakarta." *Habitat International* 28, no. 1 (2004): 41-65.

¹³⁹ Tunas and Peresthu. "The Self-help Housing in Indonesia: The Only Option for the Poor?" 2010.

¹⁴⁰ Monkkonen, Paavo. "Housing deficits as a frame for housing policy: demographic change, economic crisis and household information in Indonesia." *International Journal of Housing Policy* 13, no. 3 (2013 a): 247-267.

¹⁴¹ Mungkasa, Oswar. "Catatan Kritis tentang Hunian Berimbang." *HUD Magazine* 4 (2013): 18-21.

¹⁴² Crane, Randall; Daniere, Amrita; and Harwood, Stacy. "The contribution of environmental amenities to low-income housing: a comparative study of Bangkok and Jakarta." *Urban Studies* 34 (1997): 1495-1500.

¹⁴³ Leaf, M. "Land rights for residential development in Jakarta: the colonial roots of contemporary urban dualism." *International Journal of Urban and Regional Research* 17 (1993): 477-491.

¹⁴⁴ Struyk, R.J.; Hoffman, M.L. and Katsura, H.M. *The market for shelter in Indonesian Cities*. Washington, D.C.: The Urban Institute. 1990.

¹⁴⁵ Leaf. Land rights for residential development in Jakarta: the colonial roots of contemporary urban dualism.

¹⁴⁶ Tunas and Peresthu. "The Self-help Housing in Indonesia: The Only Option for the Poor?" 2010.

¹⁴⁷ Winarso, Haryo. "Urban dualism in the Jakarta Metropolitan Area." In *Megacities: Urban Form, Governance and Sustainability*. Eds. A. Sorensen and J. Okata. New York: Springer. 2010. pp. 163-190.

¹⁴⁸ Monkkonen, Paavo. "Housing deficits as a frame for housing policy: demographic change, economic crisis and household information in Indonesia." 2013a.

¹⁴⁹ Garr, Daniel. "Indonesia's Kampung Improvement Program: Policy Issues and Local Impacts for Secondary Cities." *Journal of Planning Education and Research* 9, no. 1 (1989): 79-83.

¹⁵⁰ Tunas and Peresthu. "The Self-help Housing in Indonesia: The Only Option for the Poor?" 2010.

of physical quality (Bina Lingkungan), the improvement of quality of life (Bina Manusia), and the improvement of the economy (Bina Usaha).^{151 152}

The community-based housing development or Pembangunan Perumahan Bertumpu pada Komunitas (P2BPK), is a housing program that facilitates informal and community-based housing delivery and construction. It encourages communities to mobilize resources to lower housing costs.¹⁵³

The Ministry of Public Housing created the Self-help Housing Assistance (BSPS) in 2006 to address and support low-income households in urban and rural Indonesia. BSPS seeks to develop new housing, improve home quality, and develop public infrastructure and utilities. They do this by providing cash, construction tools, and materials. BSPS recipients must live below the poverty line, be married, have title to land, and have a bank account. The number of built or improved housing units and other projects increased from 3,550 in 2006 to 16,403 units in 2011.¹⁵⁴

Informal and self-help housing has become an essential and integral part of the urban landscape in Indonesia. These informal settlements accommodate millions of urban poor who otherwise lack access to affordable or public housing.¹⁵⁵ Indonesian kampungs house most of the urban poor in Indonesia and suffer from extreme density, poor quality of life, and lack appropriate infrastructure and public facilities.^{156 157}

C. KIP Slum upgrading

The Kampung Improvement Project (KIP) was launched in 1969 by the Governor of Jakarta, in an effort to upgrade the living conditions within Jakarta's kampungs. KIP was the first

¹⁵¹ Tunas and Peresthu. "The Self-help Housing in Indonesia: The Only Option for the Poor?" 2010.

¹⁵² Silver, Christopher. *Planning the Megacity: Jakarta in the Twentieth Century*. New York: Routledge. 2008.

¹⁵³ Rukmana, Deden. "The Megacity of Jakarta: Problems, Challenges and Planning Efforts." *Indonesia's Urban Studies*. Last modified March 29, 2014. <http://indonesiurbanstudies.blogspot.com/2014/03/the-megacity-of-jakarta-problems.html>

¹⁵⁴ IBID

¹⁵⁵ Tunas and Peresthu. "The Self-help Housing in Indonesia: The Only Option for the Poor?" 2010.

¹⁵⁶ IBID

¹⁵⁷ Winayanti, Lana and Lang, Heracles C. "Provision of urban services in an informal settlement: a case study of Kampung Penas Tanggul, Jakarta." 2004.

slum upgrading project in the world, and was funded by the World Bank until 1982.¹⁵⁸ The program aimed to retain and improve existing housing stock and to provide services to sites for the construction of new housing, utilizing self-build and self-help methods.¹⁵⁹

The urban population of Indonesia spiked from 22.6 million in 1970 to 32.8 million in 1980, to 55.4 million in 1990.¹⁶⁰ By 1995, Indonesia's total population was estimated at 175 million, 28 percent of whom live in urban areas.¹⁶¹ An annual urban growth rate of four percent meant that the country's urban population rose to 36 percent of the entire population of the country by 2000.¹⁶²

Over the past three decades, the World Bank closely observed this rapid urbanization. The first generation of World Bank-financed projects included Urban I, Urban II, Urban III, and Urban IV.¹⁶³ The primary component of these projects was the Kampung Improvement Program (KIP). KIP funding ranged from 70 percent in Urban I to 32.8 percent in Urban IV.¹⁶⁴ Components of the four projects included solid waste management, drainage, community health service, land registration, and technical assistance and training provision and improvement. KIP sought to alleviate poverty with support for efforts focused on improving housing services and basic infrastructure in low-income areas. Although implemented in 1974 and the following decades, Urban I-IV addressed problems that still affect Indonesia's cities today: inadequate infrastructure and deteriorating environmental conditions.¹⁶⁵

KIP Urban I-IV projects facilitated housing and environmental improvements for low-income urban households in Indonesia and Jakarta at a low cost (ranging from 118 USD per person in Jakarta to 23 USD in smaller cities, using 1993 US dollars). KIP improvements in non-

¹⁵⁸ Juliman, D. "The world's first slum upgrading programme." Presented at the World Urban Forum III in Vancouver, BC, June 19-23, 2006.

¹⁵⁹ Silver, Christopher. *Planning the Megacity: Jakarta in the Twentieth Century*. 2008.

¹⁶⁰ World Bank. *Indonesia Impact Evaluation Report: Enhancing quality of Life in Urban Indonesia: The Legacy of Kampung Improvement Program*. Washington, D.C.: The World Bank, 1995.

¹⁶¹ IBID

¹⁶² IBID

¹⁶³ IBID

¹⁶⁴ IBID

¹⁶⁵ World Bank. *Indonesia Impact Evaluation Report: Enhancing quality of Life in Urban Indonesia: The Legacy of Kampung Improvement Program*. 1995.

KIP kampungs have caught up with those in upgraded kampungs due to favorable economic development. Evidence exists, however, showing that improvements to non-KIP kampungs were completed at a slower speed when compared to the rapid changes KIP had on the kampungs where it was implemented.¹⁶⁶

The most positive result of KIP was improvement of the quality of life for kampung residents. This was realized through improved footpaths, lighting, education and health facilities, living space and reduction of housing density. KIP provided broader access to potable water, private toilets/septic tanks, and less frequent flood events. More than two thirds of respondents in project areas associated improvements in their kampung to KIP.¹⁶⁷ Most respondents also indicated overall environmental conditions in their neighborhood had improved since KIP implementation, however, one-third of respondents were not fully satisfied. Garbage collection (both frequency and quality), was cited as a persistent problem.¹⁶⁸

Throughout Jakarta, environmental conditions have deteriorated as rapid population and economic growth resulted in increased demand for urban infrastructure. Despite KIP Urban I-IV improvements, the environment in Jakarta continues to deteriorate, fueled by population growth. The urban environmental challenge today is more substantial than during Urban I-IV implementation. Further actions should be taken to balance urban growth and environmental conditions. At kampung and city-wide levels, KIP did not anticipate future environmental problems, ranging from increased traffic congestion to air pollution. While the design standards of KIP increased access to fire-fighting units, the use of flammable building materials and overcrowding simultaneously increased fire risk.¹⁶⁹

Indonesian cities are rapidly growing, meaning some kampungs have become valuable urban real estate. Rising demand for well located real estate have driven kampungs into the

¹⁶⁶ World Bank. *Indonesia Impact Evaluation Report: Enhancing quality of Life in Urban Indonesia: The Legacy of Kampung Improvement Program*. 1995.

¹⁶⁷ IBID

¹⁶⁸ IBID

¹⁶⁹ IBID

private land and real estate market. Do kampung residents benefit from investment? Have Urban I-IV projects failed when demolition occurs? Residents did benefit, but could have gained more value had their property rights been secured. The study also found that KIP investments could see returns of twelve percent even outside the five-year term period.¹⁷⁰ Some of the Urban I-IV impacts have since been demolished within improved kampungs to make space for market rate urban development. The rising demand and scarcity of urban land within the Indonesian real estate sector will lead to many situations where improved kampungs are demolished for conversion into commercial and upmarket residential real estate.¹⁷¹

KIP did not lead to an influx of higher-income groups (gentrification) into kampungs. KIP did not disturb the residential stability of the kampungs, even as the social profile of the kampungs has improved. Residents are better educated and healthier; household sizes have declined; residents are employed and have greater income; and women play a more significant role in meeting economic needs of their families.¹⁷²

KIP serves as a starting point for the upgrade and formalization of Jakarta's plentiful slums. The simple and somewhat rudimentary upgrades it provided helped improve the living conditions of vast swathes of Jakarta. KIP, however, failed to address many aspects of the informal architecture present in Jakarta's slums, meaning individuals were not direct beneficiaries of KIP improvements. Cooperation with institutional, government, and planning policies became a component of later stages of KIP, highlighting physical improvements cannot be the sole remedy for slum improvement.

¹⁷⁰ World Bank. *Indonesia Impact Evaluation Report: Enhancing quality of Life in Urban Indonesia: The Legacy of Kampung Improvement Program*. 1995.

¹⁷¹ IBID

¹⁷² IBID

CHAPTER IV

INCREMENTALISM IN ACTION

A. Underlying Concepts

The following chapter focuses on theories and case studies important to my understanding of incrementalism. The theories I present are not directly linked to incrementalism, but feature guides to the creation of resilient housing, architecture as impermanent and changeable entities, self build methods, resource utilization and social empowerment aims. Each theory played an important role in all stages of design for my project.

The chapter also highlights case studies that provide lessons, problems, and solutions that various approaches to incrementalism can entail. The case studies I have focused on do not outright link themselves to incrementalism, but feature many aspect, condition, and typological links to the movement. Some case studies serve as anti-precedents, while others highlight positive and negative aspects of their approach to incrementalism.

1. How Buildings Learn

In How Buildings Learn, Stewart Brand discusses the changes in use, form, program, and technology that buildings experience over time. Brand examines how more time and money is spent retrofitting existing buildings than building new structures. He argues that three major forces are responsible: technology, money, and fashion. The most rapidly modified buildings are commercial, while domestic architecture changes steadily and more discretely within its program, while institutions are reluctant to change (and are most costly).¹⁷³

¹⁷³ Brand, Stewart. *How Buildings Learn: what happens after they're built*. New York, NY: Viking. 1994.

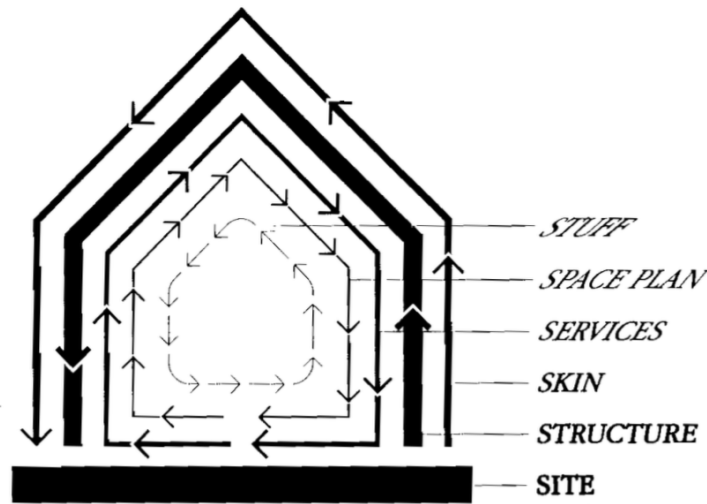


Figure 14: Stewart Brand shells¹⁷⁴

Each layer adapts independently from the other creating different rates of change that occur within buildings. Structure is generally the most permanent feature of a building, it usually remains unchanged over time. Occasionally a building receives an addition, but for the most part the original structure remains intact. The services within a building are slightly less static. Services such as wiring, plumbing, and lifts go through technological changes over time and will render the original technology obsolete, or inefficient. The scenery of a building consists of the non-structural divisions within a building. Partitions are altered to adapt to the changing use of a structure, allowing for new uses over time. This is a relatively minor change to the building, but provides significant changes to the uses allowed inside. The set, or furniture, is the least static element of a building. It changes based on the user, and is susceptible to fluctuations in fashion. Furniture is independent of structure and easily changed, but it still shapes the experience of the interior of the building.¹⁷⁵

Brand expands the conditions of a building beyond its structure into the site or context of the structure. This is important in determining the economic, social, and urban forces acting on a given structure. These are the prevailing forces that determine the need for change within the

¹⁷⁴ Brand, Stewart. *How Buildings Learn: what happens after they're built*. 1994.

¹⁷⁵ IBID

subsequent categories. Brand separates the structure of a building from the skin. The structure is altered far less than the envelope of a structure, due to the exposure to the elements. The skin of a building is replaced at standard intervals to maintain insulation from the elements.¹⁷⁶

A relative hierarchy is established within each category across time, rate of change, and cost of change. The cheapest, most rapid, and least costly method of change is the “stuff” found within a structure, and the site is the most static. This hierarchy is exhibited in structures we see today.

Adaptive buildings allow ‘slippage’ between layers. Slower layers block quick changes, while quick layers “tear up” the slow. Embedding these different layers may appear more efficient initially, but cause conflicts over time. Growth does not equal adaptation. When a building is able to age while providing adaptability, it becomes more valued.¹⁷⁷

Brand discusses how the program of a building is a prediction (one that is often wrong). He explains that program can be too specific, short term, and static. Programs should incorporate multiple scenarios into their outcomes in order to provide adaptability for the future. He argues medium-sized spaces are the most adaptable, and believes storage is adaptable - these unfinished spaces can change use over time and allow reconfiguration in the future.¹⁷⁸ He highlights that designing around a specific technology can limit adaptability over time due to the rapid evolution and progression of technology.

