OPEN BUILDING AS AN INTERNATIONAL APPROACH FOR MULTI-FAMILY HOUSING PRODUCTION

User-Oriented Housing Practices and Opportunities for Emerging Markets through the SI Housing Perspective

January 2016

MARIANNE COSTA

Graduate School of Engineering

CHIBA UNIVERSITY

(千葉大学審査学位論文)

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Thesis Presented to
The Faculty of Urban Environment Systems of Chiba University

in Partial Fulfillment of the Requirement for
the Degree of Doctor of Philosophy

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Abstract

This thesis is a following part of a major research on customized apartments, sponsored by the Ministry of Education, Culture, Sports, Science and Technology of Japan, towards the Open Building implementation in emerging markets.

The Open Building concept is a sustainable measure for residential construction proposed by N. J. Habraken, in Netherlands, 1961, which incorporates two basic ideas. The first is about making buildings respond to people and time, by separating decision-making in a residential environment through an approach that distinguishes parts that should adapt according to the user's needs (Infill, I) and parts that should endure (Support, S). The second is about shifting the housing demand from stock production to stock renovation. This concept has been reinterpreted worldwide, remarkably in developed countries, and acquired different purposes according to each national housing demand at the time of its proposal.

In the case of Japan, land of NEXT21, claimed as the most successful application of this concept so far, S and I were disentangled into a hierarchy structure with four sublevels of decision, along with the aim of specifying the building components that compose each level, turning multistory dwellings into long-lasting user-oriented goods. The purpose of this study is to reinterpret this idea and update it to emerging countries in a way they can become able to remove housing shortage from their priority agendas, by improving their housing stock rather than just multiplying it.

In order to achieve that, we carried out a replication study focused on customized apartments in four emerging nations, along with the aim of clarifying the scope of individual decisions, their legislative systems and the development of their house building industries. Therefore, we had to obtain a sample of individuals who had their apartments customized and are disposed to concede us an interview, as well as allow us to visit, photograph and draft floor plans of their homes before and after customization. These duties involve learning a lot about the privacy of the volunteered households, and dealing with language, time and budget constraints. Under these conditions, we opted for non-probabilistic sampling and developed our fieldwork in the metropolitan areas of Jakarta, Seoul, Dalian, Sao Paulo and Santos, guided by native members of our research team. On a time span of six years, we could observe a total of 169 households, in 77 housing complexes.

This study was divided into three major assignments. The first is about clarifying the adaptability demands, in terms of specifying which elements need to be changed, and who controls the decision of changing them, in order to establish the decision making levels for Open Building implementation in each emerging market. Based on the results of the first assignment, the second is about facade individualization. The goal is to clarify the individual perception of these spaces, and the role of local building policies in establishing margins of individual and collective control of decision. Finally, our third assignment is to clarify actual market approaches for user-oriented housing provision, and analyze their differences in terms of product adaptability and affordability, and propose a universal model to deliver user-oriented housing for different market segments.

Keywords: SI housing, dwelling customization, decision-making, user-oriented housing production, emerging markets

CHAPTER 1

INTRODUCTION

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1.1 THE NEED FOR USER CHOICE IN EMERGING MARKETS

For a long time, the only choice we could give to users of emerging housing markets was the choice of having a shelter with access to the urban opportunities. Due to the housing shortage and to the inappropriateness of the existing dwellings, emerging housing policies and market goals have been more focused in multiplying the housing stock, rather than improving its quality (Douglas, 2006). Furthermore, multi-family dwellings have long been dismissed of housing studies as incapable of providing decent dwelling conditions, especially for people on low incomes (Malard, 1992).

Recently, it has been noticed that some emerging economies have recognized the production of multistory dwellings as a decent housing approach, and by offering a broader supply of this typology, could even overcome the housing shortage issue. However, the newly built housing stock has been showing the same massive and generalized aspect that has been criticized for creating impersonal and improper homes, in the period post World War II. As a result of this inadequate amount of choice, user's decisions have to find their ways through legislative ambiguities and informality.

Since the 1970s, the developed world have confirmed that mass-housing production is incapable to suit the needs of individuals, and has shown that there are more effective ways to address housing shortage issues. For instance, it would be much sustainable if we built buildings that can respond to people and time, using concepts such as flexibility, changing lifestyles, upgradability, etc. Another great idea could be to keep housing shortage indexes low by maintaining or upgrading the existing stock, instead of simply redeveloping it.

The Open Building approach incorporates all these ideas, and its application in emerging economies could harness benefits from their noticeable industrial progress and new societal values, by incorporating socio-environmentally sustainable principles in housing production, and ensuring longer life span for residential buildings (**Error! Reference source not found.**).

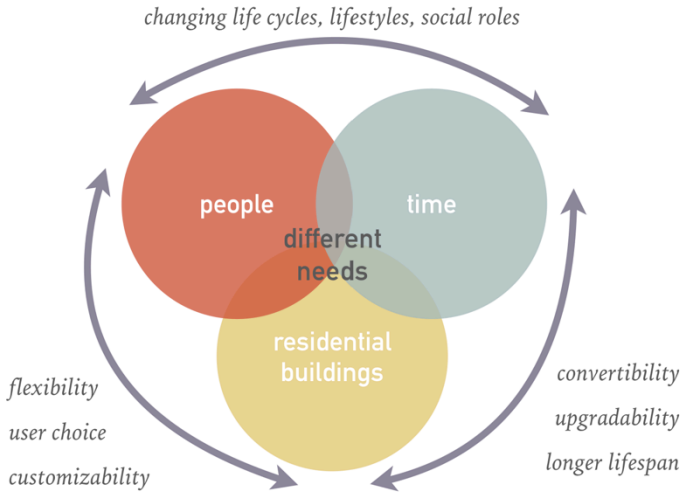


Figure 1.1 The Open Building Concept

1.2 REVISITING THE OPEN BUILDING APPROACH

Residential Open Building is a multidisciplinary approach, with technical, organizational and financial solutions for a built environment that can adapt to changing needs. It supports user participation, industrialization, and restructuring of the building process. Its goals include creating varied, fine-grained and sustainable environment, and increasing individual choice and responsibility within it. Moreover, it is a strategy that aims for a long-lasting housing stock by acknowledging and enabling building transformations according to needs of different participants in design, building and post-occupation processes such as: design and construction teams, real estate agencies, property owners, tenants, product manufacturers (Kendall & Teicher, 2002; Cuperus, 2001; Nicolic, 2011).

In order to accommodate these building transformations, N. J. Habraken (1972) suggested the introduction of "*levels of control*" and "*controlled hierarchies*" of building parts in building design. The concept was based on the division of buildings in two major groups of parts: the base building (Support, S) and fit-out (Infill, I), which were treated as separate entities, with different life cycles, in order to build an environment that can both respond to needs of individuals and groups of users.

This concept could also be expressed in terms of care, responsibility and technology. People, who care about the environment they live in, will make it a better place. Open Building stands for a built environment that encourages people to take responsibility for their own territory. Therefore, the division of buildings should reflect the lines of decision-making and the definition of responsibilities between parties, and then, be turned into guidelines in order to create buildings that can be modified by their users (Cuperus, 2001).

1.2.1 Supports and Skeletons

The Open Building theory had its origins in Europe and Japan as a reaction to the outcomes of post-war mass housing production. That approach was worldwide renown for centralizing decision-making as a means for delivering large amounts of units fast. Moreover, mass housing introduced manufacturing practices into residential construction. But, none of these processes offered a place for the user as a decision-maker. While previous building typologies preserved people's lifestyles, traditions and preferences about territory, self-expression, entry sequences, and relationship to neighbors, mass housing, on behalf of better sanitary conditions and rationalized production, trailed the urge of supposedly reinventing housing types, at the pace of industrial progress.

Developments toward Open Building follow many distinct and interweaving streams. Although many concepts pursue the combination of 'technical' and 'social/organizational' purposes, this dichotomy describes the tendencies of many OB initiatives worldwide. In western countries, 'Supports' principles had their origin on the 1960s political rhetoric of user participation and an effective distribution of control and responsibility. After the advent of 'Open Building' and of new industrially produced consumer components for the residential market in the late '70s, it started a campaign

in favor of consumer choice. Later, another generation of architects introduced to the debate the need of recognizing the OB potential of reducing waste.
In contrast, in Japan, problems around the post-war implementation of mass housing were aggravated by further issues: medium-rise multi-family housing was unprecedented; the first production of this typology was quite rigid and of poor quality, and rapidly grew obsolete. As a result, increasing the life span of their housing stock was more urgent than making home environments more personal. Therefore, the theory has developed a different emphasis and gained also a different name. In Japan, 'Supports' are called 'Skeleton', which, similarly, is closer to collective decisions, but mostly, seeks endurance as a direct response to the unique social structure, cultural history, climatic and seismic conditions and other features of Japan.

In most of its Japanese applications, Open Building has been a result of research in collaboration with various government agencies and industry associations. Such developments are best exemplified by the CHS approach. In Next21, for example, innovations include: a sophisticated modular coordination system developed for use by all members of the design team; construction of an innovative skeleton an public infrastructure; installation of new recycling and energy management systems; and development of a new facade kit-of-parts to make subsequent one-at-a-time renovation units easier and less disruptive than in most multi-story buildings.

Furthermore, Open Building in Japan is closely associated with reform of land ownership and tenancy law. The absolute boundaries drawn between 'public' and 'private', and between 'owned' and 'rented', used to be insufficient and inaccurate when applied to urban housing in Japan. Aiming for a definition that correlated with the complex characteristics of housing products and processes, a study guided by Kazuo Tatsumi and Mitsuo Takada led to the elaboration of the Two Step Housing Supply System, built on Japan's vernacular tradition of skeleton/infill construction. As a first step, a public skeleton is designed as social overhead capital, common property of good quality and long durability. In the second step, the infill is installed, ideally supplied by small local construction companies. The main driver of this stream is rather than rationalizing production, focused on effectively organizing the social sphere of housing.

Although 'Supports' and 'Skeleton' are used to refer to similar concepts, the appropriateness regarding the use of one or another as terminologies is quite controversial. As defended by Habraken (1972), Kendall and Teicher (2002) and other western 'Supports' theorists "*A Support is not merely a skeleton. It is not neutral, but is rather enabling architecture. It is more like a serviced, environmentally protected site within a built landscape: a Support is a physical setting that offers space and possibility to make dwellings with as few constraints as possible, while requiring as little work as possible.*" This statement comes often complemented with the famous sketch of the Domino Skeleton of Le Corbusier struck through with a cross, as if it was denying its own source of inspiration (Leupen, 2006).

In spite of the clear picture they paint, western theorists fail in clearly describing these Supports. Rather, the Japanese theorists are more pragmatic as they establish the Skeleton after naming the building parts that compose each decision making level and setting guidelines to operate each level. Hence, a serviced plot of ground with regulated use, building placement and size restrictions might be a very limited sort of Support, as stated by Kendall and Teicher (2002), but like a biological Skeleton, it configures the constitution of a body, based on its genetic information. In fact, considering its potential

of reducing ambiguities, Skeleton might contain the precise amount of pragmatism required for the dissemination of the Open Building theory in emerging economies.

1.2.2 Decision-Making Levels

Although there are several definitions for decision-making levels in Open Building, the present research adopts the definition conceived by Kobayashi and Fujimoto (2003), which disentangles Skeleton and Infill into a hierarchy structure with four sublevels of decision (Figure 1.2). This segmentation, along with the aim of clarifying the idea of Skeleton and Infill, were based on the following conditions in Japan:

- **Base Level:** it was proposed to address the need to enhance the life span of buildings in Japan. Aiming for building parts that should last for about a hundred years, the base level was projected to be a permanently unchangeable part.

- **Common Level:** it was proposed to address the need of a long-term maintenance plan for apartment buildings. Therefore, with the purpose to enforce the maintenance of the common parts of apartment buildings, the common level was established to define which parts should suffer regular maintenance in the totality of common areas.

- **Boundary Level:** it was proposed to address conflicts of interest regarding decision-making and investment burden for maintenance of apartment buildings. For instance, the walls facing balconies in Japan are generally considered as common parts. Therefore, in case it needs alteration, the group of dwellers are supposed to decide a pattern together, and each homeowner should bear the investment linked to the portion occupied by the dwelling unit of their own as the repair becomes necessary.

- **Interior Level:** it was proposed to clarify the range of individual decisions. In Japanese apartment buildings, each homeowner is responsible by the decision-making regarding the improvement or remodeling of his/her dwelling unit within the inner limits of its exterior walls.

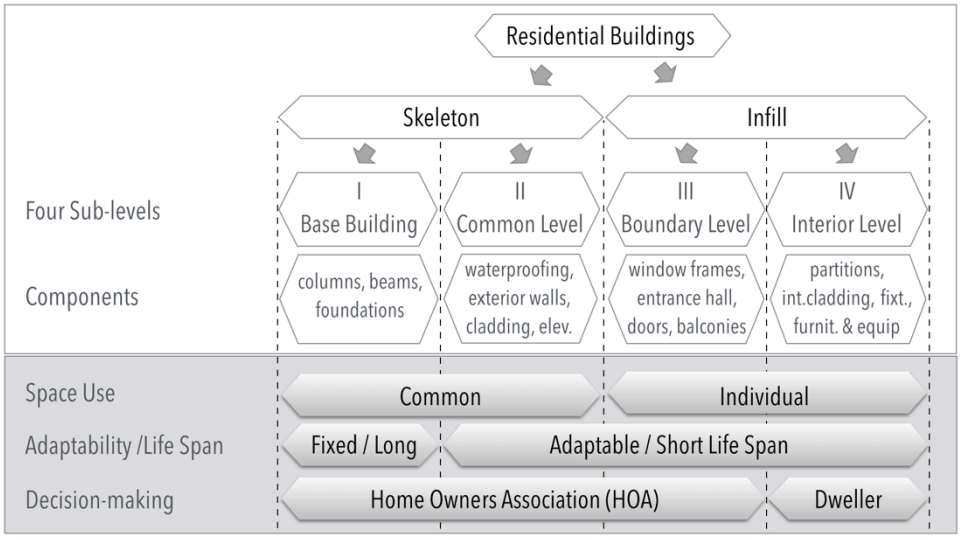


Figure 1.2 Decision-Making Levels
(Kobayashi and Fujimoto, 2003)

1.3 TOWARDS AN INTERNATIONAL HOUSING APPROACH

1.3.1 Target Markets Selection and Study Expectations

The procedure applied for selecting the subjects in this research is based on purposeful sampling, which lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research, thus the term purposeful sampling (Patton, 1990).

Although there are several different strategies for purposefully selecting information-rich cases, we used a multi-stage sampling strategy combining criterion sampling, typical case sampling, stratified purposeful sampling, and snowball sampling strategies to serve our research goals. Figure 1.3 summarizes the entire process, which will be explained below.