Brand’s architectural observations, categorization, and theories focus on the rates of change present in all architecture. He explores architecture as infrastructure, composed of several layers each experiencing change at predictable intervals due to weathering, technology upgrades, new inhabitants, and programmatic changes. His thinking highlights the need for designers to consider the programs, users, and technology of the future.

¹⁷⁶ Brand, Stewart. *How Buildings Learn: what happens after they're built*. 1994.

¹⁷⁷ IBID

¹⁷⁸ IBID

2. Social Urbanism

The term “social urbanism” was coined to describe the physical intervention projects that were implemented in the poorer sectors of Medellín from 2002-2010.¹⁷⁹ ¹⁸⁰ Public investment was shifted to poor neighborhoods to provide infrastructure, public buildings, and service upgrades, incorporating urban space and environmental improvements. Functionally, it improved the provision and access to services, and improved quality of life. It also resulted in aesthetic improvements, leading to high quality architecture that promoted a sense of inclusion into the broader city of Medellín. This upgrading method was applied to many types of projects ranging from an aerial cable-car to new schools and public spaces.¹⁸¹ The signature features of Medellín’s social urbanism are the cable-cars, known as Metrocables. Their construction was the first application of tourist infrastructure technology for public transport to serve urban poor, and to connect them to the existing metro system.¹⁸²

Another design feature of social urbanism in Medellín is the “library-park.” Library-parks were conceived of as visual affirmations signaling state presence in comunas. They provide access to computer and information technology, training courses, cultural activities, spaces for sport and recreation, social programs, business incubators, and more. Architecture played a key role in signaling state presence. These sleek, minimalist buildings stand out for their scale, form, materials, and color, in stark contrast to the surrounding informal and chaotic appearing comuna.¹⁸³

In Medellín, social urbanism was important to redefining the city’s image as a progressive, enlightened, and innovative place. This external success partially eclipsed the social aims of social urbanism; local success, however, has superseded this ambition, raising the

¹⁷⁹ Echeverri, A. and Orsini, F. “Informalidad y urbanismo social en Medellín” in *Medellín: Medio Ambiente, Urbanismo y Sociedad*. Medellín: Universidad EAFIT. 2010.

¹⁸⁰ Architectural Review. “AR Special issue: recent work in Colombia ‘How architecture is healing the public realm. A tale of two cities – Bogotá and Medellín.’” CCXXIX, 1368. 2011.

¹⁸¹ Brand, Peter. “Governing inequality in the South through the Barcelona model: ‘social urbanism’ in Medellín, Colombia.” Paper presented at the “Interrogating Urban Crisis: Governance, Contestation, Critique” conference, De Montfort University, Leicester, United Kingdom, September 9-11, 2013.

¹⁸² *IBID*

¹⁸³ Brand, Peter. “Governing inequality in the South through the Barcelona model: ‘social urbanism’ in Medellín, Colombia.” 2013.

standard of living, safety, outlook, and legitimacy for the residents of the communa.¹⁸⁴ Social urbanism provides the underpinning theories, approaches, and social aims required when addressing slum upgrading. It provides methods of introducing various types of infrastructure, community engagement, as well as policy frameworks necessary to upgrading slums.

3. Cradle-to-Cradle

Waste has long been approached with a “cradle-to-grave” mentality, which treats materials as a waste management problem that has an impact natural systems, where “cradle” represents manufacturing and “grave” suggests disposal.¹⁸⁵ “Cradle-to-cradle” is a new approach to design based on the closed-loop nutrient cycles present in nature, in which waste is not unwanted, but instead serves as nutrition for another entity. This thinking was developed and popularized by architect William McDonough and chemist Michael Braungart in their 2002 book, *Cradle to Cradle: Remaking the Way We Make Things*.

As in nature, “cradle-to-cradle” design aims to create buildings, communities, and systems that generate wholly positive effects for human and environmental health beginning with the initial stages of design. Attempts are not made to reduce waste, instead waste is re-assessed for possible positive uses. This approach suggests one should anticipate the design, materials, and embedded energy of a project beyond a product's life cycle. In nature, one organism’s waste serves as another’s food. Nutrients and energy flow continuously in closed-loop systems of growth, decay, and rebirth.¹⁸⁶

The concept “reduce, reuse, recycle” is fundamental to the cradle-to-cradle design approach. The first step is to reduce the amount that we consume, and to consume well-designed products and services. Finding constructive uses for “waste” and byproducts should follow.

¹⁸⁴ Brand, Peter. “Governing inequality in the South through the Barcelona model: ‘social urbanism’ in Medellin, Colombia.” 2013.

¹⁸⁵ Beame, Susie. “Cradle to Grave vs Cradle to Cradle.” *Design Industry* 2009. January 01, 1970.

¹⁸⁶ IBID

Recycling is the last step, and ideally limited in the cradle-to-cradle design approach due to efficient reuse.¹⁸⁷

The “cradle-to-cradle” design theory is an active movement committed to developing safe materials, products, supply chains, and manufacturing processes in architecture and industry. When architectural designs are modeled after this concept, they create useful, practical and sustainable places to live. It encourages a stronger sense of community and cooperation, and also allows for efficiency and cost-effectiveness to play larger roles.¹⁸⁸

4. Flexible Housing

Jeremy Till and Tatjana Schneider’s “Flexible Housing: The Means to the End” outlines methods that can be used to achieve flexible housing. It argues that flexible housing is an essential part of future housing because of its emphasis on social, economic, and environmental sustainability. Flexible housing is defined as “housing that can adapt to the changing needs of users.”¹⁸⁹ The resulting architecture is intentionally broad to allow for different interpretations and housing layouts. It also leaves room to incorporate new technologies over time, and to adjust to changing demographics or program throughout the building.

Flexibility is explored through determinate and indeterminate design, also known as “hard” and “soft” systems. Previous approaches toward flexibility adopted all-or-nothing approaches that were technically off-putting to designers or developers. Till and Schneider’s process proposes alternative methods to achieve flexibility that allow a range of possibilities from wholesale change to discrete alterations.¹⁹⁰

In order to achieve flexibility, design should seek to “design out inflexibility,” using three approaches. First, construction methods should seek to reduce load bearing or solid internal partitions, as well as avoid roof construction that limits future expansion. Second, technological

¹⁸⁷ Beame, Susie. “Cradle to Grave vs Cradle to Cradle.” *Design Industry* 2009. January 01, 1970.

¹⁸⁸ *IBID*

¹⁸⁹ Till, Jeremy and Schneider, Tatjana. “Flexible Housing: the means to the end.” *Architectural Research Quarterly* 9, no. 3-4 (2005): 287-296.

¹⁹⁰ *IBID*

choices should be considered in order to reduce non-accessible or non-adaptable services. Third, space should be considered to eliminate tight-fit functions and rooms that can be used or accessed in only one way. These methods help avoid inflexibility.¹⁹¹

Till and Schneider researched various examples of flexible housing and discovered the terraced house, a row house typology common in England since the 17th century, was a common and effective example of flexible housing. They observed that over time these terraced houses had been modified both horizontally and vertically, and were divided, joined, and used for multiple other purposes than their initial intended program. Terraced houses possessed relatively generous space compared to contemporary housing standards. The adaptability of the space allowed for subdivision within the structure, often leading to room partitioning, the addition of a bathroom, or in the case of high ceilings, allowed for lofts and false ceilings. Terraced houses were constructed using repetitive simple techniques, making it easy for unskilled labor to alter the space.¹⁹²

From these observations Till and Schneider devised generic principles for achieving flexible housing. A correlation exists between the amount of space and level of flexibility. Limited space may appear to limit flexibility, but encourages and demands multiple uses. The complexity of construction methods used can severely limit the flexibility of a given structure. Simple and robust construction techniques allow for future modifications. If specialist construction methods or services are required, they should be placed in accessible and separate zones so that only one set of specialists is required to make changes. The placement of staircases, service cores, or entrances allow future flexibility at no extra cost, but must be considered in the early stages of design.¹⁹³

Recalling Stewart Brand's work, the identification of layers in construction range from structure, skin, services, internal partitions to finishes. External shells are inflexible, while cores

¹⁹¹ Till, Jeremy and Schneider, Tatjana. "Flexible Housing: the means to the end." 2005.

¹⁹² IBID

¹⁹³ IBID

provide access and services. The space within is indeterminate with large spaces, and allows for the addition and removal of partitions. Services can be placed vertically in accessible ducts, while horizontal services can be tucked under raised floors or dropped ceilings, thus allowing for services to be distributed anywhere, and to provide ease of access. Each can be categorized into the broader categories: “hard” and “soft.”¹⁹⁴

“Soft” use allows the user to adapt the plan according to their needs; here the designer works in the background. “Hard” use places the designer in the foreground; they are responsible for determining how spaces can be used over time. “Soft” generally requires more space, redundancy, and a reduced approach to planning and technology. “Hard” use is appropriate when space is scarce and multifunctionality is important.¹⁹⁵

Modernist housing of the 1920s and 30s responded to a housing shortage that occurred after WWI through the provision of housing with rooms that were undefined. New structural systems allowed indeterminate space to emerge as a new type available to early modernists. It accommodated longer spans and non-structural partitions. This approach made room for flexible modules that could vary in size and repetition. The occupation and program of the rooms was determined by the occupants. Similarly sized spaces with separate zones for circulation and services give way to multiple configurations from individual to household occupation. Future changes are made with ease, however coordination with adjacent apartments would be required for expansion and contraction in the future. This suggests designers should provide raw space that can be divided according to the needs of occupants. However, open space alone can be inefficient in terms of space usage.¹⁹⁶

“Soft” space lends itself to a participative approach to design. It allows tenants to control spaces during the design stages of a project and throughout the life of the building. “Hard” use is determined by the architect. Here the architect keeps control of the project, and is a much more

¹⁹⁴ Till, Jeremy and Schneider, Tatjana. “Flexible Housing: the means to the end.” 2005.

¹⁹⁵ IBID

¹⁹⁶ IBID

common approach. “Hard” approaches work best when space is at a premium. Moving or folding components that result in highly specific configurations are produced. It can require users to be participants in an architectural experiment, leading to spaces that become more and more difficult to rent and sell over time.¹⁹⁷

Technology can also help achieve flexibility, when considering construction techniques, structural solutions, and servicing strategies. “Hard” technology is developed specifically to achieve flexibility and can be essential to a scheme. This led to the development of the “open building movement.” Mass housing, an example of “hard” design, is a common approach to the housing market, “reduces the dwelling to a consumer article and the dweller to consumer.”¹⁹⁸ Instead users should be given control of the process of dwelling and should be considered as a structure of supports (infrastructure) and infills (short-term user adaptations). This requires the designer to relinquish control of portions of the design process, however. If flexibility is applied at all scales it can become a means for social empowerment.¹⁹⁹

“Soft” technology can create greater flexibility in structure over time. If load bearing columns and beams are completely eliminated, partition walls can be removed to combine units into larger units. The strategic placement of service cores is necessary to equip kitchens and bathrooms, while allowing their position to remain somewhat flexible. Access to services is required to allow future upgrades and should be distributed across the floor plate so they can be accessed in any configuration.

Till and Schneider encourage designers to relinquish control of parts of their designs to users for the creation of dwelling units. They encourage the consideration of hard and soft infrastructures as a means to create flexible architecture. When flexibility is applied at all scales it can become a means for social empowerment.

¹⁹⁷ Till, Jeremy and Schneider, Tatjana. “Flexible Housing: the means to the end.” 2005.

¹⁹⁸ IBID

¹⁹⁹ IBID

B. Case Studies: Incremental Approaches

1. Kowloon Walled City

The site of the Kowloon Walled City at the northeastern corner of Kowloon peninsula was first fortified in 1668 when a signal station was established. Since this date a small fortification existed on this site in Hong Kong until it was developed by squatters. With two governments claiming jurisdiction over it, the Walled City fell between two jurisdictions, one undertook minimal administrative responsibility to avoid diplomatic embarrassment, the other took no action at all. The result was a vacuum of administrative function and authority.²⁰⁰

Although squatters had filtered in after 1899, the population was still fewer than 500 in the 1930s. Conditions were unsanitary but here residents were able to escape the over-crowding of adjacent parts of the city. In 1933, the government announced plans to demolish the settlement for its poor sanitation. By 1940, most buildings had been demolished, sparing only those used for public purposes. The clearance continued under Japanese rule when the wall was torn down to harvest materials to extend Kai Tak Airport.²⁰¹

After WWII, refugees fled to Hong Kong where many settled in the Walled City. By 1947, the population had risen to 2,000. The Hong Kong government again attempted to expel settlers, but no eviction took place. Instead, the area was left to its own devices developing into a compact, vertical slum.²⁰² The area experienced massive construction in the 1960s and developers were forced to erect new buildings and structures above older ones. Over 30,000 people inhabited 300 buildings that occupied just over 7 acres (2.8 ha). The Walled City reached its maximum size by the late 1970s due to a height restriction of 13-14 storeys, imposed by the adjacent Kai Tak Airport flight paths.²⁰³ The proximity to the airport also subjected residents to significant noise and air pollution for the final 20 years of the city's existence.

²⁰⁰ Sinn, Elizabeth. "Kowloon Walled City: its origin and early history." *Journal of the Hong Kong Branch of the Royal Asiatic Society* 27 (1987): 30-45.

²⁰¹ Sinn, Elizabeth. "Kowloon Walled City: its origin and early history." 1987.

²⁰² *IBID*

²⁰³ Lambot, Ian. *City of Darkness: Life in Kowloon Walled City*. Honolulu: Watermark. 1999.

There was limited infrastructure present in the Walled City. Eight municipal pipes provided water to the structure.²⁰⁴ Some streets were illuminated with fluorescent lights, because sunlight did not reach the lower levels due to the density of development.²⁰⁵



Figure 15: Kowloon Walled City: Incrementalism unchecked

Although crime was reduced in later years, many took advantage of the absence of law enforcement in the Walled City. A high number of unlicensed doctors and dentists practiced in the Walled City due to limited threats of prosecution.²⁰⁶ However, most residents were not involved in crime and lived peacefully. Many small factories and businesses thrived inside the Walled City, and community groups organized to improve daily life there.²⁰⁷ Charities, religious groups, and other welfare organizations were introduced into the City over time.²⁰⁸

The Walled City provides an example of incrementalism unchecked by any authority, building standards, rational plan, or guiding framework. The Walled City arose from a unique set of conditions, but it highlights the importance of design standards when dealing with incremental projects. If no clear structural, architectural, or urban design framework is provided to an incremental project, anarchic, unsafe, and undesirable results may ensue.

²⁰⁴ Goddard, Charles. "The Water Supply." In *City of Darkness: Life in Kowloon Walled City*. Honolulu: Watermark. 1999. 36-38.

²⁰⁵ Wilkinson, Julia. "A Chinese Magistrate's Fort." In *City of Darkness: Life in Kowloon Walled City*. Honolulu: Watermark. 1999. 60-71.