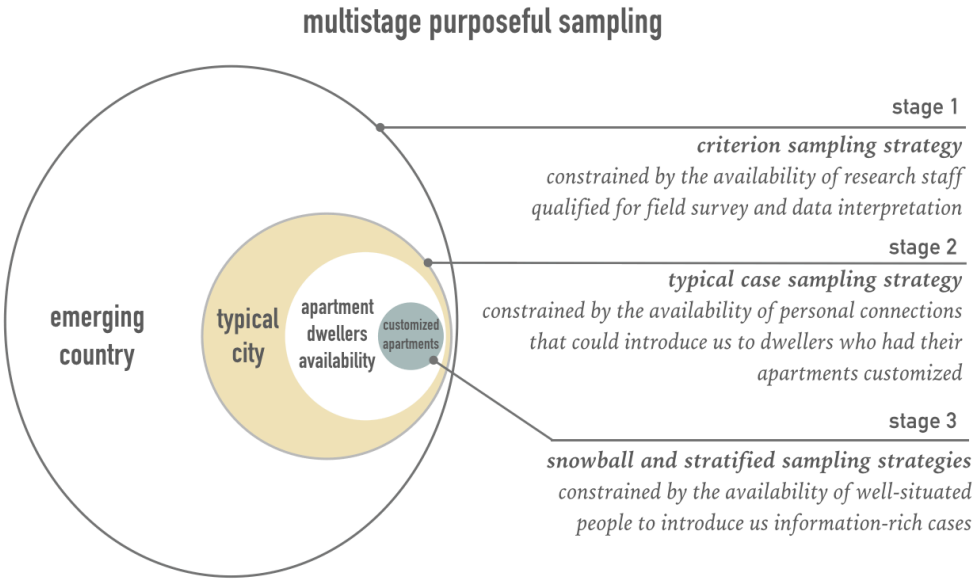


Figure 1.3 Schematic Diagram of Sampling Strategies

In the first stage, in order to clarify user-oriented housing practices and opportunities for emerging markets, we chose an observational approach that required volunteers who reside in customized multi-family dwelling units and who would also let our research team invade their privacy to hear about the customization process and register that information through photos, sketches and so on. Moreover, another important constrain is that at least one member of our fieldwork team should have a minimum of cultural knowledge about that local to carry out the inquiry process smoothly and have language skills to read and organize the information later. Therefore, this could only be done in countries where we had personal connections during the term of our research, which included Brazil, China, Indonesia and South Korea.

In the second stage, aiming to develop comparable national profiles that describe distinct local practices, we applied typical sampling strategies. From official statistic data, we could select cities and sometimes neighborhoods where there is a large availability of multi-family housing with "average" user behaviors. But most importantly, with the cooperation of native members in our research team, familiar

with the housing habits of each of those countries, it was also important to provide a qualitative profile of "typical" dwelling customization samples. The major constrain at this stage was to have direct or indirect personal connections in those cities, to introduce us to the multi-family dwellers we had to select in the final stage. As a result, our selected cities encompassed Dalian, Jakarta, Santos, Sao Paulo, and Seoul.

The third and final stage was to identify people who had their dwellings customized within those five cities. Because this information is not available from an official source, we used the snowball sampling strategy to ask well-situated people about information-rich cases. By asking a number of people who else had their dwelling customized, the snowball got bigger as we accumulated new information-rich cases. But in Jakarta and Seoul, where we had key informants related with the academic field, we could combine stratified purposeful strategies to capture samples from specific income groups and building periods, respectively.

Supported by a Grant-in-Aid for Scientific Research of the MEXT, Japan, fieldwork activities were replicated in a time span of six years, one city at a time, guided by a member of our research team. In total, we have observed 169 households in 77 housing developments (Figure 1.4).

Figure 1.4 Surveyed Locations

As a result of this study, we expect two kinds of findings: (1) high-quality, detailed descriptions of each national case, which are useful for documenting uniqueness, and (2) important shared patterns that transcend cultural barriers and derive their meaning from coming out of heterogeneity. Like the infill and skeleton principles, respectively, these findings can help us to design an open building model for emerging markets. Please notice that our purpose is not to set the "best" housing model for each country. Instead, we aim to provide a road map for user-oriented housing production that can be tailored and sequenced to each country's condition.

1.3.2 Putting Those Markets into Perspective

First of all, it is worth to mention that there is no exact list of emerging markets to create a panorama. The most reliable sources tend to be investment information sources or market index makers, but depending on nature of investment, they might go into conflict for two reasons. One is an element of historicity; markets may be maintained in an index for continuity, even if the countries have since developed past the emerging market phase, such as South Korea and Taiwan. The second is the simplification intrinsic of building an index; small countries, or small markets are often disregarded, in the shade of their larger neighbors. In order to place our samples within the emerging markets spectrum, we chose the countries designated as BRICS (Brazil, Russia, India, China and South Africa) and Next 11 (Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, the Philippines, Turkey, South Korea and Vietnam).

According to World Bank (2009), housing finance plays a major role operating the housing market and the economy in a number of ways, both directly by facilitating transactions and indirectly by improving the environments in which transactions take place. In many emerging economies, housing remains mostly self-financed by households' equity. This limits access to home ownership and leads to expanding incremental construction and informal housing. Frequently, the only alternative is finance provided by developers through deferred installment sales. In the last decades, the following trends have been significant drivers for the expansion of housing markets in emerging economies.

1.3.2.1 Favorable macroeconomic conditions

Broader access to housing finance has a meaningful impact on construction, economic growth, and urban development (Renaud, as cited in World Bank, 2009). In countries with underdeveloped housing finance systems, households incrementally self-build their house over long periods of time, or settle for a low-quality structure that does not comply with the local building policy, which contributes to the proliferation of slums. This hinders formal construction, creating a vicious cycle that leads to further shortages. Another critical element in the housing chain consists of providing finance to real estate developers. Without adequate finance in plate, it falls to the households to provide larger amounts of unsecured deposits during construction phase. As a result, a household's ability to leverage becomes reduced and exposed to risks associated with frauds or construction problems.

Several emerging economies have experienced GDP growth, which is partly converted into rising incomes of households. These conditions have favored the expansion of mortgage markets, although at a different pace and with different outcomes and impacts across countries. Nowadays, housing finance has reached significant levels in South Africa and South Korea with residential mortgage debts amounting to 22-33 percent of GDP. Over the past twelve years, housing finance has also made some progress in several upper-middle income countries (including China, Iran, Mexico and Brazil) where mortgage markets stand at 7-17 percent of GDP. Progress is also observed in a few lower-middle income economies, including Bangladesh, India, Indonesia and Nigeria, but not on a large-enough scale to address some of the chronic housing issues they face (Figure 1.5).

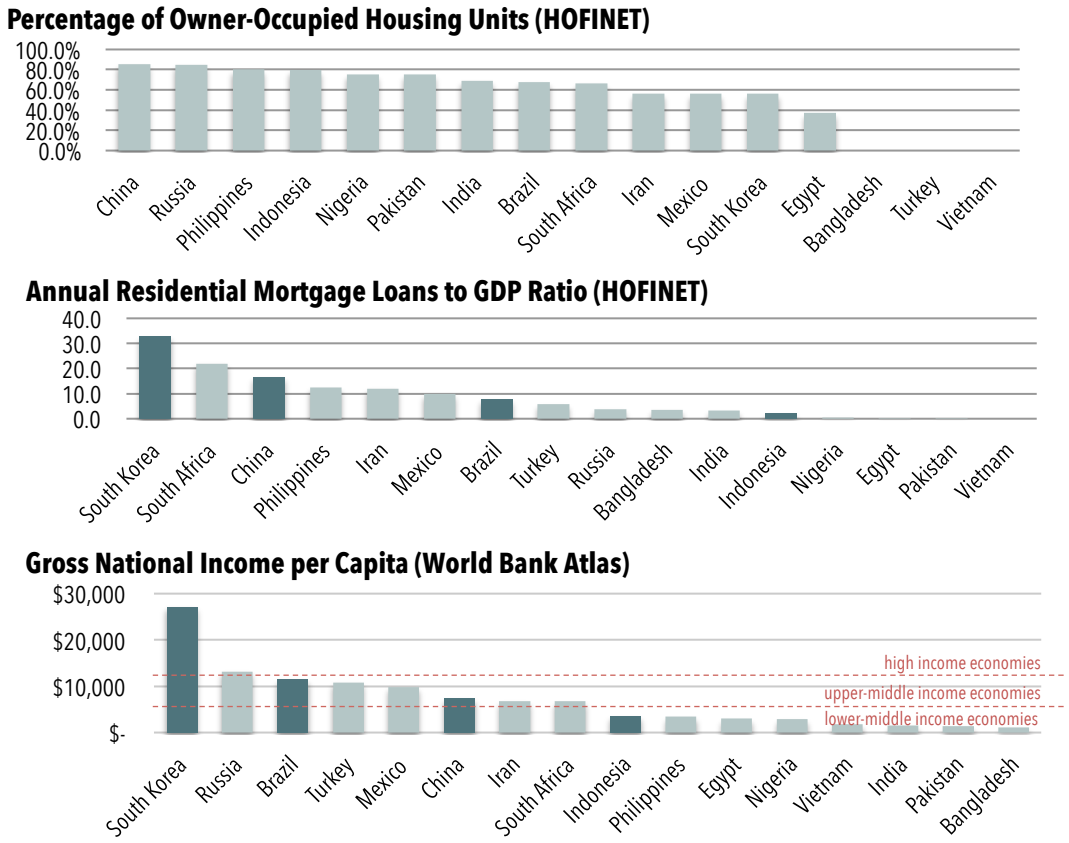


Figure 1.5 Housing Market Conditions of BRICS and N-11 Countries

1.3.1.2 Housing demand linked to urbanization and demographic pressures

In 1950, there were only two cities, New York and Tokyo, with a population exceeding 10 million. In 2014, the World Urbanization Prospects Report developed by the United Nations has registered 28 of those cities, 21 of which are in emerging countries (Figure 1.6). China alone houses 88 million people in six of those cities.

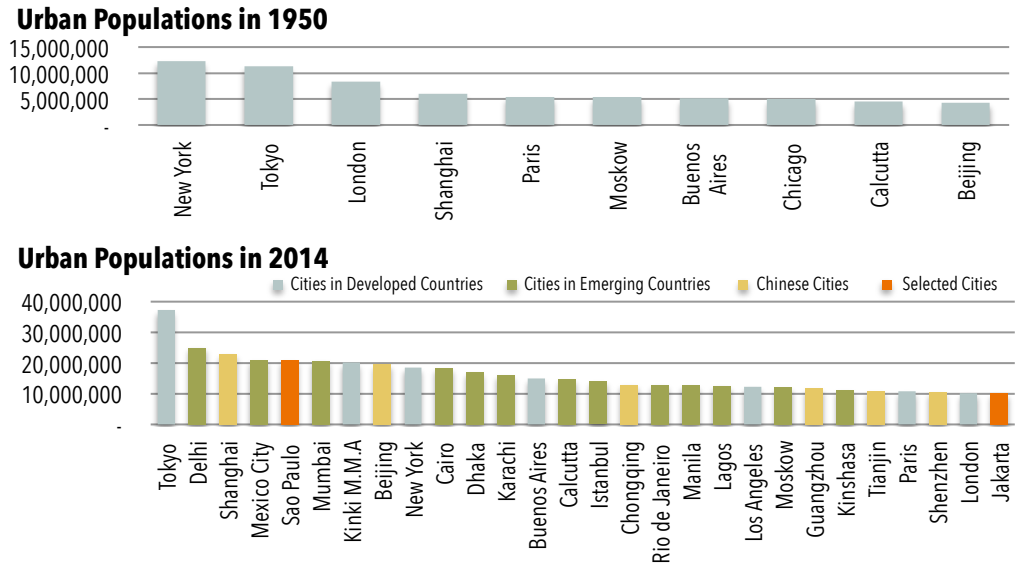


Figure 1.6 Urban Populations Exceeding 10 Million People (United Nations)

This inevitable demographic trend implies on an increasing urbanization pressure and a housing demand fueled by strong aspirations for better housing conditions. In addition, housing increasingly forms part of a household's savings strategy for investment and as security for old age. In many cases, real estate is one of the asset-classes available when financial investment instruments and government debt markets are underdeveloped.

1.3.1.3 Financial liberalization

With the ending of closed public housing finance circuits (earmarked housing funds, state-owned housing banks, and so forth), financial liberalization can be an important stimulant for housing finance. The housing sector is too large for any government to finance it alone. Liberalization is a universal trend that mobilizes savings from the public through banks and, in later stages of development, through capital markets, as long as housing loans can offer an attractive risk-adjusted rate of return for investors. Housing finance has become an area of increasing importance for many institutions (linked to retail finance and construction finance), including liquid banks and finance and specialist mortgage companies. Their access to private bond markets is a key ingredient, inextricably linked to other reforms (public debt management, development of capital markets, pension funds, and insurance). The growth of the financial sector has led to lower operational costs, improved information technology, and better risk- management tools.

The role of the state has evolved from direct lending and housing construction to regulation, policy development, building market infrastructure, and more efficient assistance for low-income groups.

1.4 OPPORTUNITIES FOR SI HOUSING IMPLEMENTATION

SI Housing implementation possibilities might differ depending on each country's access to housing finance, tenure models and state role in housing provision. For instance, in Japan, the popularity of ownership and rental skeletons publicly and privately supplied was driven by the need of renovation of the dwelling units' interior.

But, focusing on emerging markets, it has been observed some cases in which, with the purpose of reducing the price of rental or ownership apartments, the provision of interior components is reduced to a minimum. This incremental strategy allows the establishment of interior components before or after move-in stage, by the time the family has accumulated enough savings. Similarly, some emerging countries employ the incremental construction approach for slum redevelopment through the provision of core houses. These ideas could be assumed as reinterpretations of the same concept for different demographic demands.

Based on previous conclusions involving this research, Figure 1.7 shows the trends for SI Housing implementation to suit different market profiles, as anticipated by Kobayashi, et.al (2014).

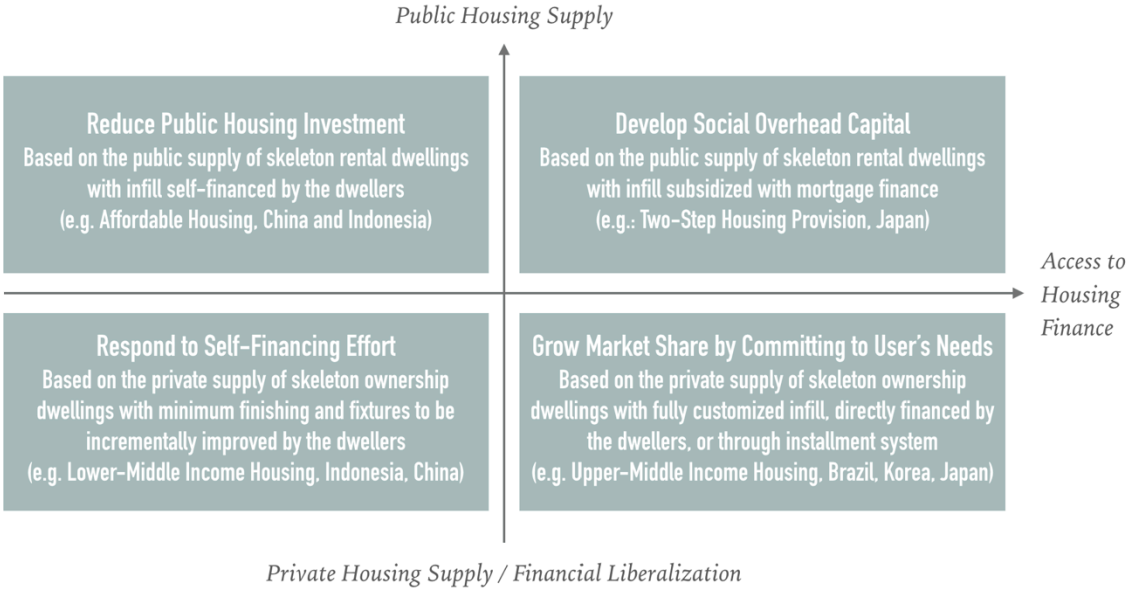


Figure 1.7 Universal Model for SI Housing Implementation
(Kobayashi et.al, 2014)

Furthermore, considering each country's housing demands, legislative systems and development stage of housing related industries, we propose to develop detailed descriptions of each national case, and discussions on three major housing behavior patterns that transcend cultural barriers as explained in the following sections.

1.4.1 SI Housing Levels and Control in Emerging Societies

As mentioned in previous pages, in Japan, the SI System has been disentangled into a hierarchy structure with four sublevels of decision (Figure 1.2). Along with the aim of specifying the building components belonging to each level, it was based on the national housing demands at the time of its development.

In turn, in the emerging world, the massive and generalized aspect of the newly built housing stock offers an inadequate amount of choice for the user to create his/her own personal space. Moreover, the local building policies can be quite vague in terms of establishing the scope of improvement decisions that might be dealt individually or collectively in multi-family building environments. As a result, individual decisions always find their ways through legislative omission, or informality. Hence, the demands of control in emerging societies might be more complex than the hierarchy of the Japanese SI System can acknowledge.

According to Professor Bar-Yam (1997, pp.13-15), an American physicist, specialist in complex systems, *"when the complexity of a system demands exceeds the complexity of an organization, the organization will be likely to fail."* Therefore, one of our goals is to investigate whether the hierarchic structure can control user decisions in our target group, and if not, propose a way to make the system and the organization suitable to each other.

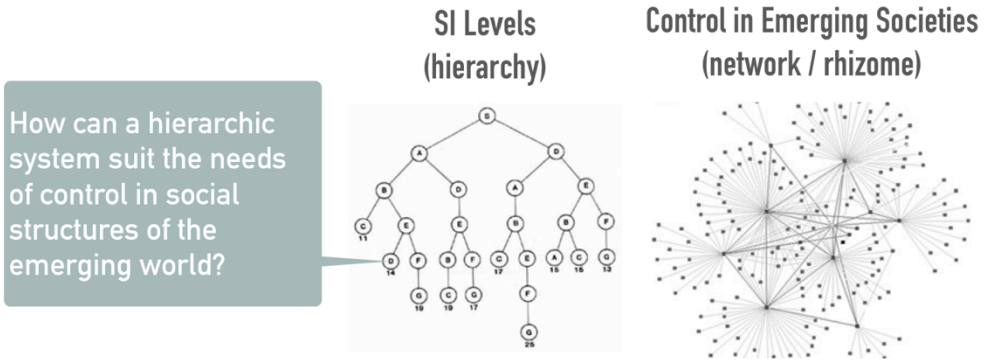


Figure 1.8 Hypothesis on SI Levels and Control in Emerging Societies

1.4.2 Facades as Margins of Territorial Power

Building facades are margins of two territories controlled by different "powers". One of them is closer to public, and the other is closer to private in the hierarchy. (Jia, 2011) But, what should we do when these two powers go into conflict? Previous studies show controversial opinions about solving conflicts between public and private interests regarding facade individualisation issues.

For Richard (2011), "*the facade is more than a building envelope, just like clothing is more than a comfortable interface between the body and the environment. Just like clothing, the facade should be responsive to the individuality and the personality of the occupant through space and time, whatever the level of appropriation available.*" But Jia (2011) believes, "*There is no need for individuals to invade the collective territory. These issues can be discussed publicly, but cannot be decided on an individual level.*"

Although there are countries with severe building regulations, there are countries that inadvertently acknowledge individual dwelling expansion in apartment buildings. In Japan, balconies are used as emergency escape routes; therefore, they are classified as common property and their individual appropriation is forbidden. But, fire and safety policies might be different in each country.

In fact, in the emerging world, even though the civil laws often say that individual opinions should stay inside the dwelling unit, they come out in the facade anyway. And if we don't give them criteria, dweller's interactions tend to trespass public interests and compromise the performance of the facade. Thus, another goal of this study is to establish guidelines for controlling facade individualization, rather than denying it.

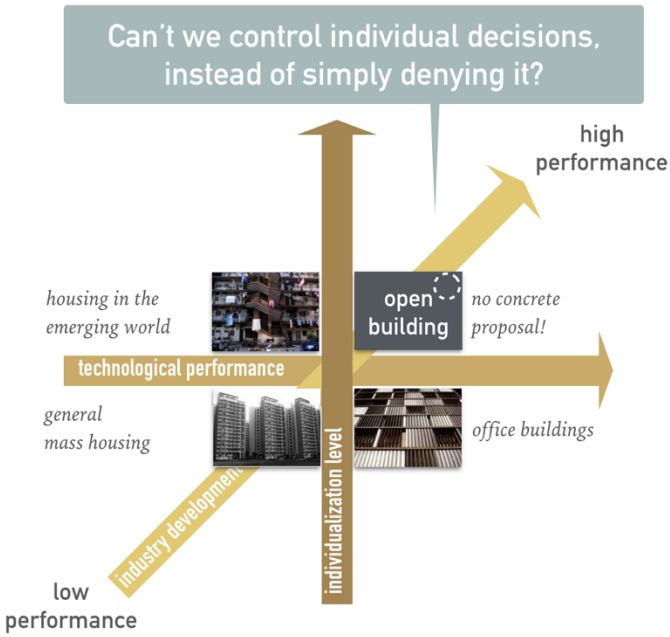


Figure 1.9 Hypothesis on Open Building Enabling Facade Individualization

1.4.3 Delivering User Choice through Infill Mass Customization

Based on the long tail theory, proposed by Anderson in 2006, a group of researchers developed a proposal for mass customization in construction. The long tail theory suggests an overview of the market by juxtaposing the volume of products with the number of variants. That means, as we get closer to the head, we have a larger volume of identical products, with reduced optional output to the consumers. And, as we get closer to the tail, we have a larger volume of unique products, increasing choice possibilities to the consumers.

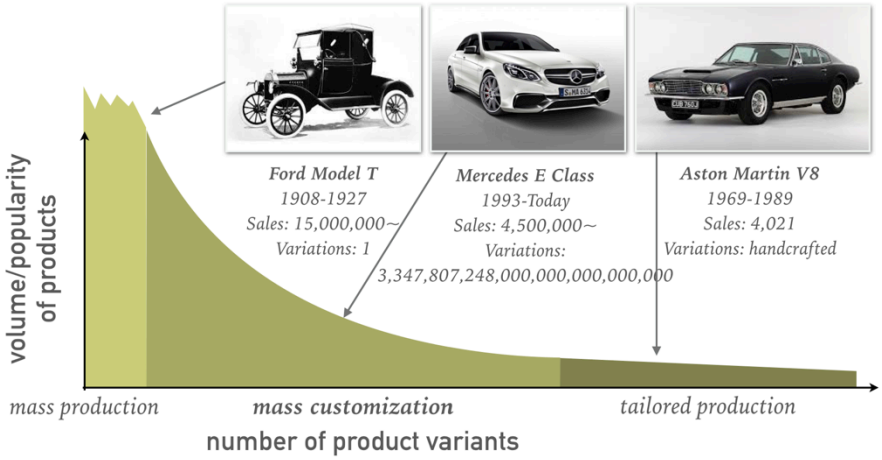


Figure 1.10 The Long Tail Theory
(Anderson, as cited by Thuesen et.al, 2013)

Reinterpreting the examples shown in Figure 1.9 to infill delivery methods, Ford T would be fully finished dwellings, delivered with infill components fully chosen by the developer during planning stage, Mercedes E would be dwellings delivered with infill components fully or partially chosen by the dweller during planning stage, and Aston Martin V8 would be dwellings delivered with infill components fully chosen by the dweller during planning stage (tailored dwellings) or post-occupation (tailored customization). Our work in science is to develop the middle part, which refers to mass customization processes. The more we develop new technologies the more individualized becomes our production and distribution, and we get closer to the tail.

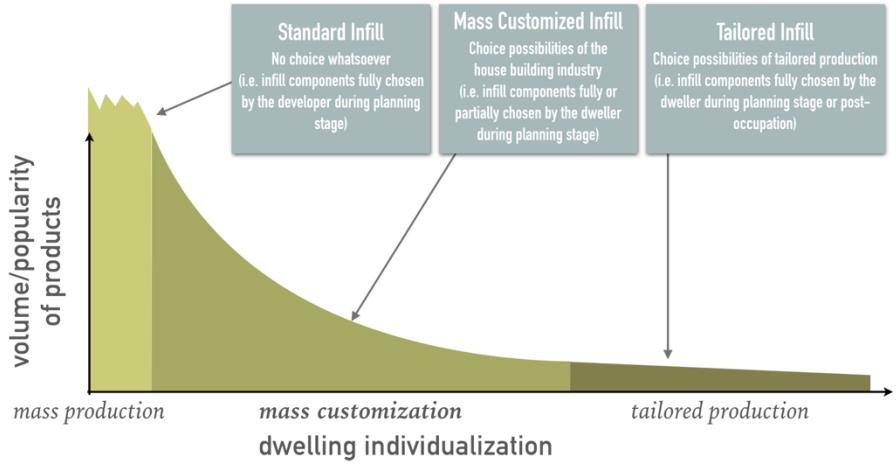


Figure 1.11 The Long Tail Theory Reinterpreted to Infill Delivery Systems

According to Pine (1993), mass customization is the mass production of customized goods and services. And one of the biggest concerns on mass customization is how to keep control of the costs compared to ordinary practices (Figure 1.12).

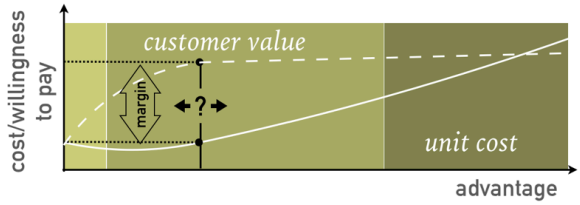


Figure 1.12 The Mass Customization Approach
(Tseng and Jiao, as cited by Thuesen, 2013)

A group of researchers lead by Christian Thuesen combined these theories and translated them for construction, in order to find how to deliver mass customized buildings. The result of their study is this generic model that combines the long tail with order-decoupling points such as match-to-order (MTO), configure-to-order (CTO), integrate-to-order (ITO) and engineer-to-order (ETO). The more you move to the right, the more you customize processes and products gain flexibility towards the market (Figure 1.13).

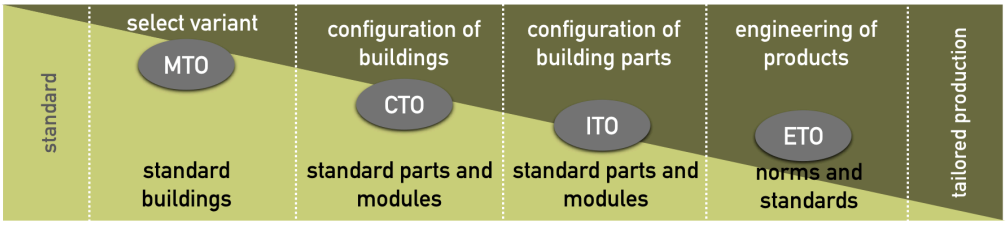


Figure 1.13 The Long Tail Combined With Order Decoupling Points
(Thuesen, et.al, 2013)

The point we want to discuss is: which of these models is more suitable to deliver infill choice in emerging markets? How can they suit actual decision-making structures, and house building technologies available in each location? Our last goal is to propose an infill delivery approach that can serve communities of different social and technological backgrounds. Figure 1.14 illustrates our hypothesis on a progressive model for delivering infill choice, according to the theory developed by Thuesen et.al.

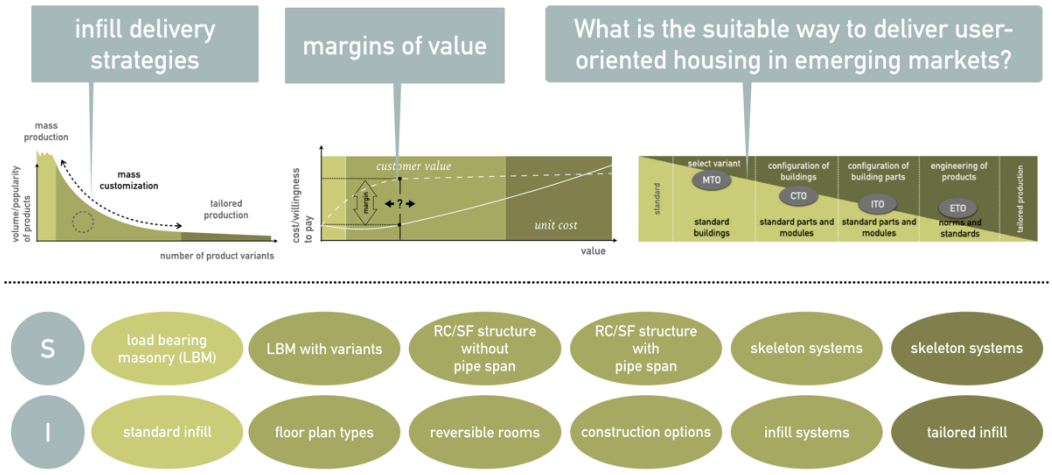


Figure 1.14 Hypothesis on Infill Choice Delivery through Mass Customization

1.5 METHODOLOGY

For the development of this research it has been made necessary to acquire deeper knowledge about the interaction demands between people and residential buildings, and the effects of these interactions, through self-managed dwelling customization. In order to build this knowledge, we carried out literature review on user-oriented approaches of housing production, which later, after our onsite investigations, had enabled us to confirm the application of the SI Housing theory for different living needs, and different groups of people in the emerging world. The research methods included in this dissertation are described below.

- **Literature Review:** acquiring knowledge about the interaction demands between people and dwellings and the impacts of individual and collective decision-making in the multi-family residential environment. It was studied topics such as, user responsive building systems, user-oriented housing production, house building legislation, remodeling regulations in condominiums, and other control mechanisms of human interactions with multi-family buildings.

- **Background Case Studies:** verifying the SI Housing levels presumed in theory, in the real condition, in background case studies. As mentioned before, other three members of our research team have carried the case studies of Jakarta, Seoul and Dalian; therefore, they also constitute literature review. The fieldwork activities included interviews, photos, videos, and sketches of dwellings before and after customization. The interviews were based on a questionnaire, which followed a basic structure that was replicated with a few adjustments to grasp specificities in these locations.

- **Original Case Studies:** verifying the SI Housing levels presumed in theory, in the real condition, in original case studies. In the case studies of Sao Paulo and Santos, with an average of 2 to 3 dwelling visits a day, our interviews were based on a questionnaire with inquiries related to the family profile, condominium profile, peculiarities of the customization works, remodeling troubles and complications, domestic repair and maintenance behavior, family lifestyle, and satisfaction with the current home space. Photographing and measuring activities were simultaneous to the interviews, with a total of three team members working on each sample.

- **Additional Interviews:** clarifying the roles of the agents involved in dwelling customization. We held questionnaire-based interviews in Sao Paulo and Santos with developers who offer custom built apartments, interior design companies, and condominium management companies in order to gather information about the status quo of the house building industry in Brazil, and identify potential barriers for user-oriented housing production, in terms of technology, management and legislation.

- **Data Mining:** finding common information about relationships that have not yet been discovered. We have translated, reorganized and built a database with the information gathered in Jakarta, Seoul, Dalian, Santos and Sao Paulo in order to analyze aspects that could only be recognized when this data was put together, and redefine the SI Housing theory into a multinational approach.

1.6 CHAPTERS ORGANIZATION

The present study is organized into three parts: Theoretical Background (Chapters 1 and 2); Case Studies (Chapter 3); and Analysis and Discussion (Chapters 4 to 7). The content of each chapter is described below.

- Chapter 1, Introduction
This chapter contains the introduction to the study presented in this thesis, i.e. problem statement, background and relevance, scope and limitations, research questions, methodology, and chapters organization.