²⁰⁶ Vines, Stephen. "Demolition begins on HK's Walled City". *The Business Times*. SG. p. 4. March 24, 1993. Retrieved 25 November 2009.

²⁰⁷ Basler, Barbara. "The Walled City, Home to Huddled Masses, Falls". *The New York Times*. p. A4. June 16, 1992. Retrieved 27 November 2009.

²⁰⁸ Wilkinson, Julia. "A Chinese Magistrate's Fort." 1999.

2. Japanese Metabolism

The Japanese Metabolist movement arose from rapid development and housing shortages similar to the conditions found in developing cities throughout the world. Land was held by multiple landowners with few large landholders. This caused the development patterns of the city to occur incrementally, and without large social housing projects.

The Metabolist movement promoted top-down solutions. Architects were “social architects.” reimagining the way individuals interacted as well as the framework of the entire city of Tokyo. The plans for Tokyo called for massive infrastructural projects that would “grow” over time according to demand. While this approach is grounded in incrementalism, the proposed plans required individuals to adapt to architectural plans. Individual choice, design freedom, and community empowerment were overlooked in order to adhere to the architect’s vision.

After the second World War, most of Tokyo required rebuilding. The city expanded at a rapid pace, especially in 1950 at the onset of the Korean War. Despite massive reconstruction and rapid industrialization, Tokyo retained its pre-modern urban structure passed down from the feudal era. The city developed piecemeal; new housing was built to accommodate the surge in population, and infrastructure lagged behind. The various issues facing Tokyo during this period included: “the vast population movement, fast proliferation of automobiles, inadequacy of social services, shortage of land and widespread private land ownership, as well as initial inexperience of the authorities in charge all contributed to Tokyo’s predicament.”²⁰⁹ During the five years after the war Tokyo’s population grew from 2.78 million to 5.38 million. The population surged as a result of “evacuees and soldiers returning from war, repatriated Japanese from lost colonies, and thousands upon thousands of desperate job seekers from impoverished prefectures and devastated cities.”²¹⁰ Growth continued throughout the 1950s reaching 8.31 million by the end of the decade.

²⁰⁹ Lin, Zhongjie. *Kenzo Tange and the Metabolist movement: urban utopias of modern Japan*. Abingdon: Routledge. 2010. 134.

²¹⁰ IBID

This surge in population caused a housing shortage; temporary housing was established in vacant lots, but was done illegally, requiring reconstruction.

The overconcentration of population and adoption of automobiles led to severe traffic congestion. Given its centripetal pattern any measures taken to broaden existing routes only resulted in a greater concentration of urban functions at the city center. With increased population and concentration of industries, Tokyo's land prices surged. Private land ownership remained even after the air raids during the war, and the city retained its Edo period street network. This contributed to high land prices as well as "fragmentation of land ownership making it difficult to assemble enough land for large-scale public developments in the inner city."²¹¹ Tokyo also lacked a coherent and powerful planning framework; zoning and coordinated land use as well as aesthetics of urban design resulted in a chaotic urban fabric.



Figure 16: Kanto earthquake aftermath



Figure. 17 Tokyo post-WWII

Tokyo had two significant opportunities to coordinate a comprehensive reconstruction: The Great Kanto 115 Earthquake of 1923 and the resulting fire, which destroyed 63 percent of Tokyo, and the decimation caused by WWII, wiping out 40 percent of buildings. After these disasters, reconstruction plans were formulated, but they "failed to make any significant impact on the city due to the costs involved, the urgency of rebuilding shelters, and the complexity of land ownership."²¹²

²¹¹ Lin, Zhongjie. *Kenzo Tange and the Metabolist movement: urban utopias of modern Japan*. 135.

²¹² IBID

Tokyo entered a period of rapid economic growth in the mid 1950s fueled partially by the Korean War and the Allied Forces use of Japan as a military base and source of supplies. This period was Japan's economic miracle. It led to rapid suburbanization and urbanization on the outskirts of Tokyo raising the metropolitan population from 13.28 million in 1955 to 18.86 million in 1964. The city's spatial structure transformed during this period from being a single core to a polycentric pattern, with new business and commercial centers emerging outside of the city core.

The rapid industrialization and urbanization that occurred after WWII was the product of intense commercialism and capitalism. The chaotic development that ensued during this period, however, presented urban issues requiring more careful and thoughtful planning. Socialist urban concepts were explored, especially by the Metabolists, a cohort of utopian architects, who sought to solve the issues of Tokyo's haphazard development and complex privatized landholdings through schemes founded on communal ownership and public housing principles.

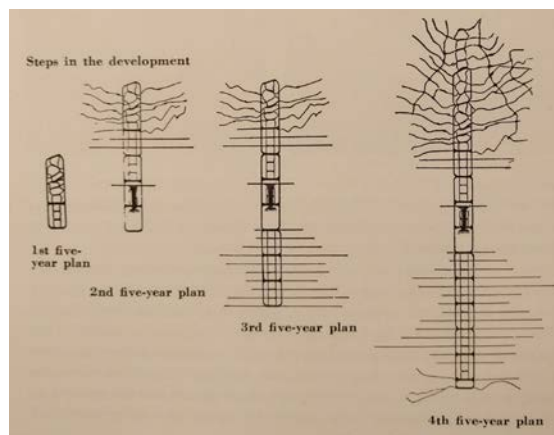


Figure 18: Tange's phased framework

After the failed implementations of Tokyo master plans, industrialists and architects set their eyes on a new frontier - Tokyo Bay. Kenzo Tange's 1960 plan for Tokyo was inspired by previous Metabolist schemes, but was able to integrate these new ideas into a plausible proposal. "[They] Metabolists actively sought new approaches to city design and, more specifically, to

reorganizing the city as a human association with an emphasis on its sociological organization and symbolic meaning.”²¹³

Tange’s vision was a new Tokyo stretching across the bay to reach Chiba on the opposite shore. The main feature was a central spine carrying an elevated highway system of interlocking loops stretching 30 km across the bay. The spine began with a loop framing the center of Tokyo city. The third, fourth and fifth loops would be entirely over water and would house a new civic center and a port. The following loops would contain office and public buildings until reaching shore. The buildings along this spine were habitable bridge trusses spanning service towers arranged on a rectangular grid. Beyond the fifth loop secondary freeways spread perpendicular to the central spine connecting the spine to clusters of tent-like residential units that spread over the bay. These structures would feature artificial land that would provide room for residents to build their own houses.²¹⁴

Tange’s plan for Tokyo consisted of three main objectives: To shift from a radial centripetal system to a system of linear development; to find means of bringing the city structure, transportation system, and urban architecture into organic unity; to find a new urban spatial order reflecting the open organization and the spontaneous mobility of contemporary society.

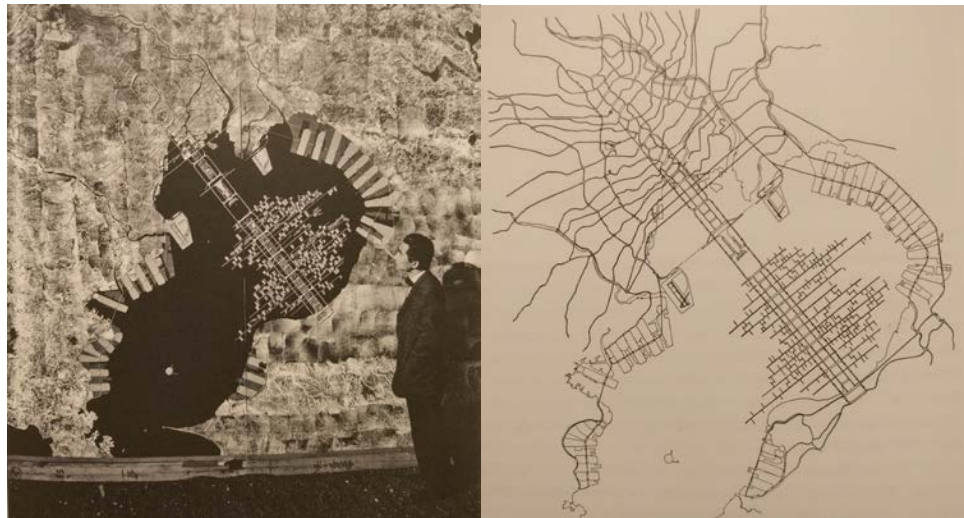


Figure 19: Tange’s plan for Tokyo (1960) Figure 20. Organizational framework

²¹³ Lin, Zhongjie. *Kenzo Tange and the Metabolist movement: urban utopias of modern Japan*. 144.

²¹⁴ Lin, Zhongjie. *Kenzo Tange and the Metabolist movement: urban utopias of modern Japan*. 147.

Conventional methods for master planning seek a static end state. Tange's plan was adaptable to external growth and internal regeneration, meaning the structural framework could grow, while smaller components within could self-renew within the structural framework. Tange writes:

“Short-lived items are becoming more and more short-lived, and the cycle is shrinking at a corresponding rate. On the other hand, the accumulation of capital has made it possible to build in large-scale operations.... The two tendencies - toward shorter cycles and toward longer cycles - are both necessary to modern life and to humanity itself.”²¹⁵

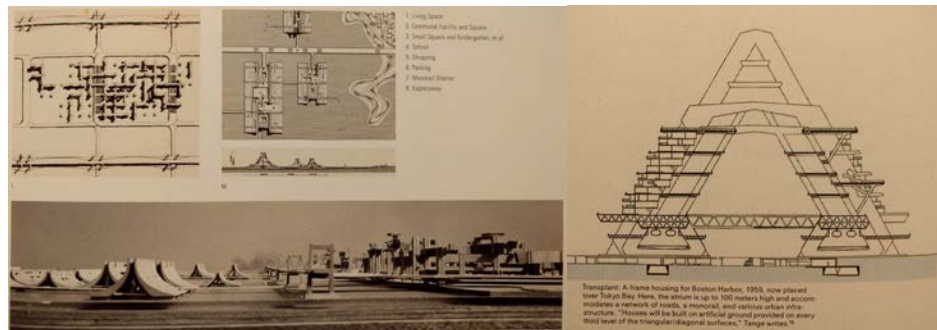


Figure 21: A-frame “artificial land,” circulation, and spine

Long-term large-scale structures curtailed individual freedom while short-term small-scale elements were expressions of individual choice. Tange's Plan for Tokyo featured A-shaped structures providing artificial ground facilitated by communal investment. Individual investments could be made in the form of private construction. Tange's plan relied on the idea the megastructure would operate on a longer cycle of change than these smaller units. While the megastructure allowed for changeable infill, Tange's plan did not account for the possibility the structure itself could become obsolete.

Tange's Plan for Tokyo exemplifies the Metabolist approach to planning and architecture. It embraces technology and mass production as a means for the betterment of society, while eliminating private land ownership in an effort to create an egalitarian society.

²¹⁵ Lin, Zhongjie. *Kenzo Tange and the Metabolist movement: urban utopias of modern Japan*. 117.

Kenzo Tange's plan was influenced by and influenced a group of architects active in Japan during the late 1950s and 1960s. They created visions for ideal cities addressing the urban crisis of Japan and its social transformation during the post war period. Frustrated by political conflicts, and impotent officials, Metabolists addressed the poor urban form and social problems with radical alternatives. They envisioned new cities that would provide true order inherent in an advanced industrial society. "What they sought was not an improvement of the city, however comprehensive, but a revolution in the way it was built and operated."²¹⁶ None of the Metabolist schemes were based on the existing urban framework; they determined society needed a new type of urban form to establish new methods of organization and operation.

"The foremost characteristic shared by the Metabolists' proposals stemmed from a vision of modern communal living. Metabolist cities often consisted of a number of self-contained collective communities, with populations ranging from 2,000 (agricultural city) to 500,000 (ocean city). The architect would serve as the mastermind of this new society, responsible for its design and the education of its citizens. Individuals would still have freedom to choose their own style of living within the organizational framework.

Metabolist plans called for the creation of permanent artificial land that would be publicly owned and managed, while private houses and offices were temporary modules attached to the permanent artificial land. "By putting land into public ownership, the Metabolists rejected other models of ideal society such as democratic individuality exemplified by Frank Lloyd Wright's Broadacre City or cooperative socialism as seen in Ebenezer Howard's Garden City. For the Metabolists, public land ownership would prevent any speculation and guarantee true equality within the society."²¹⁷

Metabolist plans provide an early example of incremental design thinking. However, they focused heavily on a technology and engineering focused design resulting in projects that

²¹⁶ Lin, Zhongjie. *Kenzo Tange and the Metabolist movement: urban utopias of modern Japan*. 71.

²¹⁷ Lin, Zhongjie. *Kenzo Tange and the Metabolist movement: urban utopias of modern Japan*. 75.

were extremely expensive, difficult to build, and relied on centralized decisionmaking. The plans did, however, include considerations for layering infrastructure, providing some individualization through user created housing, and a plan that afforded incremental growth.

3. Aranya Community Housing

The Aranya Community Housing project was prepared by the Vastu-Shilpa Foundation in 1983, in Indore, India, as a way to house newly arriving and existing slum dwellers. The project rejected the intense grid plan associated with S&S projects, and instead presented an urban design that catered to the vernacular architecture of the area, the economic circumstances of residents, and the climate of the locale. A small utility core designed by an architect provided residents with the opportunity to build incrementally and affordably. The units, while providing standardized utilities, structure, and foundations allowed for countless variations of infill to occur over time.²¹⁸

Common spaces promoted cooperation, community, tolerance, and cohesive social relationships. This space also provided socioeconomic mixing, aiding cross-subsidies, economic vitality, and the financial viability of the development.²¹⁹

The plan for Aranya was informal, imitating the surrounding slums. 10-unit residential clusters open up to the street with individual courtyards in the rear. Open spaces and pedestrian pathways connect each cluster to a central spine of circulation. Every twenty houses are connected to one septic tank. Three reservoirs interconnect to provide water to the development. Electricity was provided to all dwelling units. The plan incorporated various income groups, with poorest groups centralized and higher income residents on the periphery and along the main circulation spine. Demonstration homes consisted of several options ranging from one-room

²¹⁸ "Aranya Community Housing." In *Architecture Beyond Architecture*, edited by Cynthia C. Davidson and Ismail Serageldin. London: Academy Editions, 1995.