- Chapter 2, Lessons From Japan
This chapter presents the storyline of Open Building implementation in Japan, from its genesis to its dissemination and consolidation until the establishment of the current condominium legislation in Japan.

- Chapter 3, Apartment Customization Practices
This chapter consists on the report of the results of our fieldwork investigation in 169 remodeled apartments in the five selected cities.

- Chapter 4, SI Levels and Control in Emerging Societies
In this chapter we will put the background case studies information into perspective, by identifying which layers of the population do our users represent in the local and global context and clarifying the housing options are currently being offered to them. Then, we will analyze the adaptability demands in each case study, in terms of which architectural elements need to be changed, and who controls the decision of changing it. The purpose of this chapter is to clarify the decision-making levels for Open Building implementation in emerging societies.

- Chapter 5, Facades as Margins of Territorial Power
Based on the outcomes of the previous chapter, we propose an analysis of a very specific and controversial zone: the building facade. First, we clarify the building policies related to facade adaptation on each country, then, we compare them to the actual adaptation behavior. The goal of this chapter is to establish ways of controlling individual decisions that might trespass the margins of public interest or harm the facade performance.

- Chapter 6, Delivering User-Choice through Infill Mass Customization
This chapter is focused on clarifying the infill delivery approaches employed in each country. First we clarify when user choice must be delivered and the infill mass customization approaches that are being employed in each country. Then we analyze the complexity of each infill production process considering the amount of user choice and professional involvement. The purpose of this chapter is to organize these infill delivery approaches according to their complexity into a progressive model that can serve communities of different social and technological backgrounds.

- Chapter 7, Conclusions
This chapter reviews the results from the analyses presented in chapters 3, 4 and 5, presenting a discussion about the outcomes of this research and recommendations for future studies and proposals on Open Building implementation in emerging markets.

CHAPTER 2

LESSONS FROM JAPAN

CHAPTER 2

LESSONS FROM JAPAN

2.1 KEY INFLUENCES ON HOUSE BUILDING IN JAPAN

2.1.1 Tatami: a Tradition of Standardization and Systematization

Since prefabrication has been deeply connected to Japanese architectural culture and tradition, Japanese timber construction can be considered as an early example of high-level prefabrication in the building history. Additionally, Japanese tradition is closely related to a strong favor for order, standardization and systematization. An important activator for early prefabrication can be found in the famous Ken, a 1:2 relation proportion and measurement system (Linner and Bock, 2013).

Furthermore, tatami mats, the traditional Japanese floor finishing, principally follow strict grids and order systems (Osamu, as cited by Linner and Bock, 2013). Having usually an edge length of 85/170 cm Tatami mats can be combined in a lot of variations in order to shape the room's dimension, which will end up always in an exact number of mats, a necessity since the mats had continuously been changed between the rooms, according to their current usage. Two layouts became common. The ceremonial layout with two mats in its center, surrounded by a number of additional mats, and the ordinary layout, with several mats parallel in a strict orientation.

Today it is still usual that a room size is expressed with the number of tatami mats instead of meter squared. Contemporary Japanese architects are at the same time familiar with these rules and measurement systems, and standardization often results in a particular multilevel grid, which can be found not only in the building's footprint but also as the underlying rhythm in its elevations, as well as its decorative and built-in parts, such as praying corners, wardrobes or shoji screens (Japanese sliding doors), allowing an easy combination or reconfiguration of rooms. Even some urban master plans follow these incremental measures since each building unit is related to a multiplication of tatami mates. This very Japanese favor for standardization and measurement systems generated a supportive environment for prefabrication centuries ago, and up to today, engineers and architects have managed to keep this culture alive and advanced its state of art (Linner and Bock, 2013).

Figure 2.1 Ceremonial and Ordinary Tatami Layouts

2.1.2 Scrap and Build

Japan currently builds over 1 million new housing units a year, and that represents 61% of total annual domestic property purchases. About half of all newly built housing units are apartment units, and 60% are owner-occupied (Figure 2.2). In addition, newly built dwellings are commonly purchased with the aim of replacing existing homes once it has outlived its usefulness (Barlow and Ozaki, 2005).

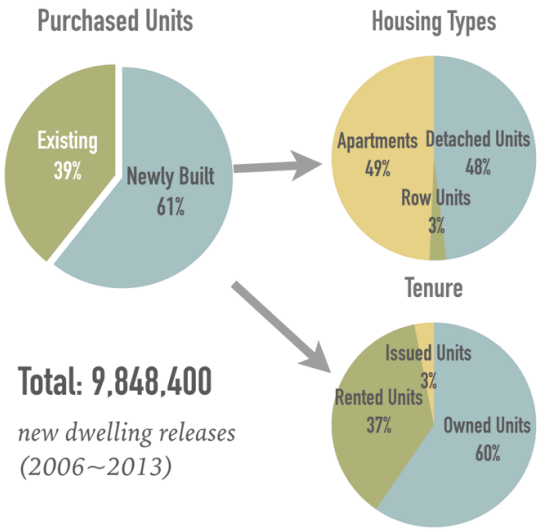


Figure 2.2 The Japanese Market of New Homes
(Japan Statistics Bureau, 2013)

Much of the quality, character and dynamism of Japanese cities is based on the continuous renovation of its building stock. 'Scrap and build' is practice of replacing buildings after they are considered old (usually around 25 years after completion). This approach has been criticized for breaking up historical linkages, and for being unsustainable. However, by enhancing newer technologies and lighter construction procedures, the practice also offers a chance to rebuild according to the latest legislations on energy saving (Tsukamoto and Almazan, 2006).

Japan has a tradition of accepting change, demolition and construction, due to its own resources and natural conditions. This construction practice has existed for centuries. Entire cities were dismantled and rebuilt, following the enthronement of a new Emperor, for relocation of the capital, or following natural disasters such as earthquakes and tsunamis. Furthermore, Shinto shrines, according to religious rituals, were rebuilt periodically, in the same form and location as before. This unique tradition (*shikinen sengu*) continues until recent days at the largest and most reverend Ise Shrine, which is rebuilt every 20 years (Tsukamoto and Almazan, 2006).

Similarly, Japanese households tend to remain on the same plot of land for generations. Although the house itself may be demolished and rebuilt, as needs change, the land remains within the ownership of the family. According to Barlow and Ozaki (2005), this is a reflection of for two major factors. First, the historically strong cultural attachment to the land in Japan reinforced by the post-1945 redistribution of farmland has played an essential role in shaping people's sense of private property rights. Second, lifetime employment with a single employer was a feature of the high economic growth rates from the 1950s to the late 1980s for much of the working population.

2.1.3 High Cost-Performance Marketing Strategy

The high cost-performance marketing strategy has been applied to a variety of end user products around the globe. For instance, although today's automobiles can be produced with lower production costs than those in the past, their selling price does not seem to be affected dramatically by higher productivity. New cars are still generally regarded as expensive; nevertheless, the list of items now offered as standard in new cars, such as air conditioning, a stereo set, airbags, remote-control keys, power steering, power windows and adjustable mirrors, were offered only as expensive options in older models. The quality of newer models is noticeably higher than that of older models (Noguchi, 2013).

The same is true for the prefabricated housing industry in Japan. The manufacturer's quality-oriented production may hardly be secured without being based on such strategy. Japanese manufacturers usually acquire ISO 9000 and 14000 accreditations to certify the quality control of their products, as well as the companies themselves. They set higher standards than ordinary building regulations, maintaining uniform product quality by strict control of their products. In particular, most Japanese manufacturers establish their own quality standards to standout compared to ordinary house builders such as improving structural resistance, durability and amenities, as well as reducing CO_2 emissions (Noguchi, 2013).

2.1.4 Shortage of Skilled Labor

The aging of the skilled labor pool is a fact in Japan. Many studies show that entry into the construction field by young people is declining. Young people are said to be disinterested in dirty (*kitanai*), dangerous (*kiken*) and hard (*kitsui*) work (the "3K" work rejection syndrome). Government agencies did many efforts to stimulate innovation in construction technology and management based on this. The highly automated factories of the house makers are in part a demonstration of the commitment to replace human workers with machines (Kendall, 1995).

However, the growth of the building remodeling industry suggests that newly skilled or multi-skilled workers will be required. Perhaps more than in new construction, remodeling involves a high percentage of on-site work, which cannot be sensibly automated. Further, the continued health of the local housing industry outside the range of the large urban-based factories is dependent on the availability of skilled workers in all trades (Kendall, 1995).

Under these circumstances, the introduction of an "infill level" of work as part of an Open Building strategy (coupled with increased factory production of housing components) may be a solution to the problem of attracting a new generation of workers. Infill is "installation" work, not "construction" in the traditional sense. It is safer and it occurs indoors. It is mentally challenging. It is also, at least potentially, a kind of teamwork, emphasizing cooperation and multi skilled individuals. A number of companies are experimenting with training workers to perform a number of tasks, like traditional carpenters, while incorporating multiple skills relating to current technology (Kendall, 1995).

2.2 GENESIS OF THE SI HOUSING CONCEPT IN JAPAN

In Japan, in order to make long lasting buildings, the architecture and urban design fields have been considering for a long time the clear separation of buildings into solid basic frames (skeleton) and secondary structures to be installed in or over this frame (infill), as an adequate approach for housing construction, property tenure, investment and management. The origin of this idea is related to the artificial land initiative, in the 1960s. In the following lines, we will introduce this and other events that contributed for the development of the SI Housing concept in Japan.

2.2.1 The Harumi Apartments

Post-war, as a test case for high-rise housing in Japan, the Japan Public Housing Authority decided to build one of fifteen apartment blocks in a housing complex as a high-rise block. The design was assigned to Kunio Mayekawa and his staff architect Masato Otaka was put in-charge. The resulting Harumi Apartments was said to have been a manifestation of Mayekawa's attempt to respect and realize a counterpart to his grand maestro, Le Corbusier's *Unité d'habitation* prototype, particularly in its use of precast concrete, and in having the first elevator for a public housing complex in Japan.

With 10 stories and 167 apartments it was only about half the size of the *Unité d'habitation* in Marseilles. While comprising the pilotis base supporting the duplex units above in an alternating composition along an internal corridor on every other floor, hence the elevator serving on only every three floors and utilizing the stairways inside the units for accessing the floors above and below the elevator stop, Mayekawa's design altogether signifies the overall composition exhibiting a direct reference to the Corbusian *Unité* proposition. Structurally, this was a "megastructure" made up of clusters, each having three floors and six apartments, and there was flexibility within each cluster to enable rooms to be enlarged or the number of apartments to be reduced. Otaka extended this design further the following year in the proposal for Tokyo Bay (1959), deploying the ideas in his own project (Mori Art Museum, 2011).

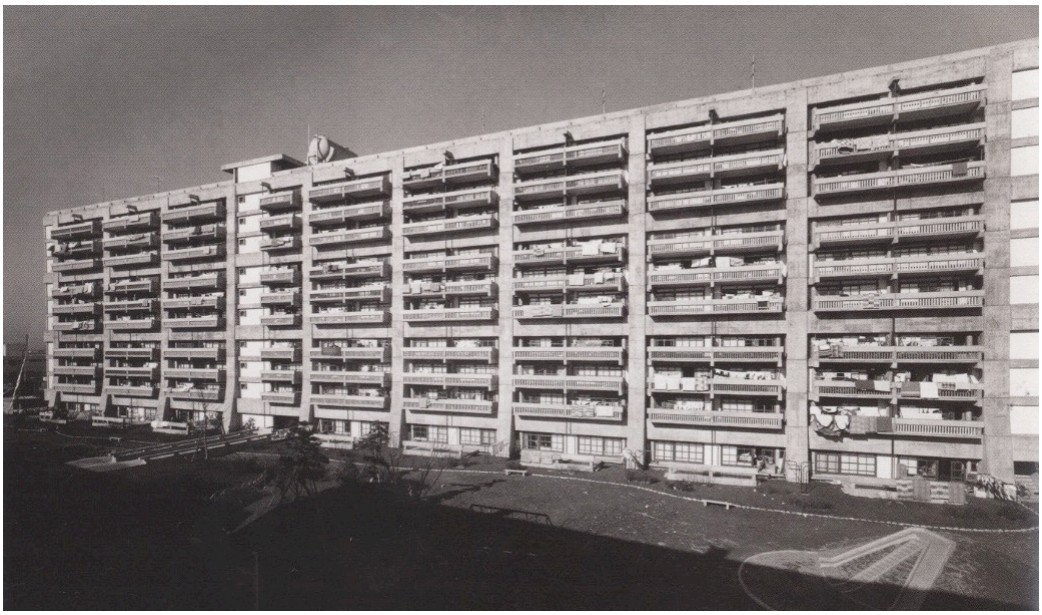


Figure 2.3 The Harumi Apartments, by Masato Otaka, Tokyo, 1958
(Mori Art Museum, 2011)

2.2.2 The Motomachi and Choju-en Apartments

A large-scale redevelopment project symbolizing the post-war restoration of Hiroshima was intended to replace the "atomic-bomb slum" of defunct and deteriorated housing with a high-density residential zone. The approximately 13-hectare site was situated on the west side of the Hiroshima Castle ruins, and located on the axis delineated by Kenzo Tange in his Hiroshima Peace Memorial Park design. The plan produced 4,500 homes in 13 high-rise apartment blocks, envisioning a population of 12,000 residents.

By creating a second axis that intersected the park axis at 45 degrees, the housing group naturally followed the path of the Ota River, with the blocks positioned to take advantage of the views of the Seto Inland Sea and the Hiroshima Castle. The blocks in the Housing Estate Motomachi and Choju-en were each independently standing structures connected by elevated "skywalk streets" at the top level. Between the two groups of residential wings, arranged in a wide V-shaped flying geese pattern, analogous to a parallel pair of *byobu* Japanese folding screens, the artificial ground produced an open park area on the top and a parking lot and a shopping center below (Mori Art Museum, 2011).

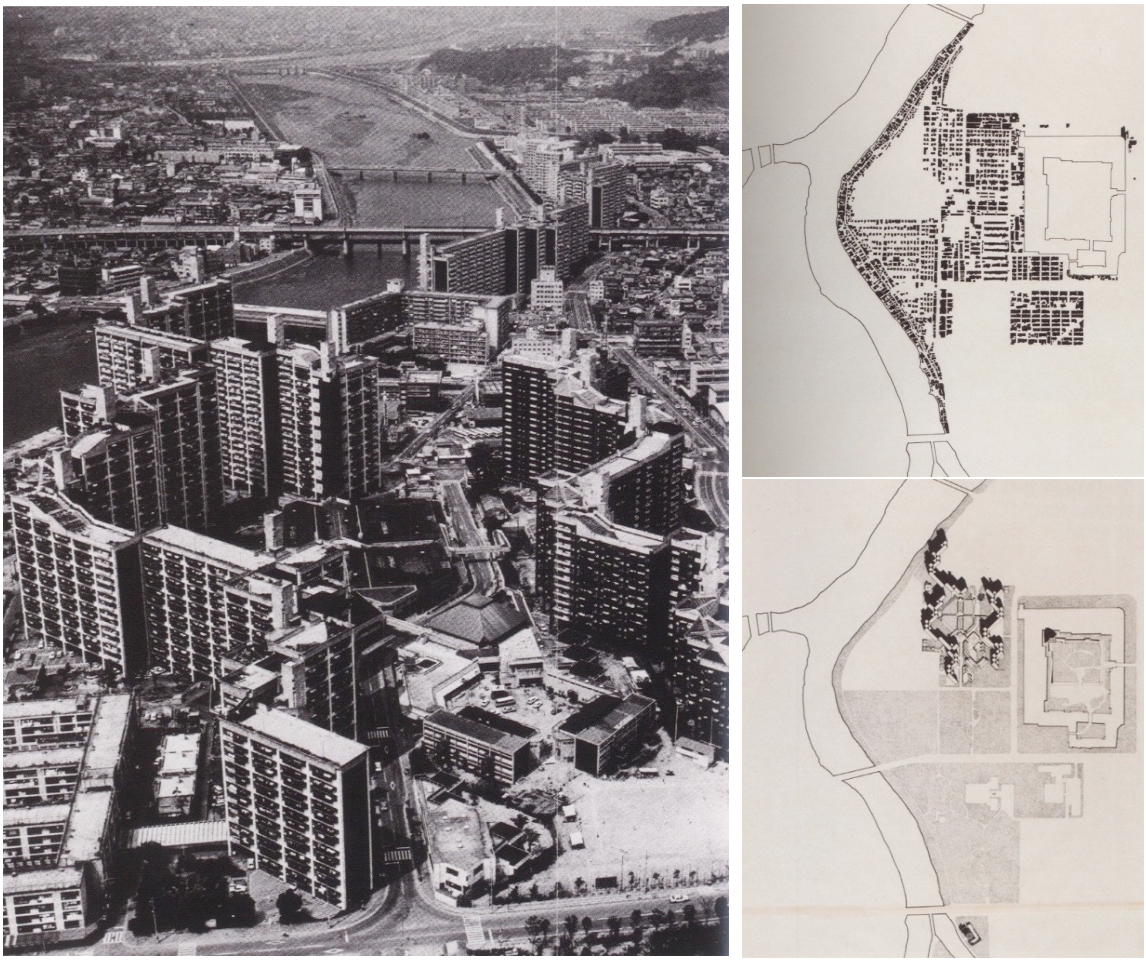


Figure 2.4 The Motomachi and Choju-en Apartments, by Masato Otaka, Hiroshima, 1976 (Mori Art Museum, 2011)

2.2.2 Metabolism, Group Form and the Artificial Land Initiative

Metabolism, which sprang up in the 1960s, is the most widely known modern architecture movement to have emerged from Japan. As its biological name suggests, the Metabolism movement contends that buildings and cities should be designed to continually grow and change in the same way as organic life. Each of the architects involved in that movement had their own concerns, which resulted in four essays entitled: Ocean City, Space City, Towards Group Form, and Material and Man.

Group Form, or *gunzokei* was a concept proposed by Masato Otaka and Fumihiko Maki, which used artificial land to redevelop the Nishi-Shinjuku district of Tokyo. Unlike other members of the Metabolist Group, Otaka and Maki placed less emphasis on the mega structures, and focused instead on a more flexible urban form that could better accommodate rapid and unpredictable demands of the city. Otaka had first idealized the relation between infrastructure and architecture in his 1949 graduation thesis and he kept exploring ideas about "artificial land" during his work at Mayekawa's office.

Once again, Masato Otaka was hired to handle the design, incorporating notions such as the second land, and land in the air. At ground level, on the natural ground, he located public facilities, then, at 6-9 meters above ground, he provided an artificial ground of reinforced concrete, putting "Group Form" theory into practice by varying the heights and locations of the housing blocks, and creating a diverse variety of outdoor spaces. When buying up or exchanging land for the project, a unique approach using "*okujo-ken*" (rooftop rights) in exchange for land rights was implemented. This innovative method became the basis for the way that rights are handled in redevelopment projects in Japan today (Figure 2.5) (Mori Art Museum, 2011).

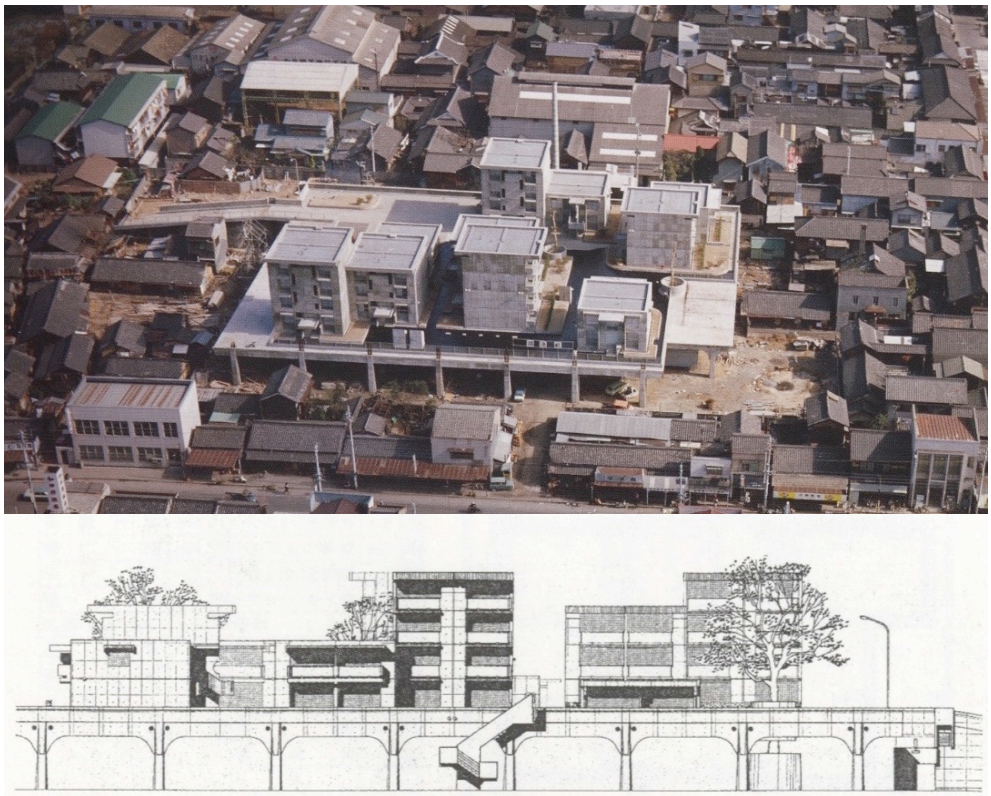


Figure 2.5 Sakaide Housing Complex, by Masato Otaka, Kagawa, 1974
(Mori Art Museum, 2011)

2.2.3 Political Expectations for the Artificial Land Initiative

At that time, architectural and urban policies, due to the severe urban densification issues, established the act for improvement of residential areas (replacing in 1960 the act for improvement of residential areas in poor conditions of 1927), the disaster prevention act for architecture and city block construction (1961), and the urban restructuring act for road broadening (1961). These legislations were also referred to as the three acts for urban redevelopment. But, considering the limitations of each act, summed to the lack of compelling forces towards the private rights, these measures were considered insufficient to fulfill the needs of urban redevelopment.

Under these circumstances, the Bureau of Residential Land, at the Housing Department of the Ministry of Construction, having jurisdiction over the first 2 acts mentioned above, had, in parallel with such a situation, the artificial land initiative as a major breakthrough solution. Specifically, the Ministry of Construction offered Grants for Research in Construction Technology from 1962 to 1963 to be entrusted to the Architectural Institute of Japan. The Urban Planning Committee carried out the research, installing a Subcommittee for Artificial Land. By that time, the land prices went high, and the artificial land was considered the most appropriate solution in order to reduce the shortage of land, facilitate restructuring measures, such as road broadening, or avoid an uncontrolled sprawl to the suburbs.

At the foundation of this initiative, not only architects such as Masato Otaka, a wide range of experts in urban and structural planning were involved (Takashi Asada, Tsune Irie, Ichiro Ueda, Yoshitika Uchida, Oba Tsuneyoshi, Toshihiko Kimura, Hidemitsu Kawakami, Akira Tamura, Fumihiko Maki). These people were also involved with the trial design for artificial land in Sakaide, and their fruitful efforts lead to the implementation of artificial land in Shiode as well.

In Shiode, the plan provided stores and parking lots under the artificial ground, and above, public housing, as if built in natural land. Major breakthroughs of the Sakaide project include marketable ways for artificial land and building property systems. However, the property systems in this proposal were inconsistent with subsequent property regulations that would become mainstream in Japan.

At first, there was no deed for artificial land, and the housing units were registered regardless of the ground were they were built. Later, although artificial land has been classified as shared property, people were not aware that everyone should jointly maintain that space from the beginning, and nowadays, these spaces cannot be easily repaired because they are in really bad conditions. The integrity between architectural and property shapes that would allow registration was an important issue, and therefore, explored in other projects (Kobayashi, et.al, 2014).

2.2.4 Lessons from the Artificial Land Initiative

As the three acts could not fulfill the needs of urban redevelopment, in 1969, it was promulgated a law to enforce the private rights, including enterprises involved with urban redevelopment. At that time, many of the claims of the need for artificial land, had absorbed principles of the redevelopment business. In other words, it absorbed the background of high land prices, height restrictions, the room flow and usage and performance of multistory dwellings, as well as the implementation of a structure with shared rights, that does not depend on public investment.

The concept of artificial land includes the following four proposals. The first includes complex traffic systems underneath the artificial ground. The second proposes a shared ground including shared facilities, such as water, sewage, pathways, and so on. The third, starts from the assumption that the city is meant to change, and thus, it is proposed a clearly positioned secondary structure to be the "changeable portion". The fourth stands for the notion that artificial structures should be as environmentally friendly as natural structures.

These proposals remain valid, because high rise buildings built in past urban redevelopment projects, could not respond to the changing demands in the real estate market, obsolete and empty buildings keep lining up one by one until these days. Therefore, implementing the four proposals has become increasingly urgent. In order to fix the current scenario, it is necessary to establish ways to diversify the real estate product, creating sustainable buildings that can respond to changes.

That means, urban structures should offer clear distinction between urban frameworks to be held in a long term, with public character, and thus, be maintained by long term investments, or "artificial lands with a solid body"; and easily upgradable "secondary structures" that respond to changing times and demands, with private character, maintained by short-term investments. These ideologies aim for the redevelopment of urban areas currently wrapped in a sense of stagnation (Kobayashi et.al, 2014).

2.2.5 Research and Development in Artificial Land Housing

As mentioned above, when the project of Sakaide was implemented, it was established a research committee for artificial land, and during the 1970s, it was drawn an opportunity to develop an investigation focused in housing as a continued study on artificial land. As a result, the Building Research Institute launched remarkable research and development on artificial land housing.

A group formed by Katsuro Uemura, Shin Okamoto and Fumiaki Seo undertook the research in 1970, and published it in 1977 as the "*Guidelines for the Development of Multistory Dwellings in Artificial Land,*" which summarized the concept of artificial land, its significance, and its application on the top of a flood control basin. By merging the ideas of housing construction and flood control basin, the concept of artificial land has become clear and noteworthy. Simultaneously, the Takenaka Corporation has developed a technology for artificial land called structural layer module. After that, in cooperation, two other groups had deepened their study on property legislation in artificial land, proposing a redevelopment plan for Tsukushima, in Tokyo.

Based on these results, in the late 1980s, it was launched a research and development program focused on implementation requirements. Specifically, after planning the construction of a two story height artificial plateau, which had inside a secondary structure that could be freely designed, it was built a real size model for fire safety experimentation, as well as investigation of legal procedures required for the sale of the dwelling units, before the actual implementation of the project.

In spite of the many research achievements, problems such as peak of construction prices, unclear relation between architecture built in artificial grounds and the property systems known at that moment, and large discrepancy of that model in relation to the actual social structure became a bottleneck, waning the idea along with the collapse of the bubble economy. Instead, the artificial land concept would be simplified, materialized and diffused later as "SI housing".

As later described by Fumiaki Seo, of the Building Research Institute: "Perhaps we caused an needless conflict by using the word land in its name. Artificial land is different from natural land, because it is a building, and does not last forever. As we started calling buildings as land, we created undue conflict with the property system, the legislation, and the social structure; and thus, our projects became unattainable. As a result, some governments, and companies have wracked some sort of hatred against artificial land. However, if we look at buildings at the same way we look at cities, the corridors as roads, meeting rooms as community centers, water distribution pipes as sewers, there is no doubt they express the same things in different scale. We need to step back, and readdress our proposal with smarter strategies". These thoughts would become reference for future research and development.

Still, during the bubble economy period, the land prices in Japan have soared, and other promising studies on hyper building, and mixed-use architectural complexes have waned as well, as the bubble collapsed. Although the premises considering mixed use and artificial land could be applied for the redevelopment of small-scale settlements, they should be reviewed and redefined (Kobayashi, et.al, 2014).

2.3 RESEARCH AND DEVELOPMENT IN SI HOUSING

2.3.1 The Origins of SI Housing

Challenging issues in artificial land, such as, the property division of the secondary structure, as well as the residential construction codes, had their origin in their inadequacy to the legislation. Therefore, countless research projects were abandoned, and the only materialization of those ideas could be observed in the artificial land of Sakaide, and its three-dimensional road systems.

Naturally, many projects were implemented, especially considering artificial grounds such as station squares, but their use is limited because it has a public nature seen in public structures, like bridges, and thus, cannot be pledged over private buildings. Still, considering the complications that the artificial land of Sakaide and its three-dimensional road systems would face in case they were actually going to adapt to respond to future urban needs, it could be assumed that the artificial land implementation has never happened, or at least, not as idealized.

Thus, keeping in mind realistic costs and legislation, and changing the subject to multistory dwellings, the study on building systems that separated "changeable" and "unchangeable" parts has continued under the name of SI housing (Figure 2.6).

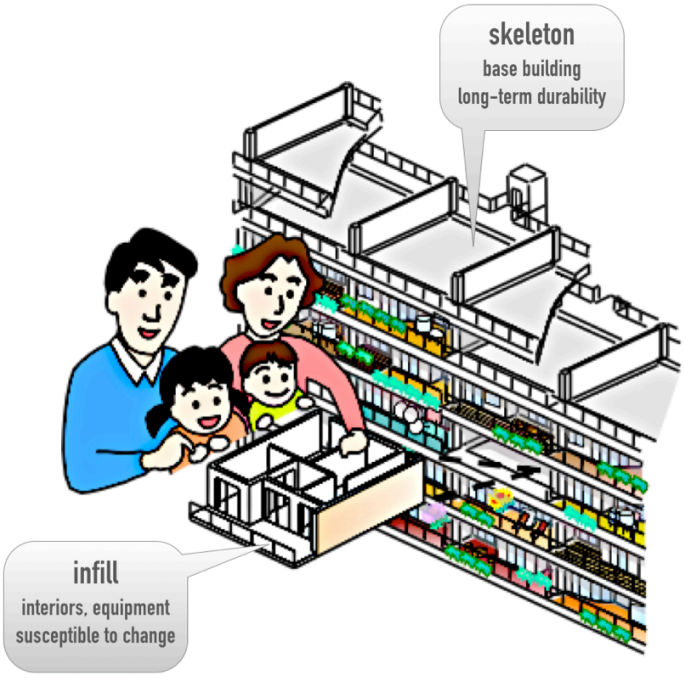
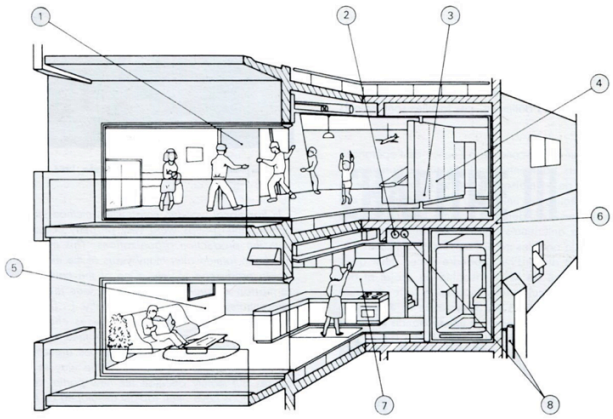


Figure 2.6 The SI Housing Concept
(Translated from Kobayashi and Fujimoto, 2003)

As mentioned in the first chapter, the "S" refers to the columns, beams, walls, ceiling, and roof and corresponds to the structural part of the building, or unchangeable part. The "I" refers to the interior layout, decorations, and installations and corresponds to the part that might be upgraded in the future, or changeable part. By clearly separating buildings into those two parts, the infill tackles future changes, because it is upgradable, while the support endures a longer run. In other words, buildings can last longer by incorporating metabolic, or renewable mechanisms (Kobayashi, et.al, 2014).