²¹⁹ IBID

shelters to multi-room homes. This was intended to encourage adaptation and personalization based on needs, resources, and household size.²²⁰

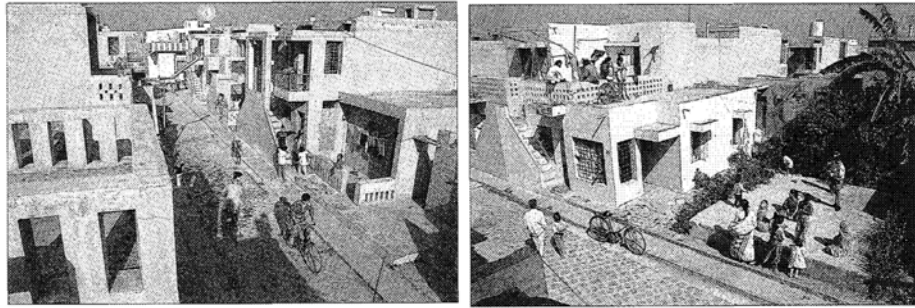


Figure 22: Aranya community housing

Lower income groups were provided with two options depending on household financial resources: a site and plinth, or a service core with one room. Homeowners could use any material for construction. The original architect-designed demonstration homes remain, while surrounding plots have been built and developed in a way that does not follow the architect's model. Since the project was realized, the Aranya Community Housing has infilled significantly demonstrating the success of this incremental project.²²¹

4. Alejandro Aravena

Alejandro Aravena, the principal architect for Elemental, is known for his incremental, participatory housing designs. Elemental's studio work focuses on common-sense ways of working within financial constraints, while providing essential services, and long term configurability. Elemental focuses on what is most difficult to achieve, individual and community faculty, and what is needed to guarantee positive future outcomes. These ambitions led to their most notable project: "Half a House."²²²

This model was first introduced in the 1970s by Professor John F.C. Turner. Turner was teaching a new master's program at MIT called Urban Settlement Design in Developing Countries. He developed a theory based on the idea that individuals can build for themselves if

²²⁰ "Aranya Community Housing." 1995.

²²¹ IBID

²²² Zilliacus, Ariana. "Half A House Builds A Whole Community: Elemental's Controversial Social Housing." ArchDaily. October 24, 2016.

provided with fundamental infrastructure, land tenure, and utilities. Turner believed that housing should be considered an ongoing process. This Idea was expanded upon and perpetuated by George Gattoni, evolving into the concept “Half A House.”²²³

Aravena was commissioned to draw up a new master plan for Constitución, Chile, after it was hit by a magnitude 8.8 earthquake; which killed over 500 people and destroyed 80% of the buildings in the city. Elemental had already experimented with unfinished low-income houses in Iquique, Chile, which were to be built at \$7,500 per unit, for 100 families. Aravena’s model consists of an expandable 40m² container with basic infrastructure (partitions, structural and firewalls, bathroom, kitchen, stairs, a roof) built-in and added over time. Elemental provided residents with just enough to meet the Chilean legal requirements for low-income housing, giving them the freedom to expand afterward. It is a remarkable achievement, not only from a conceptual and project management standpoint, but also as an aesthetically open and diverse project. From this one idea stemmed 100 variations.²²⁴



Figure 23: Elemental project Villa Verde

The Constitución Villa Verde project features two-storey half houses. One half of each house (part of the original architect-designed structure) is identical across the program, while the second halves of each residence are completely unique. The first floor of the finished half is

²²³ “Aranya Community Housing.” 1995.

²²⁴ IBID

comprises unfinished concrete floors, while the second floor is fitted with unfinished plywood. The kitchen features one sink with no other appliances. This makes the house cheap, practical, and efficient. Fundamental structural and architectural needs were provided to residents, including concrete foundations, plumbing, and electricity. The Chilean government paid for, constructed, and provided roads, drainage, sewage, garbage collection, busses and other vital infrastructure important to fostering community. Residents were responsible for contributing time, labor, and any additional materials.²²⁵

Residents were given the option to participate in community design meetings hosted by Elemental. Each homeowner received a manual highlighting ways to expand using standard affordable building materials. The project aims to offer residents a higher quality home than what they otherwise would have been able to construct themselves or receive support to do so. Efforts were made to make the architecture highly affordable and basic so any extra resources could go into improving the surrounding area uplifting the neighborhood, showcasing Elemental's social conscience.

Elemental has produced low-income houses with architecture that is disaster resistant. The concept appears to be succeeding in using "scarcity as a tool." Alejandro Aravena has recently been recognized by the architectural community, winning the Pritzker Prize in 2016, for epitomizing "the revival of a more socially engaged architect...fighting for a better urban environment for all."²²⁶

Participatory design has been lauded as a means to face the challenges of unprecedented urbanization and urban poverty. However, little has been written about the way information-sharing can be a disruptor to the construction industry. Aravena recently made some of his socially oriented architectural projects open source online, making it available to anyone with internet access.²²⁷

²²⁵ Zilliacus, Ariana. "Half A House Builds A Whole Community: Elemental's Controversial Social Housing."

²²⁶ IBID

²²⁷ "Why Aravena's Open Source Project is a Huge Step Toward Better, Cheaper Housing for Everyone." ArchDaily. April 29, 2016.

Aravena's work has led to an reevaluation and questioning of housing. Labor accounts for around one third of the cost of a house, while services (administrative, financing, marketing, architectural, and engineering) represent another third. If more components of architectural projects are made open source, from design to manufacturing, cheaper, better housing can be offered.²²⁸

Aravena and Elemental's work draws heavily from early theories and practices first tested in the 1970s. His projects focus heavily on architecture, and the creation of a design that limits and confines future expansions. The urban plans of such projects are deployed with little regard for the surrounding landscape and rely on clearance tactics. While Elemental's projects focus on *tabula rasa* developments, their designs make limited efforts to engage residents and community in the formation and layout of incremental projects.



Figure 24: Elemental project Villa Verde urban design

5. Medellin

Moving away from planning practices of the past, Colombian cities have introduced an increased focus on urban transformations that are based on integrated, participatory, pro-poor, and inclusive urban development strategies.²²⁹ Medellin focused its development strategies on integrated and inclusionary upgrading policies that would seek to preserve existing communities. An “equal city for all and where all citizens can construct relations stimulated by neighbourhoods

²²⁸ "Why Aravena's Open Source Project is a Huge Step Toward Better, Cheaper Housing for Everyone." ArchDaily. April 29, 2016.

²²⁹ United Nations Settlements Programme. *The Challenge of Slums: Global Report on Human Settlements 2003*. Nairobi: United Nations, 2003.

rich in services, culture and public space” became the main goal of the 3-year development plan of Medellin 2004-2007.²³⁰ Deprived neighborhoods of the city were seen as a limitation to improve Medellin as a whole. Therefore, poverty, inequity, violence, and the lack of participatory governance were identified as obstacles for achieving Medellin’s goals. This led to integrated and participatory upgrading projects given highest priority in the political arena. Local administration saw this as strategic, believing that improving the social, economic, and spatial problems of these neighborhoods would contribute to the development of the city as a whole.²³¹

The ideas developed by designers and planners in Medellin were collected by the local administration into a strategy of urban development coined “social urbanism.” This became the main framework for all urban projects in Medellin, especially in communa neighborhoods.²³² It was conceived as a development strategy that combined physical transformations, social/institutional programs, and participatory processes simultaneously. Social urbanism’s objective was: “whenever there was an urban intervention, in parallel to the physical transformation, there were new social/institutional programs and activities that complemented the physical change.”²³³ Social and institutional programs would reinforce and make active use of new public spaces and public facilities. This was done through an integrated approach that engaged multiple municipal agencies and involved the community at different stages of the project.

The first *Proyecto Urbano Integral* (PUI) was located in northeastern Medellin. Its approach was to concentrate on a delineated area with an integrated intervention that converged resources, projects, and programs of the government. It was thought that this strategy would create more impactful, faster, and more visible results for the area. Three components informing the project were: physical components, based on new public spaces and facilities; social

²³⁰ Municipio de Medellin. “Plan de desarrollo 2004 - 2007 ‘Medellin, Compromiso de toda la Ciudadania.’” Medellin: Municipio de Medellin. 2004.

²³¹ IBID

²³² BID. *Medellin - Transformacion de una ciudad*. Medellin: BID - Banco Interamericano de Desarrollo, Alcaldia de Medellin. 2009.

²³³ Echeverri, A. “La Transformación de Medellin - Urbanismo Social 2004-2007.” Presented to the Sociedad Central de Arquitectos, Medellin, Colombia, April 20, 2009.

components, based on the participation of the community in the different stages of the projects, and the appropriation of these by the community; and an institutional component, that coordinated the implementation of existing social programs of the administration and created arena for collaboration among agencies²³⁴



Figure 25: PUI urban fabric typologies, pre PUI

The built environment consists of four development types. Planned development is exclusive to the lowland areas of the PUI and consists of a gridded urban layout with a highly regular streetwall. Higher in elevation, two other types of development emerge, organic and mixed. The organic development has undefined edges, and no order to the arrangement of buildings. Mixed urban form is a mix of the more regular planned appearance, while containing aspects of organic development. Street walls are evident but back lots and vacant lots create a relatively more organic appearance.²³⁵ Finally, an invasive pattern of settlement fills the margins between the previous settlement patterns. It is confined to the least desirable areas and creates a buffer surrounding the more formal development patterns listed above. The invasive settlement pattern is not confined to a single area of the PUI and appears to be a more opportunistic

²³⁴ Alcaldía de Medellín. *Proyecto Urbano Integral en la Zona Nororiental de Medellín*. Medellín: Alcaldía de Medellín. 2007.

²³⁵ EDU. "PUI Nororiental - Hacia un Urbanismo Social." Medellín: Empresa de Desarrollo Urbano - Alcaldía de Medellín. 2005.

extension of development beyond the confines of the planned, organic, and mixed development patterns.



Figure 26: PUI circulation hierarchy

Prior to the PUI project, the street network consisted of three different means of circulation: linear, network, and arboreal. The linear circulation routes are confined to the southern and western portion of the PUI and create a gridded pattern of circulation. They are not confined entirely to the lowland areas, but are the predominant means of circulation at lower elevations. The network circulation pattern is highly irregular, but still forms complete blocks. This pattern of development fills the midsection and mid-elevations of the PUI area. The arboreal circulation is confined to the higher elevations and the steepest slopes located within the PUI.²³⁶ This circulation network is relatively linear spreading north and southward. Much of the arboreal circulation network is located along forested slopes, and where buildings are more intermittent.

The project resulted in improvements that extended beyond the physical results of the project. The safety of the neighborhood vastly improved. Previously a haven for criminals, drug dealers, and organized crime, the neighborhood was dangerous with a high murder rate. Pablo

²³⁶ EDU. "PUI Nororiental - Hacia un Urbanismo Social." 2005.

Escobar, a notorious international drug lord situated many of his operations here, exacerbating the safety issues during and after his occupation. During this time the neighborhood was a ‘no-go zone’ for the rest of Medellin due to the safety, economic, and physical connection to the rest of the city.²³⁷ Before the PUI implementation, circulation was narrow, illegible, and steep. The steep terrain was largely responsible for this configuration, and contributed to the safety issues of the neighborhood.²³⁸



Figure 27: Conditions before PUI project upgrades

Steep ravines cut through the PUI and surrounding comunas, creating physical boundaries between communities. These physical boundaries translated into rivalries between gangs and contributed to the safety issues plaguing the neighborhood. The PUI introduced infrastructure that connected these distinct neighborhoods, creating bridges literally and figuratively between the comunas. Narrow circulation paths and streets were widened to improve circulation and to provide legibility to pedestrians. Wider, more legible streets reduced spaces for potential criminals to hide and helped pedestrians unfamiliar with the illegible street network better navigate through the comuna. The present day safety situation of the neighborhood has improved, but still retains some of the issues from its previous ‘no-go zone’ status.

²³⁷ EDU. “PUI Proyecto Urbano Integral Nororiental - Balance y Proyecciones.” Medellin: Empresa de Desarrollo Urbano. 2007.

²³⁸ EDU. “PUI Nororiental - Hacia un Urbanismo Social.” 2005.

The economic outlook of the neighborhood vastly improved after the implementation of the PUI. With the introduction of transportation to the neighborhood, the communa was integrated into the larger economy of Medellin. Before the PUI improvements, the communa functioned as a shadow economy. Informal retail, businesses, and services were the lifeblood of the neighborhood.²³⁹ While these provided economic opportunities for the residents, they did not provide tax revenue for the city, nor any contributions to the broader populace of the city. Economic opportunities for the residents of the communa were limited to this informal economy, and thus led to stagnation, and poor social mobility. With the introduction of the cable car transportation, residents of the neighborhood were brought ‘online’ into Medellin. Residents were able to commute more easily, rapidly, and economically to the broader city through the cable car’s connection to the Medellin Metro.²⁴⁰ This connection to Medellin provided many more economic opportunities to the residents of the PUI and helped move some of the residents out of the informal economy.



Figure 28: Metrocable serving the PUI

A more subtle outcome of the PUI were the psychological improvements of the residents. As the economic, social, safety, and physical improvements occurred, the psychological outlook of the residents improved as well. While difficult to measure, project leaders indicated that

²³⁹ EDU. “PUI Nororiental - Hacia un Urbanismo Social.” 2005.

²⁴⁰ EDU. “PUI Proyecto Urbano Integral Nororiental - Balance y Proyecciones.” 2007.

residents had much better outlooks. One of the greatest contributing factors was related to safety. The past, semi-warlike state of the neighborhood attributed to Pablo Escobar's connection to the communa left residents traumatized and trapped. With his expulsion and the PUI improvements, the community was lifted out of this state of trauma and given opportunities that were previously unavailable to residents in the broader city of Medellin.²⁴¹

Echeverri was careful not to attribute all improvements to the PUI, due to the political, social, and economic changes that were sweeping Medellin in the early 2000s. However, it is evident the PUI ameliorated the conditions of the communa.²⁴²

The Social Urbanism employed in the PUI Nororiental features many components of "green infrastructure." Green infrastructure is defined as "an interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife. Used in this context, green infrastructure is the ecological framework for environmental, social, and economic health—in short, our natural life-support system."²⁴³ While the PUI area focused heavily on social factors and community efforts, there were significant green infrastructure improvements as well. Green infrastructure works in concert with land development and man-made infrastructure planning to better lead to land conservation and natural resource protection.²⁴⁴ Because the PUI was previously developed, it was necessary to introduce green infrastructure that worked alongside development. Utilizing the hydrological network present in the neighborhood, green corridors were introduced to the design area using selective demolition and relocation.²⁴⁵

²⁴¹ EDU. "PUI Proyecto Urbano Integral Nororiental - Balance y Proyecciones." 2007.

²⁴² IBID

²⁴³ Benedict, Mark A. and McMahon, Edward T. "Chapter 1 Why green Infrastructure?" *Green Infrastructure: Linking landscapes and Communities*. Washington, D.C.: Island Press. 2006. 1-22.

²⁴⁴ IBID

²⁴⁵ EDU. "PUI Nororiental - Hacia un Urbanismo Social." 2005.



Figure 29: PUI selective home relocation for green infrastructure upgrades

The relocation of existing housing to make way for green corridors, and streams provides vital services for the communa. It helps provide more surface area for stormwater runoff to inundate, reduces the risk of flooding impacts, provides riparian corridors that in turn increases the biodiversity potential of the area, and reduces the heat island effect of the surrounding neighborhood.²⁴⁶ While the ambitions of the PUI appear to be somewhat more aesthetic based, these new green hydrologic corridors provide vital ecosystem services for the neighborhood, and Medellin as a whole.