2.3.2 Two Streams of SI Housing

The research and development in SI Housing runs in two streams. The first stream is represented by the ideas such as enhancement of infill versatility, building modularization and standardization, technological development of building components. It started with the Kodan Experimental Project (KEP) and later, it was developed in Yoshitika Uchida's Laboratory at the University of Tokyo on a research under the theme of systems building, as well as by the Ministry of Construction on a project that aimed a housing system that would last a hundred years, called Century Housing System (CHS), which was firstly recognized in 1981, and is being developed until these days (Figure 2.7).



1. The floor plan can be modified to accommodate life changes, such as child's growth
2. Plumbing and wiring branches work independently for each dwelling unit
3. The interface of groups of components is streamlined.
4. Building components are designed and dimensioned for modular coordination
5. Home settings can be improved to suit future lifestyle needs
6. Long-lasting building frames, with building components that can be successively changed, increase the durability of dwellings in a whole sense.
7. Home equipment can be replaced or upgraded to suit future standards
8. Plumbing is not embedded in the building frame to enable easy replacement, maintenance, and inspection.

Figure 2.7 CHS Concept
(Translated from Kobayashi and Fujimoto, 2003)

The second stream stands for research and development of a housing supply system leveraged by the detachment of support and infill. It started in the 1970s at Tatsumi Kazuo's Laboratory at Kyoto University, with the research and development of a Two-Step Housing Supply System (Figure 2.8). Specifically, it consists of the prior sale or leasing of the support, and later, the infill would be built individually at the expense of its tenants. This idea has been concretely applied in two condominiums built by the Osaka Prefectural Housing Corporation: Senboku Momoyamadai and Chisato Kotani.

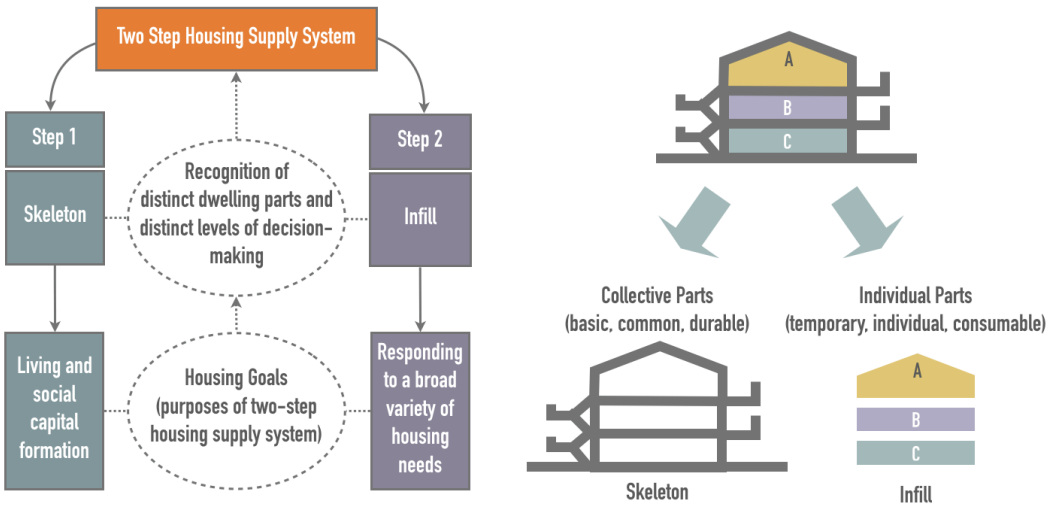


Figure 2.8 Two-Step Housing Supply System
(Translated from Kobayashi and Fujimoto, 2003)

Similarly, the Municipal Housing Company (today, Urban Renascence Agency) had tried to build rental supports to have their infill built later by their tenants, under a project called Free Plan Rental Housing. The first building block using this approach was built in 1986, in Hikarigaoka Park Town, and later the idea was replicated in three other locations. Nevertheless, problems concerning the second hand occupation of these buildings remain unsolved until today (Figure 2.9).

Figure 2.9 Hikarigaoka Park Town
(Kobayashi and Fujimoto, 2003)

More recently, another group has joined the second stream, lead by Hideki Kobayashi at the Building Research Institute, developing the Tsukuba Method Apartments (Skeleton Teika 1, 1996 completion). In response to the need of reducing construction costs, it stands for a fixed leasehold term program, accommodated by an inexpensive housing supply mechanism. It aims to solve the SI Housing conflict by expanding the leaseholds span from 50 to 100 years, by turning regular fixed leasehold contracts into flexible rental contracts (Figure 2.10). Such developments have put the skeleton infill concept into proof for other building types such as detached houses and office buildings (Kobayashi, et.al, 2014).

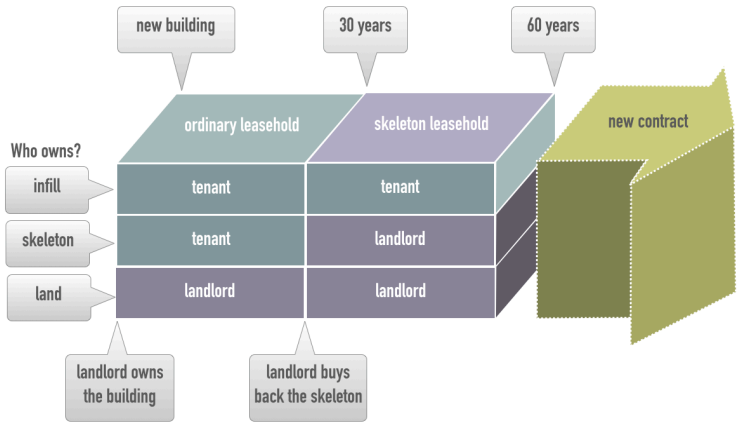


Figure 2.10 The Tsukuba Method
(Translated from Kobayashi and Fujimoto, 2003)

2.3.3 NEXT 21 Experimental Housing

As previously described, the coalescence of the two streams of SI Housing in Japan has culminated in an experimental housing project, the NEXT 21, by Osaka Gas (1993). Thereupon, members of the Uchida Laboratory at the University of Tokyo, which were developing building systems, had worked in cooperation with members of Tatsumi Laboratory, at Kyoto University, which were developing housing provision systems, in order to build an experimental house that foreseen the housing concept of the twenty-first century (Figure 2.11) (Kobayashi et.al, 2014).

Figure 2.11 NEXT 21: External View and Conceptual Sketches
(Photo by the author, Osaka Gas, 2005)

This project is a logical result of the separation of skeleton and infill (SI). The skeleton captures the structural durability as conceived in the artificial land project, while the infill offers as many dwelling design possibilities as if it were detached units to be built over an artificial land (Kobayashi et.al, 2014). Just like a city is extended by the design of streets and squares complete with trees and sidewalks and the utility lines under the surface, the NEXT21 base building provides public space of bridges, elevators, stairs, and corridors. The public circulation provided in three dimensions from street level to roof garden connects individual dwellings to the urban space network, and just as in urban design, these individual dwellings can be built, changed, removed and replaced like buildings along a street (Habraken, 2005).

Moreover, the NEXT 21 project offered a new possibility: its facade system is part of the skeleton concept intended for overall application. But the actual use of the system is part of the infill design. This combines infill level variety and change over time with skeleton harmony on an urban scale. Using this system, each architect could design a facade expressing the interior layout. Keeping in mind future changes, the facade system was designed in such a way that it could be taken apart and installed again from the inside, without need for exterior scaffolding built up from the ground level (Habraken, 2005). This experimental project was built to be the residence of employees of Osaka Gas, therefore, the proposal was not intended be generalized, at least in terms of costs. Until recently, it has been undergoing continuous experiments of infill expansion and renovation, and the long-term research results have attracted public attention (Kobayashi et.al, 2014).

2.3.4 Technological Developments in SI Housing

Under these circumstances, taking in consideration the importance of coordinating SI Housing both in terms of building technology (hard) and housing supply system (soft), a lot of research and development projects were underway.

As of representative examples, the Ministry of Construction has organized the New Urban Housing Project (1985-1989) and the mid and High-and-Medium Rise Housing Project (1990-1994) (Figure 2.12, left). In addition, the Ministry of International Trade and Industry had organized House Japan (1994-1999) (Figure 2.12, right), and the Next Generation District Forum (1997-2001), with similar content; they aimed for research and development of SI Housing ranging hard and soft aspects. Finally, the Municipal Housing Corporation has built the KSI Experimental Housing Project (1998-now) (Figure 2.13), promoting several experiments in cooperation with the private sector, for the development of infill technology.

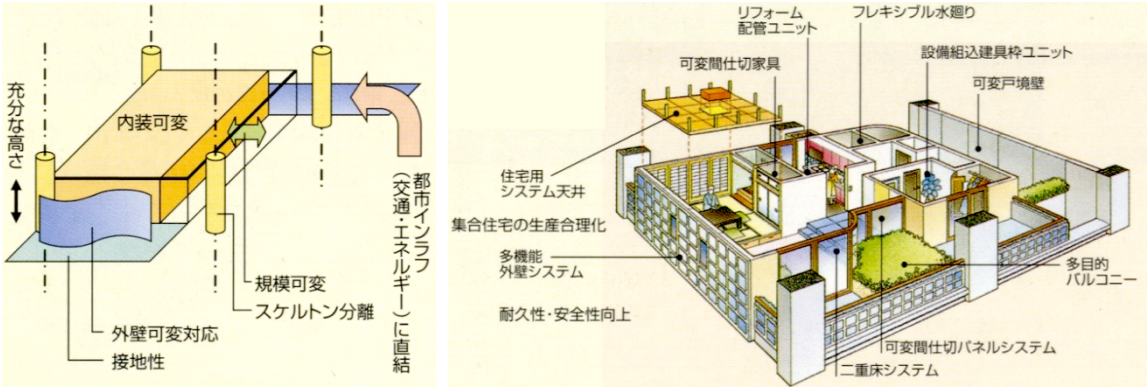


Figure 2.12 High-and-Medium Rise Housing Project (left) and House Japan Project (right) (Kobayashi and Fujimoto, 2003)

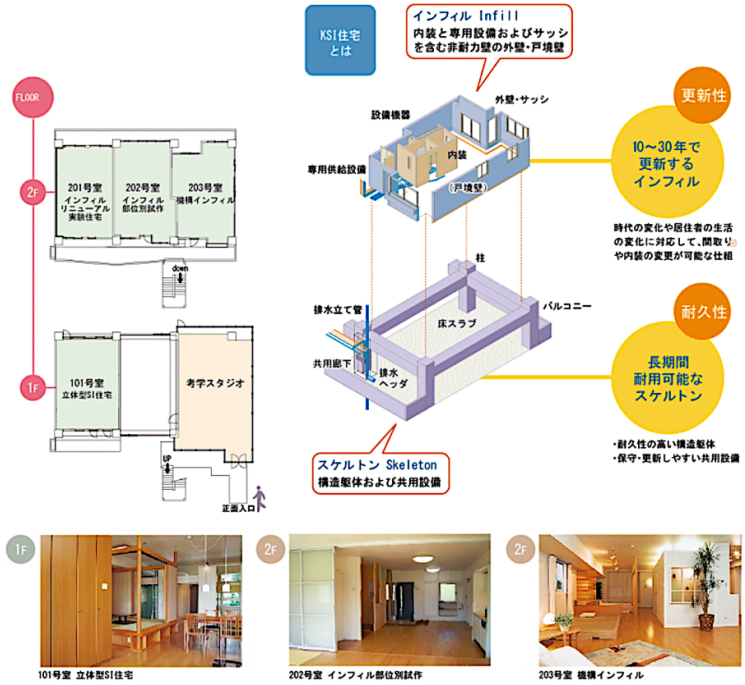


Figure 2.13 KSI Experimental Housing Project (Urban Renascence Agency, 1998-now)

As of series of results of such experiments, it was developed a technology for large frame supports with concrete filled steel tubes (CFT), and it was planned and built three-dimensional dwelling units with floor-to-floor height 1.5 times larger than usual. Moreover, it was introduced the use of reverse beams to ensure deep under floor span as a technique for enhancing the floor plan versatility (Figure 2.14).

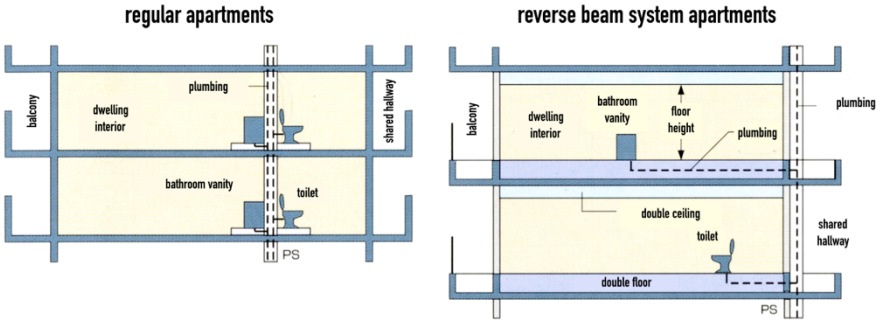


Figure 2.14 Support and Infill Distinction by the Use of Reverse Beams
(Translated from Kobayashi and Fujimoto, 2003)

The SI Housing progress was due to the period between 1997 and 2001, on a project for technological development by the Ministry of Construction (also known as, Mansion So Pro). It aimed to investigate why after so many years of research; the system would not become widespread and find a way to solve the problem.

In this project, one of the major reasons that inhibited the diffusion of SI Housing in Japan was that the exaggerated construction cost could not compensate any advantage perceived by the consumer, and there were no ways to show this information in a different manner. This issue will be specifically addressed in the next section, when we describe the establishment of a legislative system to promote the popularization of SI Housing in the real estate market.

2.3.5 The Rise of a Legislative System Towards the Diffusion of SI Housing

The ultimate goal of SI Housing is to promote the establishment of multistory housing that responds to future lifestyle changes, and therefore, can be effectively used for a long period of time. However, the social goal itself is not enough to make SI Housing widespread. There is a need to clarify the benefits of it as a product for the consumer. For this purpose, the first move in the development of a legislative system that could support the establishment of "free plan apartments".

To meet these demands, it began a movement towards the creation of a legislative system that could support the sale and rental of SI Housing. Firts, it was proposed an amendment in the Building Standards Law that authorized the temporary use permission of a residential building before its completion (Housing Authority Permission H9.3.31). Then, it was enabled the registration of properties deprived of interior decoration, so that the dwelling unit could be transferred to its purchaser before completion (Civil Authority Permission H14.1.8). Therefore it became recognized the registration of "unfinished residences". After the establishment of these legislations, it was expected that homeowners and/or tenants would just have to order the infill of their dream homes from their preferred suppliers (Figure 2.15). By then, the first SI housing units started to be sold (Kobayashi et.al, 2014).