The PUI also offers an integrated solution to green infrastructure. Types of infrastructure (hard and soft) were introduced with equal weight, especially given the requirement for the relocation of individuals within the neighborhood.²⁴⁷

²⁴⁶ EDU. "PUI Nororiental - Hacia un Urbanismo Social." 2005.

²⁴⁷ IBID

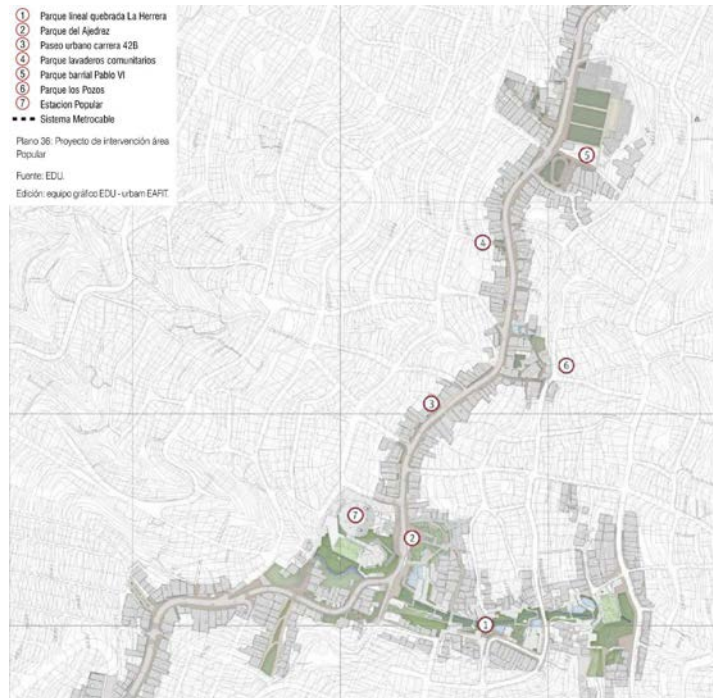


Figure 30: PUI circulation, built form, and green infrastructure integrated

While the PUI provided many social services and improvements for the residents of the communa, it stopped short of fully realizing ecosystem services. As one can see in the image above, the green infrastructure improvements were integrated with the physical improvements of the neighborhood. This integration was key to the PUI project, as it improved the aesthetics of the neighborhood, but also provided ecosystem services that will serve the community long term. The green infrastructure introduced also provides the opportunity to embed public spaces, and recreational spaces that were previously unavailable to the residents. This plan also includes an important hydrological function. Cascading pools were introduced to reduce peak flows of stormwater runoff, creating time and opportunities for stormwater runoff to infiltrate, replenishing groundwater, providing riparian habitats, reducing peak flow, and providing aesthetic features.²⁴⁸

²⁴⁸ EDU. "PUI Nororiental - Hacia un Urbanismo Social." 2005.



Figure 31: “Green” infrastructure approaches in PUI

While the plans indicate a strong regard for green infrastructure, it is unclear if the implementation is as “green.” Above we can see that some of these pools appear to function more as grey infrastructure, or perhaps aren’t even integrated into the green infrastructure laid out in the plan. These aesthetic hard infrastructure implementations could lead to flooding and stormwater runoff issues, and may not provide the same natural services indicated in the plans of the project



Figure 32: PUI circulation, runoff, and green infrastructure upgrade

While some hard infrastructure “improvements” may not provide the implied benefits of the PUI plans, some indirectly provide for green infrastructure. Bridges spanning streams and ravines were introduced to aid circulation between the communities. Their introduction prevents

any impacts on the stream and riparian corridor, while also encouraging any future development higher up the faces of the ravine.²⁴⁹

The PUI Nororiental is clearly successful in its social and sustainability aims. Through a five phased approach, the community was engaged and consulted at all stages of development. The development sought to introduce various new physical forms of infrastructure ranging from roads, footpaths, bridges, cable car, riparian corridors, and streetscape improvements. The project also effectively introduced institutional infrastructure that will improve and upgrade the community over time. It is clear that this integrated approach to planning and design is highly effective in upgrading an existing neighborhood in place, and demonstrates the potential of Social Urbanism going forward.

6. KIP Successes and Failures

The Kampung Improvement Program (KIP) largely improved the quality of life and living standards of Indonesian urban slums at a low cost of investment. KIP had an immediate and positive impact on kampungs where the inputs were directed. Improvements to the kampungs encouraged residents to invest in home repairs, higher quality architecture, and participate in the operations and maintenance of community infrastructure.²⁵⁰

The immediate areas surrounding KIP kampungs benefited from the projects as the physical and economic impacts of KIP expanded into neighboring communities. At the citywide level, however, environmental conditions deteriorated as rapid population and economic growth increased demand for urban infrastructure elements like housing, water, sanitation, footpaths, roads, and drainage. KIP kampungs and their immediate surroundings became islands of environmental improvements.²⁵¹

Community consultation and participation in early stages of design was essential to instilling a sense of ownership and participation for the community. KIP did not provide urban

²⁴⁹ EDU. "PUI Nororiental - Hacia un Urbanismo Social." 2005.

²⁵⁰ Independent Evaluation Group. "Indonesia- Enhancing the Quality of Life in Urban Indonesia: the Legacy of Kampung Improvement Program." 2012. Accessed April 2, 2017.

²⁵¹ IBID

mobility, but it promoted tenure and senses of house ownership. KIP's rapid and extensive implementation may have led to a low level of household turnover and mobility. Residents, widely aware of KIP's broad territory across the city, did not feel the need to move in order to take advantage of the program.²⁵²

The rising demand for scarce urban land in major Indonesian cities, especially Jakarta, will lead to the redevelopment of kampungs into commercial and high-end residential real estate. Despite KIP's focus on physical improvements to infrastructure, Urban I-IV did have some significant and notable impacts on institutional developments in the urban sector of Indonesia. New agencies and existing institutions were strengthened at the central level.²⁵³

KIP provided many lessons for the future of slum upgrading in Jakarta, as well as around the world. However, several recommendations can be made to ensure future approaches best address the many Kampung still present in Jakarta. Future upgrade programs should integrate flood control measures as well as drainage networks at the citywide scale. Improved drainage systems helped to reduce flooding with KIP investments and interventions. However, some issues arose from drainage backlogs at entrances to city drains where backups were common when drains are not cleared regularly. Any improvements to drainage in one area should not negatively impact neighboring areas. This issue often arises when the project addresses site specific issues piecemeal.²⁵⁴

Some aspects of infrastructure and environmental conditions can be managed and maintained by the communities they serve. Residents and communities can help improve and manage dwelling conditions, road and footpath maintenance, solid waste collection, and the upkeep of local drains. The illegal dumping of solid waste, the integration of kampung infrastructure into city-wide infrastructure, and the effects of pollution, are beyond the control of

²⁵² Independent Evaluation Group. "Indonesia- Enhancing the Quality of Life in Urban Indonesia: the Legacy of Kampung Improvement Program." 2012

²⁵³ IBID

²⁵⁴ IBID

communities and require government intervention and management.²⁵⁵

Future urban projects in Indonesia should consider and assess the dynamics of the local real estate market. Demand for modern real estate development in Indonesia's cities can limit low income infrastructure improvements to Kampung in prime locations. The redevelopment of kampung is occurring rapidly, indicating future projects should address policy issues relating to compensation for displaced low income families, as well as their relocation.²⁵⁶

Future projects should promote partnerships with community groups and NGOs as a means to ensure that they are responsive to kampung needs. The participation of communities and NGOs at early stages of design should be addressed early in planning stages, due to their important role instilling a sense of project ownership by the community. Although the concept of community consultation and participation is now widely accepted, those at the local government level understand the concept but do not translate it into practice. This signals better guidelines for community members, NGOs, and project staff should be created.²⁵⁷

It is important to document, monitor, and quantify the successes and failures of such projects to provide guidance for future endeavors, as well as to facilitate the sharing of knowledge for these aims worldwide. Steps should be taken to consolidate institutional memory within government and the World Bank for future projects. An urban development arm of the Indonesian national government, BAPPENAS, plans to develop an in-house evaluation for all sectors, including impact evaluations.²⁵⁸

KIP serves as a starting point for the upgrade and formalization of Jakarta's plentiful slums. The simple and somewhat rudimentary upgrades it provided helped improve the living conditions of vast swathes of Jakarta. KIP, however, failed to make upgrades across scales, and engage and encourage any significant community participation. KIP provides a history and local

²⁵⁵ Independent Evaluation Group. "Indonesia- Enhancing the Quality of Life in Urban Indonesia: the Legacy of Kampung Improvement Program." 2012.

²⁵⁶ IBID

²⁵⁷ IBID

²⁵⁸ IBID

knowledge among Indonesians as to what they can expect from slum improvement projects, perhaps making them more receptive to proposed projects.

CHAPTER V

KAMPUNG WADUK PLUIT

A. Kampung Muara Baru - Site in Context

The Kampung Muara Baru, located in North Jakarta, and more specifically the Kampung located along the eastern shore of Waduk Pluit will serve as the site for my design approach. There are approximately 600 kampungs in Jakarta.²⁵⁹ These neighborhoods vary in size, density, and composition. 360 of these kampungs were labeled “slums” or a squatter settlement.²⁶⁰ 60 percent of Jakarta residents live in these kampungs.²⁶¹ Most slums in Jakarta are located in hazardous areas, including riverbanks, railways, lakesides, coastlines, etc. This puts these neighborhoods and their residents at higher risk for damage, displacement, and disaster.



Figure 33: Jakarta aerial showing focus area

Kampung Muara Baru (KMB) is administratively defined as “RW 17” and is a district within Kelurahan Penjaringan. The neighborhood is 112 hectares and is surrounded by water. The

²⁵⁹ Kompas Daily News: February 19, 2010.

²⁶⁰ United Nations Settlements Programme. *The Challenge of Slums: Global Report on Human Settlements 2003*. 2003.

²⁶¹ Silver, Christopher. *Planning the Megacity: Jakarta in the Twentieth Century*. 2008.

Java Sea and Mutiara Bay lie to the north, Pluit Lake to the west, Jakarta Bay to the east, and Kota (the ‘old city’ of Jakarta) to the South. The registered population of KMB in 2012 was 21,865 inhabitants, with a density of 1,955 persons per hectares.²⁶² This makes KMB the largest and densest kampung in Penjaringan. KMB houses the highest concentration of poor households in Penjaringan (2008)²⁶³ and the DKI Jakarta Government categorized KMB as a “high-slum” typology.²⁶⁴

The settlement of KMB began to increase in the 1990s as the nearby harbor was developed by the central government. The population increased by 300 percent during these years, reaching 12,818 households by 2012.²⁶⁵ It is an attractive kampung, most likely for its proximity to jobs. Despite increasing flooding incidents, squatters and new residents continue to settle, not having been deterred by the vulnerable location.²⁶⁶



Figure 34: Project focus area: Kampung Waduk Pluit

The neighborhood is extremely dense, filled with dwelling units, ground floor retail, warehouses, workshops, and circulation. The neighborhood features a small channel that runs along the back side of the neighborhood parallel to the shoreline of the Waduk Pluit lagoon.

²⁶² Kantor Kelurahan Penjaringan. Laporan Tahunan 2012 Kelurahan Penjaringan Jakarta Utara, Pemerintah Provinsi DKI Jakarta. Jakarta. 2013.

²⁶³ Firman, T., I. Chaidir, I. Surbakti and H.A. Simarmata. “Potential Climate Change Impact on North Coastal Jakarta.” *Habitat International* 3 (2011): 32-37.

²⁶⁴ BPS-Badan Pusat Statistik DKI Jakarta. Kecamatan Penjaringan dalam Angka 2012. Pemerintah Provinsi DKI Jakarta. Jakarta, Indonesia. 2012.

²⁶⁵ Kantor Kelurahan Penjaringan. Laporan Tahunan 2012 Kelurahan Penjaringan Jakarta Utara, Pemerintah Provinsi DKI Jakarta. 2013.

²⁶⁶ Simarmata, Hendricus. *How informal institutions manage flood-risk at community level: An empirical study of Kampung Muara Baru, Jakarta*. Geneva, switzerland: United Nations International Strategy for Disaster Reduction, 2015.

Circulation is oriented in the same configuration. One long relatively contiguous alley provides circulation to the majority of the neighborhood; connections to the “mainland” are limited and are only provided by ramshackle pedestrian bridges.



Figure 35: Project focus area: Kampung Waduk Pluit

My proposed intervention and design concept focuses on the northern part of the Waduk Pluit neighborhood. This portion of the neighborhood features a broader swath of Kampung bounded by Waduk Pluit to the south and west, a canal to the north, and a city road to the east. This portion of the neighborhood is less linear in nature and features a vague circulation network that weaves in and out of the built environment, sometimes becoming fully incorporated and concealed by the built environment.

B. Waduk Pluit Site Conditions



Figure 36: Project focus area figure ground: Kampung Waduk Pluit

Waduk Pluit's urban form is linear in nature given the constraints of the land it is located on. Circulation within the Kampung is different from the surrounding urban fabric. The neighborhood is only accessible on foot and scooters can navigate only a portion of the alley network. The alleys range in width from 2-4 m, however, throughout the day small businesses on the ground floors of structures and pushcarts spill into this space, making the paths more irregular and less navigable. Taller structures typically feature second floor overhangs that extend into the air rights of the circulation network, further confining circulation. These extensions, however, provide shade from the hot tropical sun and respite from the frequent tropical downpours.

The neighborhood's location at the end of an extensive river and canal network that snakes across Jakarta exposes the neighborhood to high levels of solid waste, sewage, pollution and flooding. Much of Jakarta lacks proper solid waste disposal, leading to the dumping of waste into water bodies, streams, and rivers. These all flow towards the Java Sea, meaning they must flow past the Kampung Waduk Pluit. A barrage exists to the north of the neighborhood,

restricting the flow of solid materials leading to a concentration and backlog of solid waste in Waduk Pluit. For the same reasons pollution and sewage reach higher concentrations in Waduk Pluit due to its downstream location, and the poor disposal and treatment options present in the rest of Jakarta. Solid waste contributes to the flooding experienced in Waduk Pluit as it clogs drainage systems and canals. Removal efforts are rudimentary, relying on individuals to collect and ship it away.