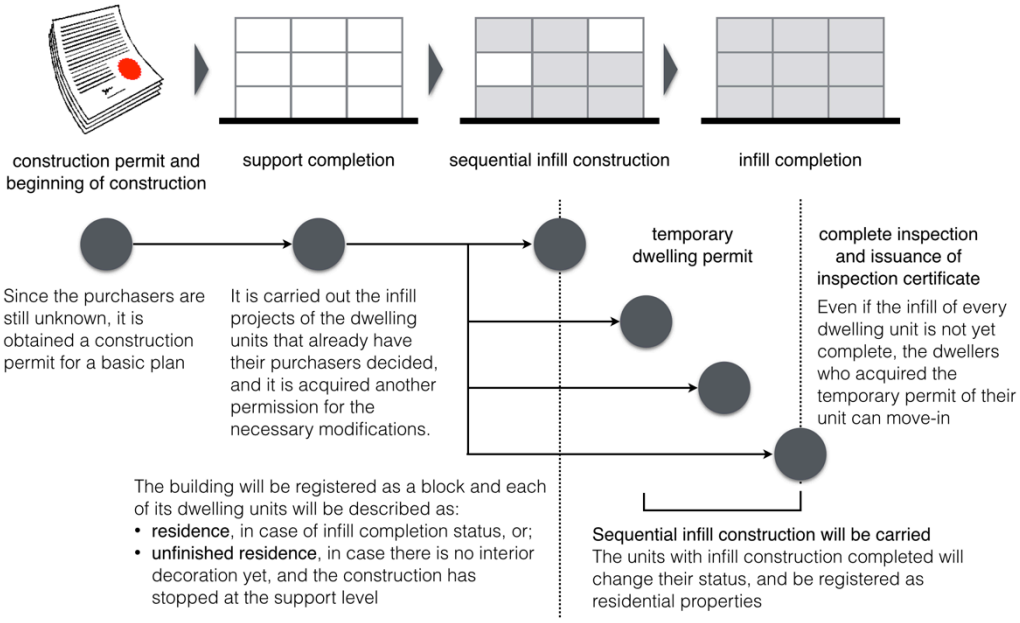


Figure 2.15 Enabling Unfinished Housing Property Registration
(Translated from Kobayashi and Fujimoto, 2003)

Once the social goal of SI housing was underway, it opened way for the plans to promote long-term durability as well. The first action was to upgrade the housing performance measurement system, in April 2007, by introducing new items, such as larger floor-to-floor heights and detachable piping, which could enhance the dwelling performance. Later on, in June 2009, it was established an Act that subsidized the dissemination of "Long-Term High-Quality Housing". By receiving a Long-Term High-Quality Housing certification, property owners would acquire tax reduction benefits, and thereby, little by little, in order to meet this certification requirements, it has incorporated the idea of design versatility, and continuous maintenance and upgrading potentials of SI Housing.

Nowadays, SI Housing is recognized as an alternative of housing supply that can meet the user demands through free plan, and as a way of saving resources, because it lasts longer than ordinary housing (Figure 2.16).

Figure 2.16 Free Plan Example of Tsukuba: From Skeleton to Made-to-Order Infill
(Kobayashi et.al, 2014)

2.3.6 The Importance of Housing Finance for Overcoming Persisting Issues

As a matter of fact, the core of real estate property systems is the circulation of capital related to the property stability. In other words, it must be associated with bank loans and mortgages. Although the limitations on SI Housing could be considered over in terms of building technology, the supply system still faces challenges in terms of financial support because some of the property aspects of S and I are relatively new.

For instance, in the case of the application for a bank loan to cover the construction costs of the interior decoration of a SI rental housing, as described above, there is a problem that there is no property to be used as collateral. Also, in the Tsukuba Method Apartments, which aimed to adjust the SI Housing compatibility according to the real estate property system, the fixed term leasehold becomes a particular problem in the case of second hand properties, because are less susceptible of being accepted in bank loan programs (option available only through the Government Housing Loan Corporation).

As a result, the limited number of second hand property trades jeopardizes the valuation of collaterals constraining bank loans. In other words, whether new types of property ownership will be subject to bank loans or not, will depend on the real estate market behavior, whereas, in order to increase those trades in the real estate market, bank loans are needed, turning this situation into a vicious cycle. In order to solve this problem, countries all over the world should actively promote public housing loans (e.g. loans for joint property, cooperative housing, reverse mortgage programs, etc.).

In Japan, although the fixed term leaseholds and the Tsukuba Method apartments had many accomplishments together with the Government Housing Loan Corporation, in recent years, a background of claims with private emphasis has been reducing the innovative power of public institutions. Rebuilding this power could be assumed as a major issue in the current housing policy agenda (Kobayashi et.al, 2014).

2.4 PRESENT AND FUTURE OF USER-ORIENTED HOUSING IN JAPAN

The Japanese *mai homu* ("my home") dream mirrors the American dream of owning one's own home: as in the U.S., Japanese rates of homeownership are around 60 percent. The house has importance as the economic asset, embodies heritage and family connections, and is used to as a means of artistic and status expression. In order to attend the Japanese user's needs of home customization, the national housing suppliers have adopted a 'quasi-standardization' approach to keep the costs of components under control, through constraints on variety of choice, even though they appear to offer extensive choice. The builders overcome the drawback of standardization by working with infill suppliers, and combining knowledge of the consumer and the supplier's specialization, adding value to the creation of "original products", such as kitchens, or bath-units (Patchel, 2002).

As a result, Japanese house-builders offer a large range of internal 'fit-out' options from which the purchasers can customize their home. Firms maintain supply agreements with manufacturers of white goods and bathroom, lighting, and storage products. These provide the standard range from which customers can choose. This is generally updated every six months. In addition, some optional items, such as ventilation systems, are included in the price of the house, but can be rejected by customers if they wish. If customers are not satisfied with the standard range of fittings, they are able to choose from other manufacturers, although the house-builder will charge a price premium on the item.

But, providing high levels of choice over design and specifications, and at the same time delivering homes on time and to a high quality, has required significant innovation across the entire production process. Underpinning the mass customized approach is the way the large suppliers have been able to use of standardization (the complete and consistent interchangeability of parts) and pre-assembly of components and complete subassemblies (such as timber and steel-frame systems and external cladding), to move from a focus on economies of scale in production towards economies of scope. Long-term relationships with suppliers help to inform product development and collaborative R&D with key suppliers is common. Together, these production-technology and process innovations have enabled the mass customized housing suppliers to exploit opportunities for improving productivity and quality, improving managerial control and coordinating processes more effectively (Barlow and Ozaki, 2005).

Moreover, customization inevitably means that house-builders spend considerable resources at the 'front end' of the customer relationship. Once a decision has been made to purchase, firms might spend three or four planning sessions with customers, which can last up to four hours each. However, purchasers sometimes liaise with the designer as many as ten times and one company said there could be two meetings a week during the design phase. To compensate this effort, great stress is placed on word-of-mouth sales and repeats business. This is achieved through high levels of after-care service, a reflection of the Japanese notion that a continuing relationship is part of the sale. More pragmatically, after-care service provides valuable feedback for product development and may lead to word-of-mouth referrals and higher brand loyalty. Apart from follow-up visits within the first year of occupation to check and deal with any problems, the long-term relationship involves routine inspection and maintenance, the construction of extensions, and internal and external remodeling. Japanese house-builders will continue to visit their customers and carry out surveys to capture their experiences of living in the home ten or even twenty years after the sale (Barlow and Ozaki, 2005).

Part of this has involved the coexistence and coevolution of large industrialized firms and small local traditional builders (Patchell, as cited by Barlow and Ozaki, 2005). The flexibility that local builders have in terms of design and planning – and their local connection, which is very important in Japan, especially in rural areas – is a huge advantage in the competition between industrialized national and local craft house builders. However, these two types of firms have influenced each other and the competition between them has helped them to evolve. Large house builders have relied on innovation across the production process to match the local connections of small firms. Although competition between the two sectors may increase as the scale of house building declines, the emergence of supplier relationships, a consolidation of firms in local – regional house building and the introduction of tighter regulation to increase quality suggests that the two sectors will continue to evolve together.

The question is how the organizational and spatial evolution of each sector will develop in the future. Despite the persistent economic problems, Japan still maintains a production of over 1 million housing units per year. However, downward pressure on the housing market is a fact. At present, there are 8,2 million vacant dwellings in Japan, representing 13.5% of the stock of owned properties nationwide (Housing and Land Use Survey, Statistics Bureau of Japan, 2013). Moreover, in 2010 the vacancy rates raised to 23% in rental housing as well, likely resulting in further degeneration of the housing stock.

It is said that one of the major causes of dwelling vacancy in Japan is the absence of a market for existing dwellings. The purchase of existing dwellings is usually inhibited by safety issues, such as lack quality guarantee of existing dwellings, and lack of information about the construction (such as appraisal of the structural condition and building components deterioration) (Iso, 2015).

There is, however concern amongst house builders over the long-term impact of rising unemployment, the introduction of part-time employment contracts, stagnating earnings and low expectations about future growth prospects. Under these conditions, house builders are worried that an increasing number of Japanese owner-occupiers will turn to renovation rather than replacement. Another issue is the environmental impact of the replacement homes, 'scrap and build' model (Barlow and Ozaki, 2005).

Eventually, in order to raise the average lifespan of new housing, responsiveness to customer's individual needs is becoming increasingly important as a market strategy throughout Japan. Menu-driven approaches to the supply of goods and services, whereby certain features are selected and products are tailored from a relatively standardized core of parts, are now common in many retail sectors. Japanese house builders – and in particular those involved in mass customized supply – have extended this philosophy into the new homes market. Competition between firms is largely on the basis of levels of choice and service, rather than their ability to manage the building process more effectively or secure development land in the right place and at the right point in the market cycle, as is the case with speculative house builders. This requires much closer integration of market intelligence with design and product development. The Japanese mass customized housing system amply demonstrates how this can be achieved in house building (Barlow and Ozaki, 2005).

CHAPTER 3

APARTMENT CUSTOMIZATION PRACTICES

CHAPTER 3

APARTMENT CUSTOMIZATION PRACTICES

The following case studies were realized with support of the Grant-in Aid for Scientific Research of the MEXT, Japan, grant number 22360247. In the following pages we will summarize the results of each survey, presenting only the content relevant for the upcoming analyses. Each of the photos used in the following summaries are intellectual property of the MEXT, and of the team leaders in their respective survey locations:

Fela Warouw, in Jakarta, Indonesia, 2007~2010;
Ji Young Jung, in Seoul, Korea, 2010~2015;
Yin Ling Young, in Dalian, China, 2013~2014;
and Marianne Costa, in Santos and Sao Paulo, Brazil, 2012~2015.

3.1 THE CASE STUDY OF JAKARTA

3.1.1 Background of Indonesian Housing Market

Most of the households in Indonesia occupy detached dwellings. The total housing stock comprises about 54 million units, of which, nearly 24 million are in urban areas. According to the BPS, as cited by UN-Habitat (2008), 95 percent of the housing stock is in good to moderate condition, but over 2.5 million units need urgent replacement. The Ministry of Housing estimates a deficit of 6 million units and a construction demand of more than 1 million units per year to eliminate the deficit by 2020.

UN-Habitat (2008) also states that home-ownership is extremely high even in urban areas (70%). Notably, the great majority of homeowners hold legal title deeds to the land after a massive campaign to improve land titles by the Land Agency (BPN). These rights are either full freehold title or a BPN certificate. This extension of property right clarification and registration is a major improvement over the past 15 years when approximately 80 percent of urban plots were not formally registered.

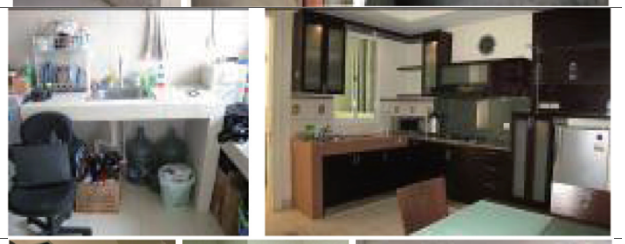
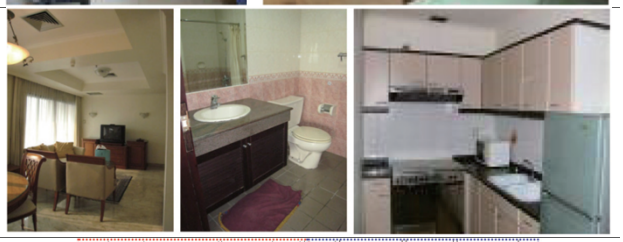
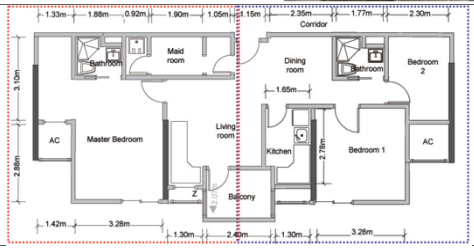
In typical settlements and informal areas a large proportion of homeowners have no title or certificate to their land. The government does not guarantee land titles; people simply provide evidence of ownership. Moreover, most housing transactions, if recorded at all, only refer to the transfer of ownership but not the actual sale price as a way of avoiding tax payments. Therefore, it is difficult to find comprehensive data on Indonesian housing prices. Other urban housing characteristics can be summarized from the BPS Survey (2004) as follows:

1) Close to 80% of urban housing is single story detached; only about 1% is multistory.
2) Close to 50% of units are between 50-100 m² and 34% are between 20-49 m².
3) 40% of plots are more than 70 m²; 17.5% are between 55-70m² and more than 40% are smaller than 55 m².
4) 58% of homeowners built their own house, 11% bought it second hand and 8% bought their house from a developer.
5) 65% of owned households were purchased with cash, while 28% used mortgage and 5% used non-mortgage credit.

3.1.2 User-Oriented Housing Provision

In Indonesia, there are four basic approaches of user-oriented housing provision that differ according to the final cost and target consumer (Table 3.1). In the case of *rumah susun* (RS, housing publicly supplied) built between 1984 and 2005, matter of our current study, their design could be classified as unfinished plans, with standard layout and finishing components. In order to reduce costs, the unit areas are as narrow as possible, consisting of a living/dining room, one or two bedrooms, squat toilet, kitchen and balcony. The dwellings have also a minimum amount of equipment (e.g., electricity, water, and plumbing) and appliances (e.g., kitchen counter and sink), while floor and walls are finished with plastered cement and non-ceramic tiles. Although the typical floor plan with narrow rooms is still in use, the interior finishing for ownership RS has been improving, since 2008. Moreover, residents can personalize the kitchen equipment and appliances just before move-in (Warouw, 2011).

Table 3.1 Infill Delivery Systems in Indonesia
(Warouw, 2011)

1. Unfinished Plan (Public Supply) Interior walls and floors are exposed without finishing (e.g., paint) and some of the units are open space without walls between rooms. Thus, residents can personalize bathrooms (e.g., basins) and kitchens (e.g., cabinets and ceramics) and install interior walls after move-in.	
2. Half-Finished Plan (Private Supply) Interior surfaces and bathroom fixtures are well equipped, except for in the kitchen area. Some developers offer standard equipment, such as counter concrete plus sink or kitchen space plus sink for residents to personalize just before move-in.	
3. Fully Finished Plan (Private Supply) The interior plan includes all equipment and appliances as part of a standard plan and uses high quality materials or fittings (e.g., built-in kitchen sets and imported marble). Residents do not need to personalize before move-in, but they can make modifications post occupation.	
4. Made-to-order Plan (Private Supply) The standard layout plan can be modified; for example, by merging two small units (e.g., a studio type and a one-two bedroom type) during the construction stage. Residents can order a new interior plan from the developer before move-in.	