Flooding in the neighborhood is caused by several factors. Given the proximity to the Java Sea, the neighborhood experiences tidal flooding during tidal maximas. While tides do not influence the water levels within the lagoon, due to a barrage that disconnects and actively manages the water level of the lagoon independent of the Java Sea, tidal maximas cause widespread flooding along the coastline, including within Waduk Pluit. Due to land subsidence, elevations at or slightly below sea level, and an ineffective city drainage and canal system, Waduk Pluit experiences tidal floods at regular intervals during tidal maximas. Flood events in Waduk Pluit also occur from runoff during rain events flowing downstream to the Java Sea from much of the city of Jakarta. A river and canal network facilitates drainage from parts of the city at higher elevations, but as this runoff reaches the broad coastal plain its flow slows. Water collects in drainage canals, rivers, and low lying areas, causing flooding during heavy rainfall. Minimal stormwater treatment and collection also contributes to localized flooding, quickly leading to impassable roads, sidewalks, and alleys. Jakarta's rapid urbanization has also led to higher peak flows during storm events, leading to flash flooding, as permeability has been significantly reduced over time. As subsidence accelerates due to groundwater extraction, the potential for flood events and more localized pooling and ponding will increase. The neighborhood of Waduk Pluit is one of the neighborhoods most impacted by subsidence, experiencing rates of up to 16 cm per year. Waduk Pluit's location at the convergence of tidal flood events as well as downstream floods means the neighborhood is highly susceptible to increasing flooding, and eventually the possibility of submergence.



Figure 37: Project focus area: Kampung Waduk Pluit

Within dwelling units individuals have implemented their own adaptations to combat flooding incidents. Residents install flood proof storage areas to raise the first floor level in their homes, while hanging floors or high shelving are used for storing electrical appliances, food, and cookware. The front thresholds of dwellings are made of terraced concrete, raised to a height of an adult's knee to prevent floodwaters from entering into homes. Floors are gradually raised with modifications to the building, but ceilings are not raised in response, creating cramped interior conditions.

The buildings in this area are highly variable in size, height, orientation, and layout. Most dwelling structures are limited to two storeys, or about 16-20 feet, due to poor construction techniques and unreliable materials. Structures are built utilizing what materials were available and affordable to residents, these range from tarps and canvas, to corrugated metal, timber, bamboo, concrete, brick, cardboard, plywood, and sometimes even rubble. This means the structures are highly irregular in appearance, extremely delicate, and impermanent.



Figure 38: Conditions within Waduk Pluit

The structural integrity of the buildings within Waduk Pluit is questionable. Those built out of concrete and masonry are more robust, but lack many of the necessary construction methods (plumb, and level) and materials (rebar) required to ensure structural integrity. Wood structures are built without adequate consideration for the loads they may be exposed to, and can rot quickly due to the tropical climate and flooding conditions present in the neighborhood. Pilings are required to provide adequate footing in the damp soil and the more aquatic portions of the kampung. Wood and bamboo pilings are most commonly used due to their affordability and availability. High quantities of pilings are used, though they are spaced irregularly and sometimes redundantly. While they are cheap and easy to acquire, they offer only temporary structural solutions given high rates of rot. This leads to impermanent architecture of poor quality because these pilings fail quickly.

Dwellings are typically single room units. Households range anywhere from four to eight family members. Household members share the common room, sleeping in shifts, or together, on foldable mattresses. These multifunction rooms are usually located to the rear or the top of the structure so that the frontage of the home can house a small business, a vital component to the livelihoods of each household. Those located in the rear lack adequate air circulation and secondary egress in the case of fire. Rooms located on the second floors of units are accessed via rudimentary ladders, usually located on the exterior. These ladders offer a layer of safety for the

residents since they can be removed to protect the individuals and belongings within. Doors are common, but windows are atypical due to the expense of glass.

Most dwellings have no running or potable water, meaning water has to be transported into the neighborhood via push cart (due to the lack of vehicular circulation). Cooking fuel ranges from woody biomass/debris, to kerosene tanks that are brought in via pushcart. The open flames of these cooking fuels expose these (already unsafe) structures to high fire risk, and explains the frequent fires that destroy portions of the neighborhood.

Sanitation is limited in the neighborhood as well. Squat toilets have been fitted in the households with greater economic resources, but much of the neighborhood relies on buckets as makeshift toilets. Since sewers are not present in the neighborhood, buckets and toilets with rudimentary plumbing are emptying directly into the lagoon or canal. Solid waste (trash) is either burned or dumped into adjacent water bodies, creating piles of trash throughout the neighborhood.

Electricity is present in the neighborhood, but widescale availability and adoption is limited due to associated costs and limited infrastructure deep within the Kampung. It is unclear if the electricity that is present in some dwellings is distributed by electric companies, or hijacked.

Waduk Pluit inhabitants rely largely on an informal economy that is confined largely to the neighborhood itself, but extends beyond for employment. Most households maintain a small business in their dwelling that may include a small convenience store, restaurant, warehousing function, or workshop. These businesses primarily employ household members and provide income to the household. Employment is also available in the surrounding waterfront area where shipping, fishing, warehousing, and transport are common businesses. This proximity has promoted the development and density of Waduk Pluit due to the difficulty of navigating and commuting within Jakarta. This is the most substantial connection Waduk Pluit has to the broader Jakarta economy, and Jakarta at large. Otherwise, Waduk Pluit lies in relative isolation due to its separation from most essential infrastructure and transportation networks.

The conditions listed above highlight the complex and compounding issues facing residents in Waduk Pluit. Left to their own devices, residents have found inventive and adaptive methods to address the numerous issues present. However, the outlook, conditions, and quality of life of the slum could be vastly improved with the provision of vital infrastructure, quality architecture, and resilient design. Given the limited financial resources of residents, NGOs, and government, any upgrades to the kampung must be “least-case,” rather than “best-case” options. Projects must provide the most essential services and infrastructure with minimal cost and interventions. It should also be noted that the formalization of this neighborhood can contribute greatly to the economy of Jakarta as a whole, whereas if this kampung were slated for demolition, as is the common practice in Jakarta, any investment would remain with developers and those already with financial means.

CHAPTER VI

PROPOSAL FOR INCREMENTAL INTERVENTION IN JAKARTA

A. Negatives into Positives

The conditions outlined in the previous section highlight the many problems facing residents of Waduk Pluit. However, if one reconsiders these “problems” as “opportunities,” the neighborhood may already possess the resources needed for improvement. Invoking the concepts outlined in “Cradle-to-Cradle,” the byproducts, waste, and debris present in the neighborhood offer a potential foundation for other uses, economies, and products.

The high quantities of trash, debris, and solid waste present in the neighborhood present an opportunity for use. My project proposes the use of solid waste as the filler for gabions. Gabions are wirework containers that can be filled with rock, broken concrete, or other material. For the purposes of my project the solid waste will be sorted according to longevity and placed within gabions as a method of land retention, and land building.

The highly polluted water found in Waduk Pluit will serve as a source of water and fertilizer for a wide array of plant species planted in my project. Phytoremediating plants thrive in polluted and otherwise inhospitable areas, absorbing pollution into biomass and creating vital habitats. Several plant species native to Indonesia will provide these services, while also improving the natural conditions of the neighborhood.



Figure 39: Water edge condition in Waduk Pluit

Human waste is a major problem within Waduk Pluit. Residents will be provided with composting toilets for each household, allowing the waste to be converted into valuable compost. This compost can then provide the nutrients and soil necessary for the growth of food within a small rooftop garden located on each structure. The roof will also feature a butterfly design for the collection of the heavy and frequent tropical downpours. This roof shape will help collect rainwater for filtration into potable drinking water for the residents of each dwelling unit.

As my project matures and the financial means of residents improve, solar panels will be made available at low cost to generate electricity. These panels will be able to convert the bright tropical sunlight into energy for cooking, lighting, electronics, and appliances. Given Jakarta's location near the equator, the orientation of the solar panels is more flexible, giving the potential for widespread implementation.

Each of these approaches utilizes the natural resources, byproducts, or discarded materials present in Waduk Pluit and converts them into useful products and resources for the neighborhood. Each approach was evaluated to ensure affordability, ease of implementation, and usefulness. An effort was also made to use methods and resources that were independent from external infrastructure, helping the neighborhood function without input from government or external organizations, and giving residents the ability to take ownership for upgrading their residences and neighborhood.

B. Independent Infrastructure

As outlined previously, independent infrastructure plays an important role in my project for the provision of essential utilities and resources for the residents of Waduk Pluit. Independent infrastructure refers to services and utilities independent and discrete from those provided by government and corporations and is essential for habitation and quality of life.

My project will employ independent infrastructure to provide potable water, electricity, sanitation, cooking fuel, phytoremediation, and solid waste disposal. Independent infrastructure gives residents with the opportunity to elect which resources and utilities are most essential to

their needs, while providing the opportunity for future upgrade with minimal intrusion. Current forms of infrastructure rely on networks of permanent pipes, wires, roads, and sewers. Taking lessons from Brand, these forms of static and unchangeable infrastructure within architecture limit adaptability, modification, and changing programs and needs. For residents of Waduk Pluit independent infrastructure will remove these utilities and services from hard infrastructure and provide a means for future upgrades independent of broader static infrastructure.

Independent infrastructure will allow for the provision of utilities and services independent from local and national government entities. Given the weak and corrupt nature of government in Indonesia and Jakarta, and the isolated and anarchic nature of Kampung, independent infrastructure will enable residents to play an active role in the provision of infrastructure independent of these entities. This type of infrastructure can also be appealing to government, NGOs, and utility companies, allowing for minimal financial investments to be made in hard infrastructure into dense unplanned neighborhoods, while providing the same services. Independent infrastructure and utilities will also enable residents to reduce long-term costs of utilities, while also producing products and benefits in many cases.

C. Kit-of-Parts

My project will employ a “kit of parts” method for the production of new dwelling units. My kit comprises components readily available in Waduk Pluit, and can be assembled simply to create a core structure from which future incremental architectural additions may occur. The same kit of parts approach is also part of the design for the landscape and urban design of my project.

The architectural kit of parts comprises: rubble and trash filled gabions used as a pad for construction; steel screw piles, capable of being driven into the earth by hand, will provide a stable footing for the dwelling; bamboo structural members will be lashed together forming the framework and structure for the dwelling unit; woven bamboo fibers will provide walls for the unit; concrete blocks will make up a vertical core that provides support for heavier components; pallets will be inserted into the bamboo structure providing the flooring and ceiling for the

dwelling unit; woven fiber mats will provide the finished flooring surface; corrugated metal panels will provide roofing and rain collection; used drums will store and treat harvested rainwater; a composting toilet will provide sanitation services to the dwelling unit; a simple sink workstation will provide a basic kitchen; solar panels will be installed on the roof for energy production; and finally a rooftop garden will provide space for on-site food production.

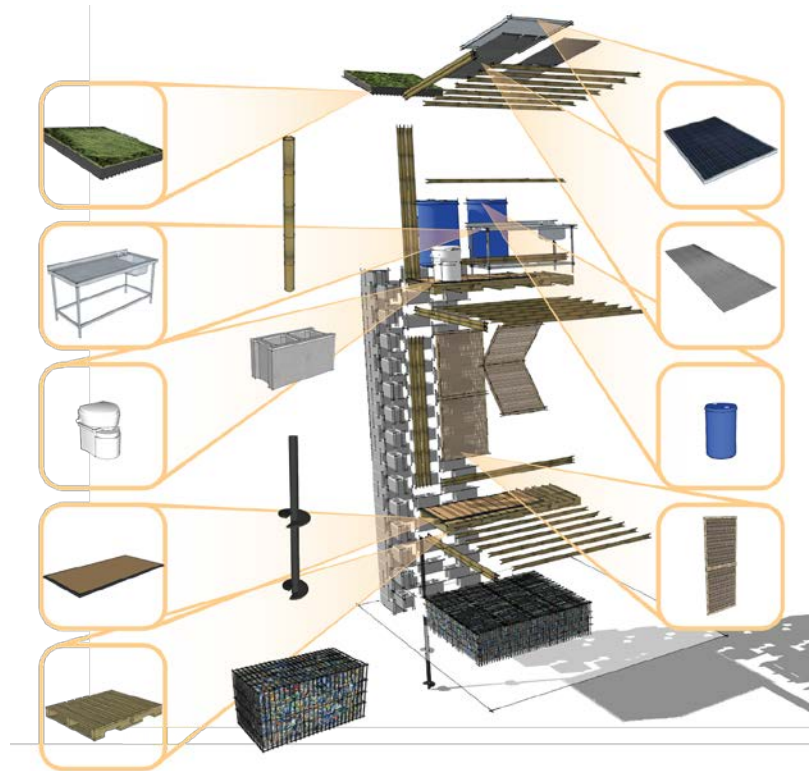


Figure 40: Architectural kit-of-parts

Most of these components were selected for their affordability, ease of assembly, familiarity, and availability. With this kit, residents receive a system that can be assembled on site, with minimal financial investment, that is highly configurable. Each component acts as a modular component allowing for various configurations, adjacencies, and layouts. Modularity is an important component of my project because it allows for expansion and adaptation over time while relying on the faculty of residents to assemble the kit. My design serves as a guide to create a core module, but the components allow users to adapt based on their unique needs and desires.

The architectural kit of parts is designed to offer a robust structure, but also affords flexibility. Additions can be made using the same kit to extend the living areas on each floor. Because the original dwelling unit is based on a modular kit, it means future extensions only require the repetition of certain components. This approach also provides the opportunity for the affordability, availability, and warehousing of materials. Because the kit relies on relatively few components, these can be warehoused in the neighborhood for easy access. The more readily available the materials, the lower the price of transport, and the more likely homeowners are to utilize them in their upgrades. Their regular use in the original modules, and prescribed addition method, suggests bulk pricing will enhance the affordability of the materials. Since a portion of the materials are sourced directly from the neighborhood landscape, financial incentives exist to use these pieces, which in turn fosters the production economy.

The kit of parts outlined for the dwelling unit module also allow for program flexibility. The ground floor is left as a fully programmable space, empowering residents to determine the function of this portion of the unit. Because small businesses are vital to the livelihoods of Waduk Pluit residents, this space can accommodate house shops, restaurants, warehouse, workshop, or even expanded living space. Its location on the ground floor provides opportunity for foot traffic, and removes the living space from the more active ground level to the second and third storeys. The higher levels of the unit are one room each. These rooms are devoid of fixtures so households can program and utilize the space as they require. Independent utility modules even give residents the ability to modify the configuration of the bathroom and kitchen locations over time should the original module no longer suit their needs.

Some components are more expensive and will rely on NGO or government funding. The composting toilet is an essential component to the quality of life within the dwelling unit and to the broader neighborhood; it will therefore be provided with each new dwelling unit. Small, affordable solar panels will be provided to each unit from the outset, providing lighting and

electricity for small electronics (such as cell phones). More productive solar panels can be purchased later in the life of the unit to provide electricity, cooking fuel, and lighting.

Landscape components have also been considered as a kit of parts. This kit features plants native to Indonesia and readily available and affordable materials (many of which are a product of the plants present within the kit). The kit includes: mangroves for land stabilization, habitat creation, and water filtration; two species of phragmites for phytoremediation, fiber, and riparian buffer; soft rush for fiber, rapid growth, and aquatic growth; water hyacinth for its rapid growth, fiber, and substantial phytoremediation capabilities; duckweed for its phytoremediation properties, and its economic potential as animal feed and fertilizer; and finally, common bamboo for its rapid growth, and structural members.

The plants listed above were selected for their ability to grow in highly polluted waters as well as for their ability to absorb and remediate pollutants. While many of the plants have invasive qualities, my design calls for a managed landscape where all plants serve a source of material for products and building components. This will encourage active landscape management by Waduk Pluit residents, thus controlling and limiting their expansion. Corrals will also be created in an effort to contain and manage the spread of the species, and will aid in harvesting. These plants were also selected for their ability to act as land stabilizers, shoring up the land of the kampung, improving the riparian buffer zone, and mitigating some aspects of flooding. Along the coastline of Waduk Pluit mangrove stands will also be introduced. These will serve to stabilize the land along the margin, increase water absorption, and provide a foundation for a vital ecosystem. Most of the waterfront of Jakarta, now developed, was once mangrove forest. My project will seek to mimic the function of this historic landscape, as well as restore some of the species, appearance, and ecosystems once present.

The material components of the landscape kit of parts will include: bamboo pilings up to two meters in length; bamboo dock structural members; pallets for the walking surface of docks;

fiber bales made up of phragmites, water hyacinth, and soft rush; and finally trash and rubble filled gabions for land stabilization at the water's edge.

The materials produced by the plants outlined in my project act as building blocks for the landscape, as well as for some architectural components. Within the landscape, bamboo pilings will create the structural surround of corrals, used to create pockets of permeability. Along this bamboo structure, bales of fiber will be collected from and placed in the landscape as a means to create permeable barriers as well as plant species corrals. This system of corrals will extend from about a meter above water level out into the shallow lagoon. As flood waters rise, these corrals will act as buffers from higher water levels, allowing for higher rates of permeability, and thus increasing the time and flood levels required to flood the Kampung. The Docks will provide access to this managed riparian landscape and will aid in the phased expansion of the managed landscape. Gabions will provide structure to water's edge about a meter above waterline. These will help shore up the land's edge, provide structure for plants, and improve permeability.

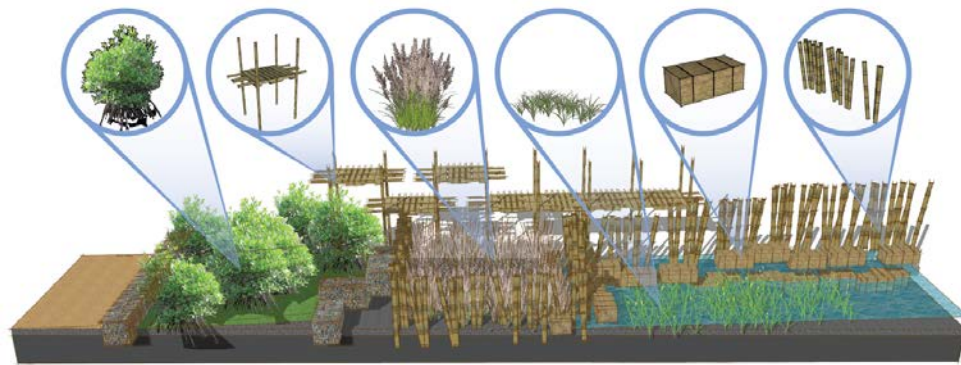


Figure 41: Landscape design kit-of-parts

The materials for this kit were selected for their adaptability, modularity, and flexibility. When the system is deployed on the landscape, infinite configurations are possible - it is up to residents and the community of Waduk Pluit to configure and assemble them as they desire. Each component acts as a modular component offering various configurations, adjacencies, and layouts. Modularity is an important aspect to the landscape of my project, allowing for expansion and adaptation to occur over time, while relying on the faculty of residents to assemble the kit of

parts. Should the needs of the Waduk Pluit community change, this modular system can adapt and react to changing conditions. This promotes resiliency and the sustainability of the project, ensuring that the landscape functions to benefit the residents of the neighborhood during all stages and phases of development.



Figure 42: Project focus area: Kampung Waduk Pluit

As outlined previously, products derived from the landscape will provide construction materials for the architectural interventions in Waduk Pluit. A material common to the site currently is rubble and trash. This solid waste will be used to fill gabions for the purpose of land building and stabilization below the dwelling unit modules. Plants grown within the landscape will provide fiber for portions of the facade and floor. The facade is a bamboo frame filled with woven fibers sourced directly from the Waduk Pluit landscape. This is also the source of the woven floor mats overlaid on pallets. The pallets are also common to the neighborhood, sourced from the adjacent waterfront where shipping and warehousing requires a high volume of their use and production. Finally the composting toilet within the dwelling unit will produce compost that can be used to fertilize the fibrous plants utilized for the dwelling unit production.

These integrated kits offer the chance to develop a new local economy based on the production of housing units and small business spaces using the materials produced by the landscape; an economy dictated and driven by the local community. By adopting these kits,

residents can play an active role in the creation of their dwelling units, urban form, and landscape, imbuing a sense of ownership, place, and belonging.

D. Incremental Development

An incremental process of development is an important and essential feature of my proposal. Allowing the architecture, urban design, and landscape to grow incrementally will contribute to its long-term sustainability and resiliency.

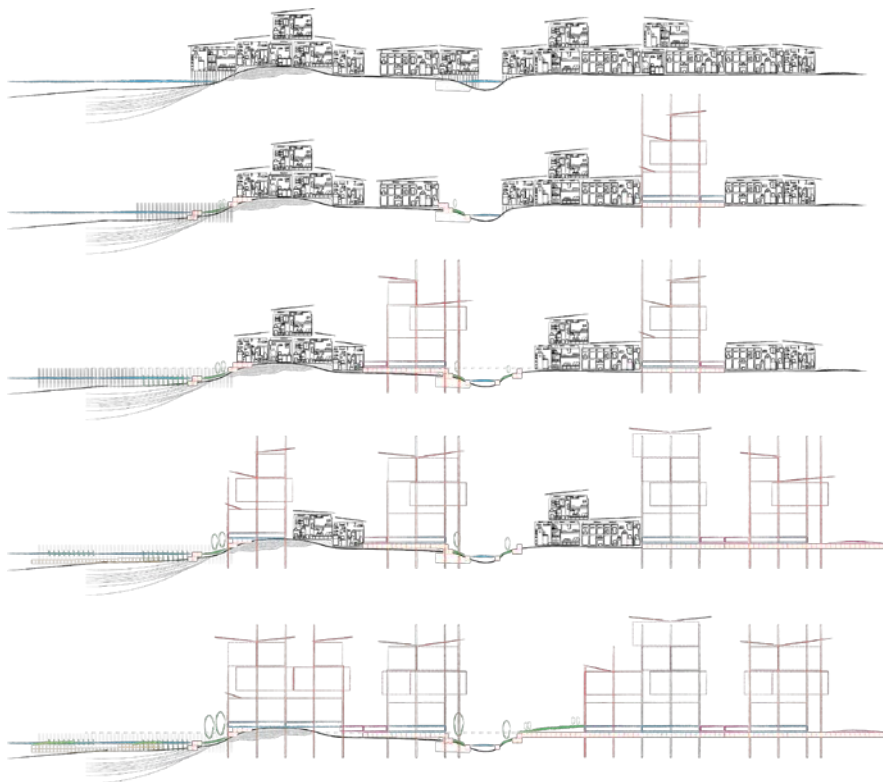


Figure 43: Phased expansion of Waduk Pluit project

The architectural response outlined in my project begins with a dwelling unit module that is highly configurable and customizable, and allows for incremental additions. The core module features a ground floor flex-space; a second floor kitchen, bathroom, and multi-purpose room; a third floor that is multi-purpose with a loft above for sleeping quarters or storage. Circulation, sanitation, potable water, and low voltage electricity is provided in the architectural module, meaning expansions can be simple and easily constructed. Utilities and services are independent from hard infrastructure, thus allowing for their placement and provision for future additions.

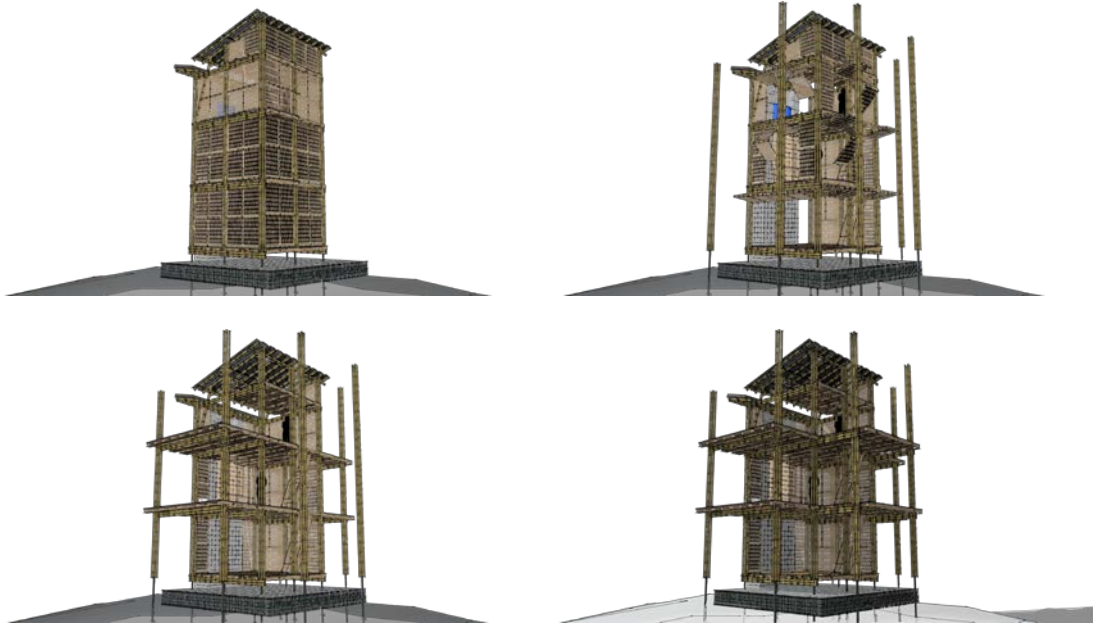


Figure 44: Phased expansion potential of the dwelling unit module

The landscape also features an incremental approach to development. Docks extending out into the lagoon provide a framework for future expansion of landscape interventions. These docks are expandable, allowing for incremental growth of my landscape components. A series of corrals composed of bamboo and fiber barriers will provide space for plant growth, flood control, phytoremediation, and productive landscapes. Corrals will be incremental, allowing for additions and accretions to occur and demand warrants.



Figure 45: Phased expansion of productive landscape components

The urban plan for the project also features an incremental development approach. Discrete and limited phased demolition would provide space for the construction of new dwelling unit modules. Displacement of residents will only occur after a new dwelling unit is made available. Once the provision of a new dwelling unit is secured, the process can continue on the vacated land. Over time interventions will merge to create an urban form that has a more efficient density, improve circulation, provide small open spaces, and formalize the informal economy of Waduk Pluit.

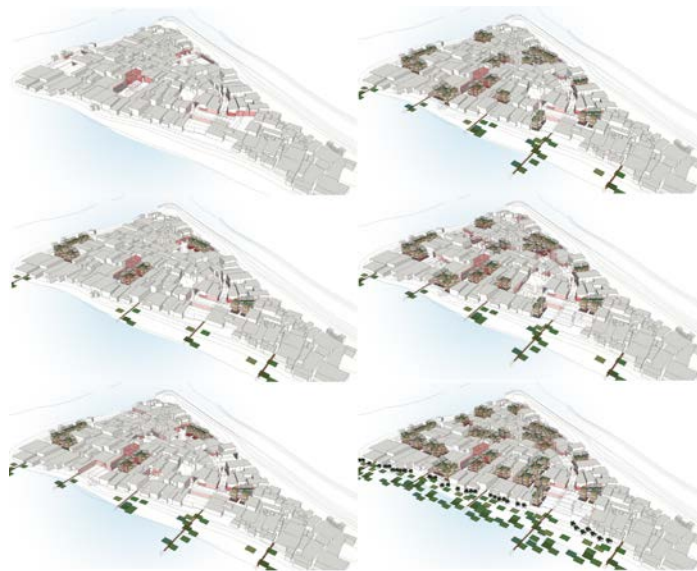


Figure 46: Phased expansion of urban plan and landscape components

Attempts were made to apply incrementalism even at a detail scale to best employ resident and community faculty, maximize phased expansion potential, and enable configurability. Figure 47 depicts the details within the dwelling unit module. The bamboo structure is lashed together using synthetic fiber rope. Lashing allows unskilled labor to assemble structural components while providing future flexibility and easy disassembly. Structurally, the dwelling unit module features vertical bamboo supports grouped in fours, allowing for cross structural members and beams to be inserted and secured within a void in between each vertical member. The facade of the structure is also inserted into the space between the four vertical members, allowing for operability to provide cross ventilation openings as well as shade-

providing awnings. Pallets are inserted onto cross members, utilizing their inherent structural integrity, and the utility of their interior void. The structure's foundation is provided using pilings screwed into the ground every six feet, and supports the four vertical bamboo supports.

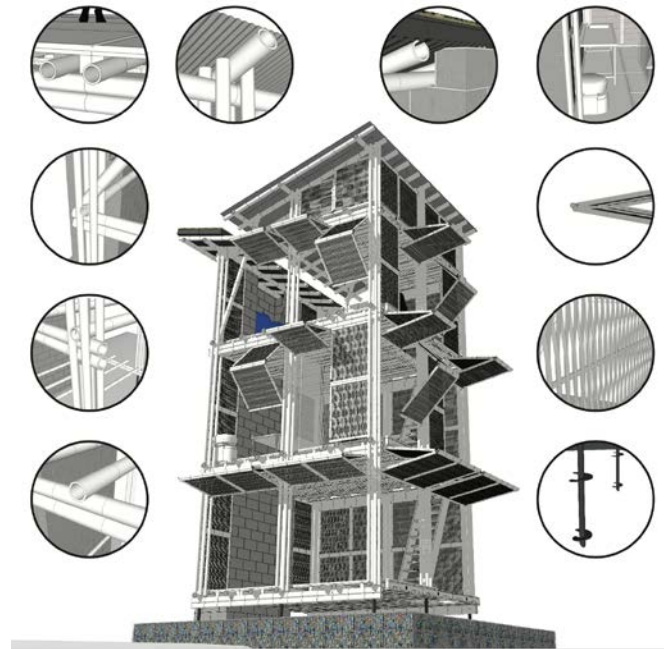


Figure 47: Architectural details and joinery

The landscape also features similar configurable and simple details. Bamboo pilings can be driven into the ground along the water's edge and within shallow water using unskilled labor. Harvested fiber is grouped into bales and are lashed onto the bamboo piles to provide permeable barriers. The dock system relies on the same properties of pallets employed in the architecture and are lashed together for ease of assembly and configurability. Gabions provide structure to the edge of the landscape, and are composed of a wireframe cube that is filled with user selected materials collected from the landscape and trash collected from the lagoon. The selection of materials is made based on the longevity of each found material in an aquatic environment.



Figure 48: Landscape design approaches

The details within the neighborhood provide natural services and introduce functional landscapes into Waduk Pluit. A terraced runnel is oriented along the centers of the circulation network. A small channel at the lowest point provides a place for runoff to flow. Two permeable tiers exist above this level to accommodate higher runoff flows as well as provide higher rates of infiltration. During dry periods the middle tier is vegetated, providing greenery to the neighborhood as well as runoff absorption and filtration. The highest tier provides the circulation network for the neighborhood. This level is surfaced in crushed stone/rubble to provide maximum permeability. Crossings of the vegetated swale are placed every five meters. Trash and rubble filled gabions provide the structure necessary for creating each terrace, while maintaining the permeability of the streetscape.



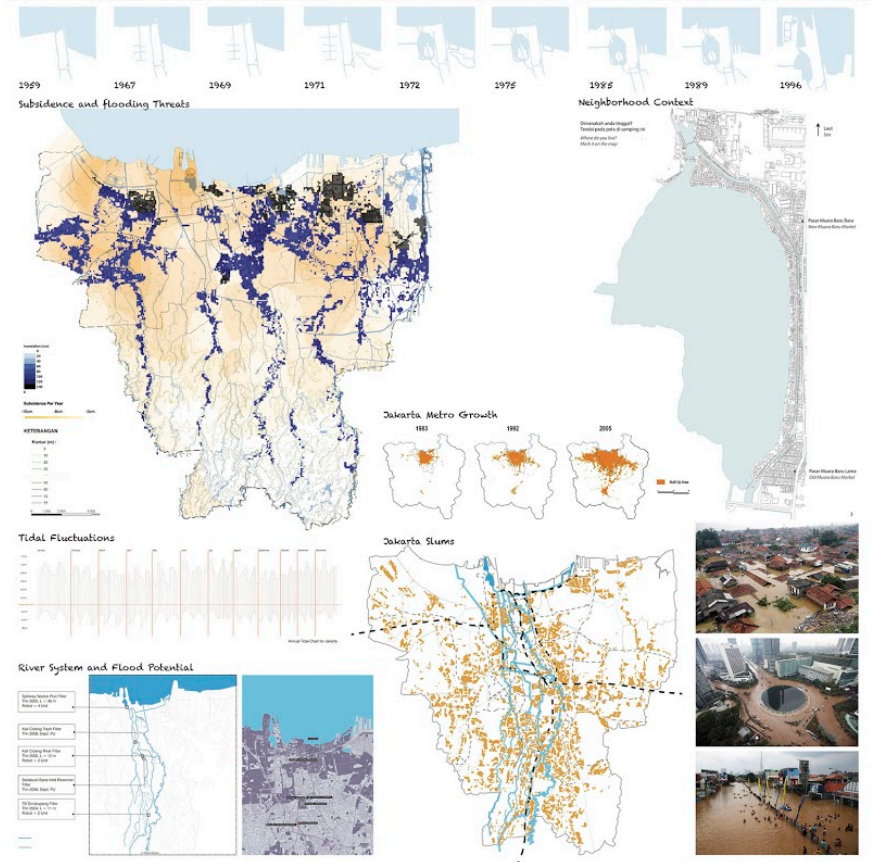
Figure 49: Streetscape and urban design approaches

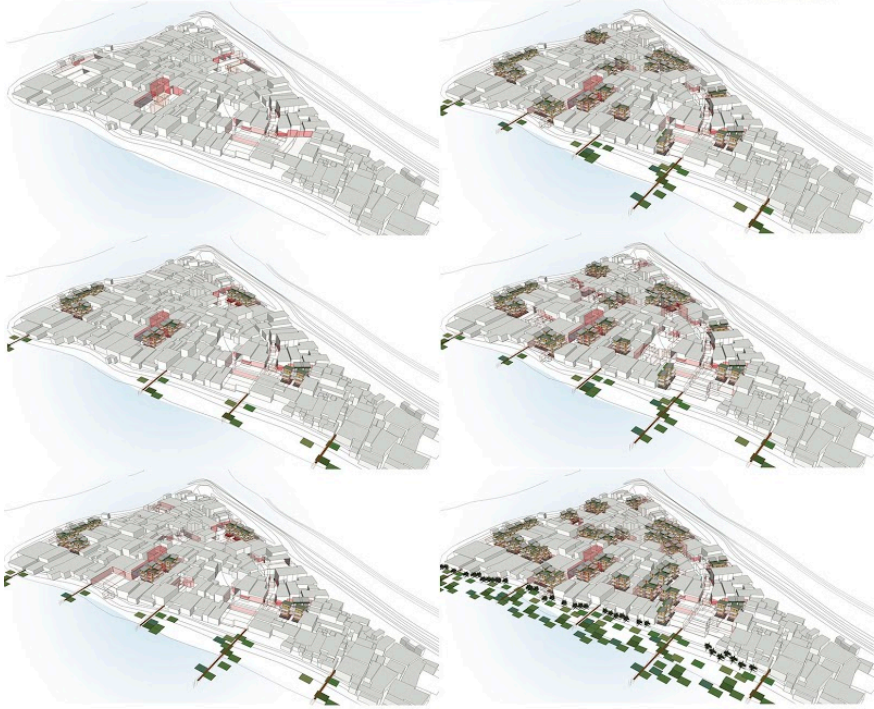
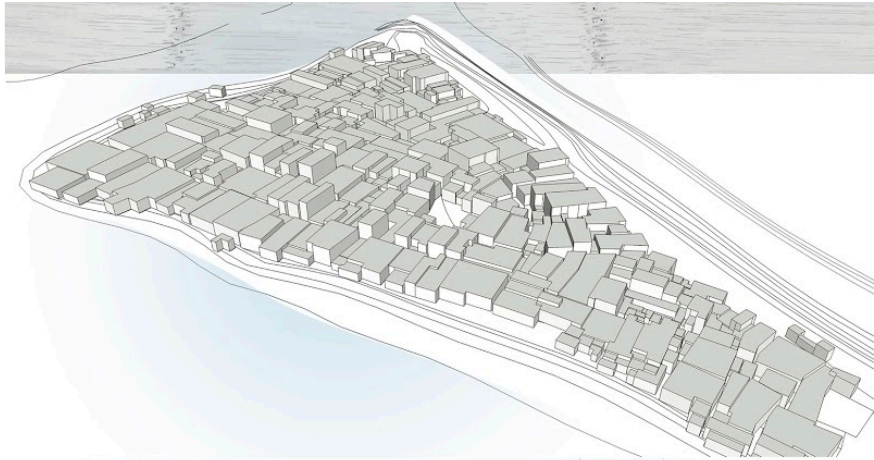
CHAPTER VII
PRESENTATION BOARDS

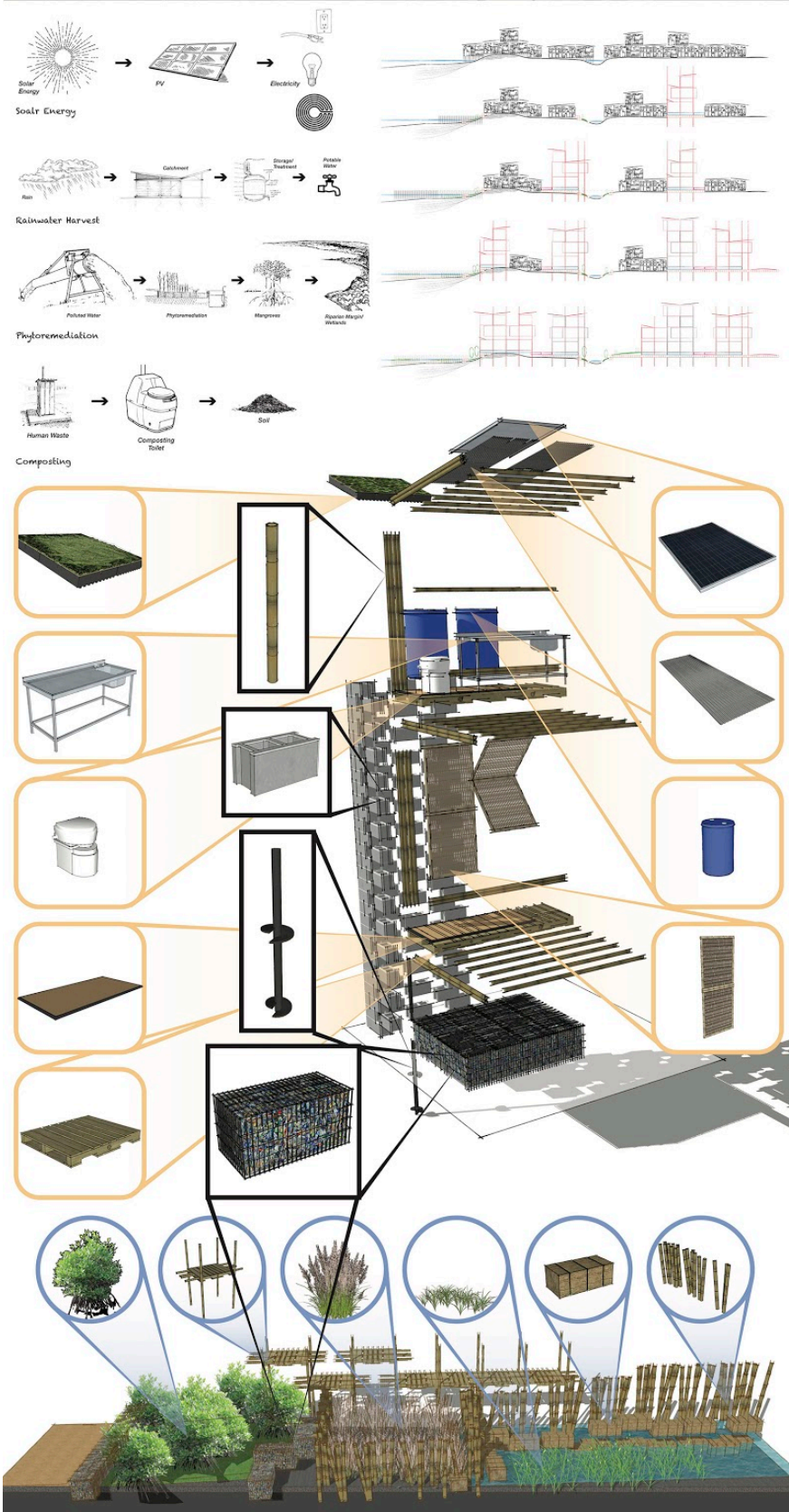
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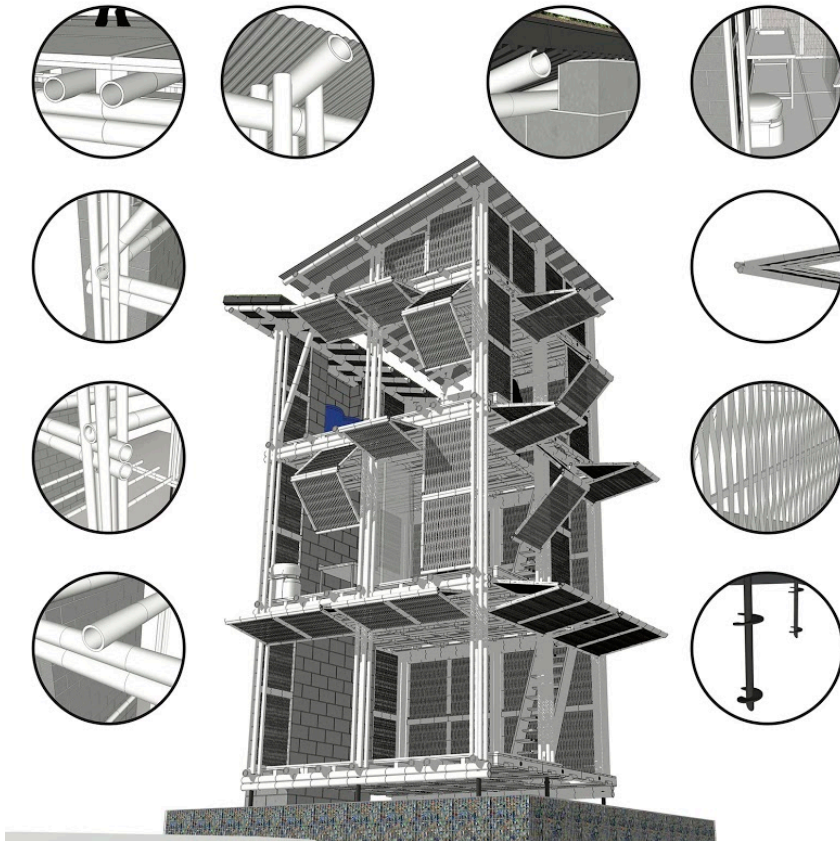
Chris Courtman













CHAPTER VIII

CONCLUSION

In this paper, I investigated theories and conditions that drive incrementalism and examined the efficacy of this concept across a selection of successful and unsuccessful case studies. I applied my learning in the form of an architectural, landscape, and urban design project aimed at improving and upgrading living conditions for the community living in Jakarta's Kampung Waduk Pluit. I devised a plan based on incremental, resident facilitated, soft infrastructural upgrades and development strategies to produce new affordable dwelling units, productive landscapes, and urban form without displacing residents. Affordable materials and simple assembly methods should foster the social aims of my project through the employment and engagement of local labor and economy, and further improve and develop a thriving neighborhood, with a unifying and empowering vision for Waduk Pluit residents.

My project approaches design with sustainable, social, and resilient aims structured around participatory, infrastructural, and incremental design approaches. My plan incorporates design approaches based on "Kit-of-Parts" and independent infrastructure, that facilitate future infill and accretion according to the demands, resources, and needs of individuals, households, and communities. Each dwelling unit provides a household with sanitation, potable water, electricity, quality architecture and flexible space. Additions are anticipated, and can be made as household resources and needs change with time. Landscape elements also emerge from a "kit-of-parts," and offer protection from flood events, treat pollution, provide raw materials, and produce natural habitats. Finally, the urban design features a phased incremental approach, so that residents are not displaced from the neighborhood, and to ensure widespread clearance does not occur.

My design relies on incrementalism across all scales as a means to empower and employ residents, foster community, upgrade living conditions, create productive landscapes, and provide

natural services. Due to the incremental nature of my project, as time passes, each service and provision contributed by my design will grow and strengthen as individuals and communities become directly engaged in shaping, constructing, and maintaining Waduk Pluit.

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