3.1.3. Urban Context of Jakarta

Jakarta is the capital and largest city of Indonesia, and one of the most populous agglomerations in the world, with a population density of 15,015 people/km2, registered by census in 2013. The population has risen from 8.3 to 9.6 million from the 2000 to 2010. Established in the fourth century, the economy of the city used to be based on agriculture and international shipping of spices. In recent days, services, banking, trading, finances, and manufacturing dominate the economy. With numerous shopping malls and traditional markets, Jakarta is the shopping hub of Indonesia and one of the most popular shopping places in Southeast Asia.

The housing prices in Jakarta have been slowing, in spite of the country's robust economic growth. With a year over year price increase of only 0.25% after inflation, the housing market have been weakening, with a decline of typical foreigner investors purchasing high-end properties, as well as business travelers renting luxury apartments due to the global economic crisis.

Table 3.2 Housing Finance Information of Jakarta

Entry	Data	Source
City	Jakarta	-
Country	Indonesia	-
Population	11,374,022	BPS (2010)
Territory (km^2)	664	BPS (2010)
Density (people/km^2)	17,129	BPS (2010)
Number of households:	2,518,000	BPS (2013)
Average household size (people/household)	3.8	BPS (2013)
Urban population (%/total, national)	52	WDI (2013)
Urban population growth (%/year, national)	2.7	WDI (2013)
Annual average % change in median house prices (national)	2.09	IMF (2014)
Monthly rent prices (in USD) for		
1 Bedroom Apartment in City Center	576.13	NUMBEO (2015)
1 Bedroom Apartment Outside of City Center	258.50	NUMBEO (2015)
3 Bedroom Apartment in City Center	1,704.68	NUMBEO (2015)
3 Bedroom Apartment Outside City Center	748.30	NUMBEO (2015)
Purchasing price per m^2 median quality apartment (in USD)		
In the city center	2,707.34	NUMBEO (2015)
Outside the city center	1,088.44	NUMBEO (2015)
Average monthly disposable salary	395.37	NUMBEO (2015)
Mortgage interest rate (%/year)	11.54	NUMBEO (2015)

3.1.4. Survey Outline

A qualitative survey was conducted from August 28th to September 1st, 2010 by visiting five RS locations, one a day. The selected samples are located in central Jakarta and were built in the period from 1980 to 2005. At each location, four groups of three persons each carried two to three household observations a day, documenting information on dwelling unit customization by interviews, photographs, and before and after sketches. The interviews were questionnaire based, focused on dwelling renovation works, occupancy history and household background.

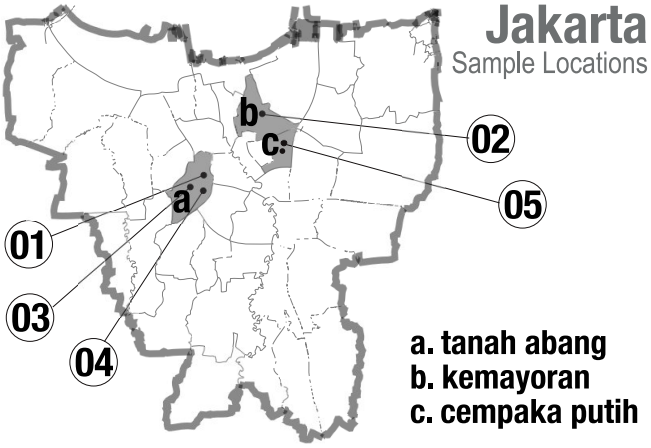


Figure 3.1 Jakarta's Survey Map

Table 3.3 Sample Locations in Jakarta

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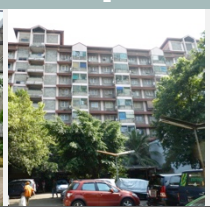
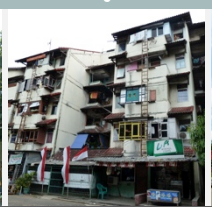
Photo					
Code	TA	BH	KD	PB	JR
Location	Tanah Abang	Kemayoran	Tanah Abang	Tanah Abang	Cempaka Putih
Year	1980	1995	1992	2001	2005
Blocks	60	57	6	6	2
Households	960	2844	910	600	180
Observations	10	10	10	10	20
Floor plan	1LDK	1K	2R	1LDK	2LDK
Unit Area (m^2)	34.5	24	18.5	22.2	27.6~37.8

3.1.5 Sampling Characterization

3.1.5.1 Households Profile

Household structure can be divided into nuclear family (parents and children) and extended family (grandparent/child or close relatives). Majority of household type is couple with children and categorized as nuclear family. There are 7 households of single parents with children and 2 households of grandparents and grandchild. Only a few number of unit room is occupied by single person, couple, couple with relatives and sharing room between friends and relatives. However, there are total 7 unit rooms occupied by two or three generation of family, from grandparents and children with family (couple parents and children). Living together with close relatives is a common household structure in public RS (Figure 3.2).

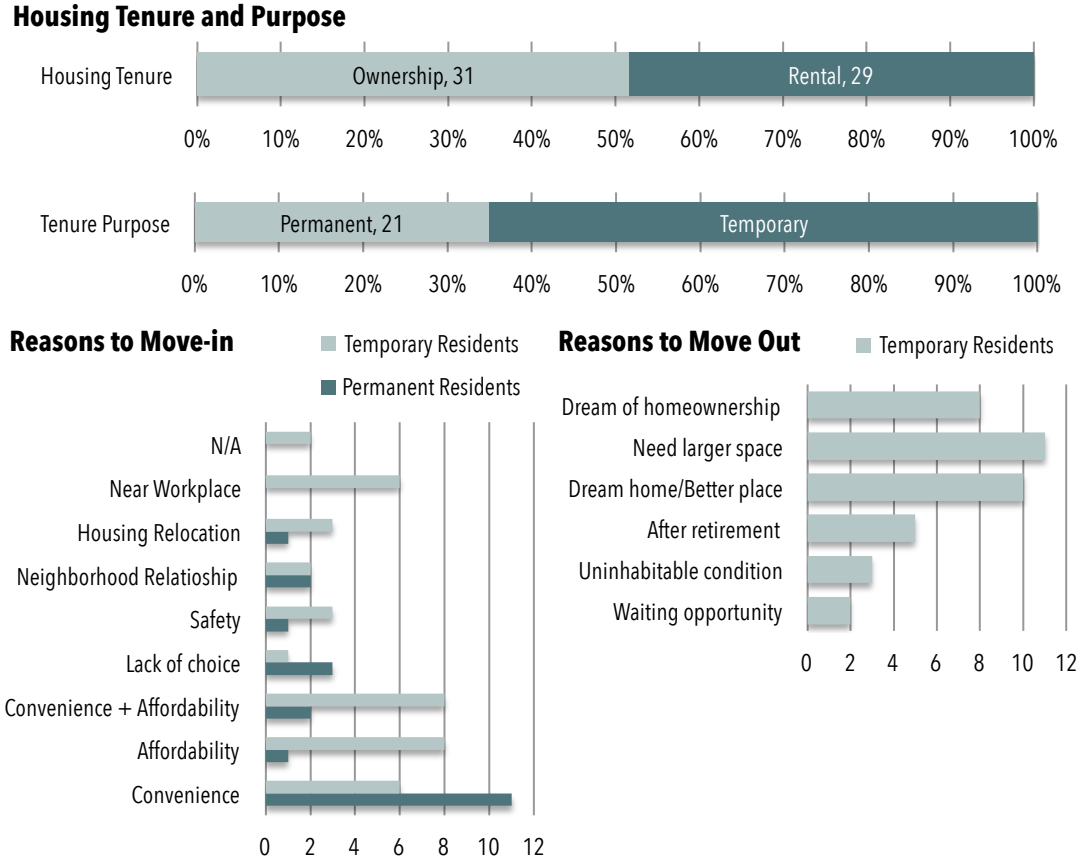


Figure 3.2 Household's Tenure and Purpose

The composition of household member ages is dominated by 30's and 10's comes next. The elderly people at 60`s is few, while the productive ages from 20's to 40's are many. This family structure is very dynamic because the number of children is larger than elderly people. This situation may relate to dweller's demand for floor plan arrangement. This condition has close relation to the composition of the ages above. Moreover, majority of household members have monthly allowance starts at 1,000,000 rupiah below 4,500,000 rupiah. According to the World Bank classification, low-income families occupy 90% of the dwellings; the other 10% are occupied by lower-middle income families (Figure 3.3).

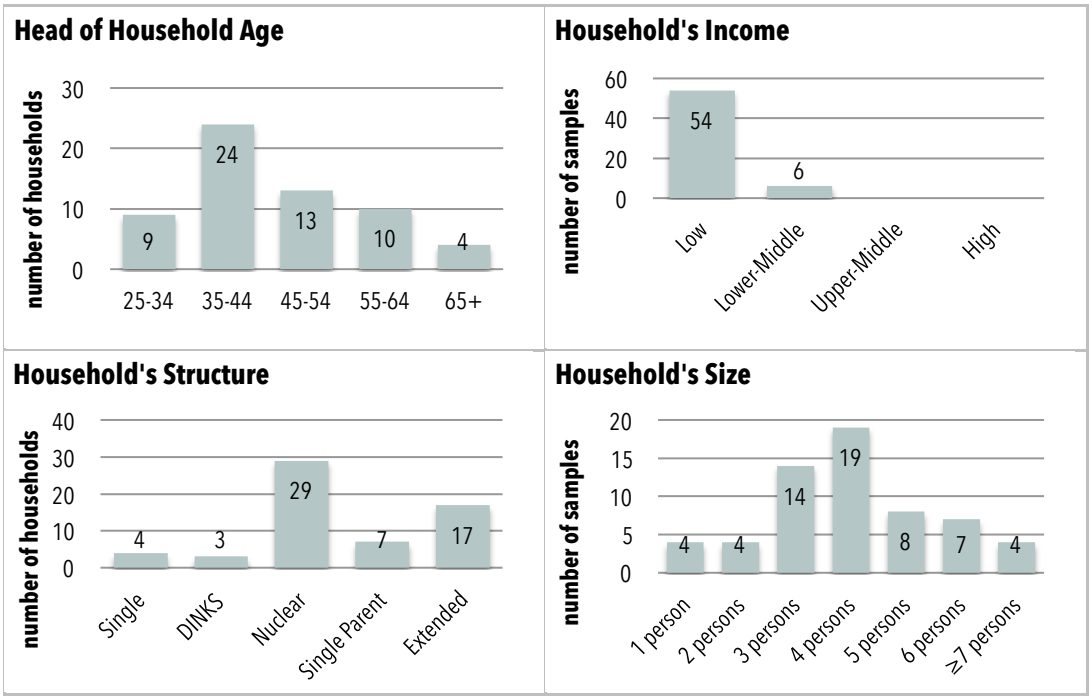
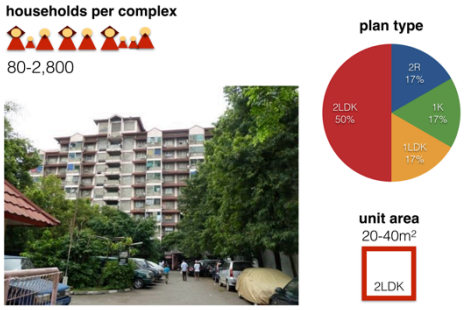


Figure 3.3 Household's Profile

3.1.5.2 Original Floor Plan Classification

Built in the 1980s, sample TA has the oldest RS design, consisting of four story building blocks with four dwelling units per story, covered with a concrete rooftop. Since 1990, RS began to be built in five story building blocks with 20 dwellings per story, distributed in two rows with an open void in the middle. Building blocks might be covered with tiled roofs over a metallic structure, or concrete rooftops. Dwelling level starts from the first floor, while the ground floor has commercial function, occupied with small shops and motorcycle parking areas. Each story has common room for social events.

Public residential buildings in Jakarta present an average of 1000 households per complex. Building heights are middle rise, varying from four to ten stories, and dwelling unit areas are very narrow, varying from 18.5m2 to 37m2, mostly comprised of two bedrooms. A distinct pattern was found in one of our condominium samples, which consists of two rooms and develops the communal space concept for living room, kitchen and toilet



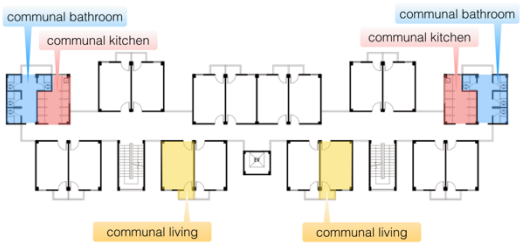


Figure 3.4 Original Design Features (left)
Figure 3.5 Particular Case of KD (right)

3.1.6. Research Findings

3.1.6.1 User's Needs and Renovation Purposes

By considering the customization process, it can be concluded there are two stages of customization in Indonesian dwellings. The first stage is related to interior and exterior customization, aiming for a comfortable, cozy and clean living space. The second stage aims for adapting the space to suit the dweller's new life style demands. Through dwelling unit observations, it was found examples of dwelling expansion, relocation of partitions, finishing renovation, and repair of aging or broken interior components. Also, there were five dwelling spaces that had their function changed after customization: front yards, attic roofs, common hall, balcony, and kitchen.

Table 3.1.4 shows 43 cases of dwelling units customized between 0 to 5 years and 10 cases within the period between 6 to 15 years of occupation. Also, 8 dwelling units were customized during occupancy period.

Table 3.4 Customization Period and Occupancy Stage

Code	Move-in (years after constr.)		N/A	Occupancy (years after move-in)
	0 to 5	6 to 15		6 to 15
TA	7	0	3	2
BH	6	4	0	6
KD	4	5	1	0
PE	9	1	0	0
JR	17	0	3	0
Total	43	10	7	8

Figure 3.1.6 shows the relation between monthly income and customization period. Among 22 dwellers with monthly income between 1,0 to 2,5 million rupiah, 15 dwellers customized their homes during move-in period. Within 19 dwellers with monthly income between 2,55 to 4,5 (million rupiah), 14 had home customization between 0 to 5 years. Also, 3 from 5 dwellers who earn less than 1,0 million monthly who decided customize during move-in period.

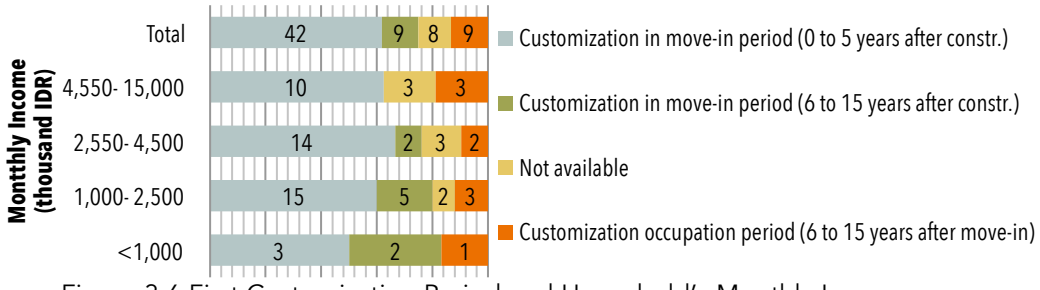


Figure 3.6 First Customization Period and Household's Monthly Income

It can be said that dwellers decision about the first customization works is not related to their monthly income, but to the customization demand. However, the income determines the quality of the most affordable customization method. For instance, if a family cannot afford hiring a skilled contractor, they will end up carrying the customization work on their own.

Table 3.5 Jakarta's Dwelling Customization Data Base

		base building / common elements / boundary elements (unclear)					interior elements			
		functional level	layout level		finishing level	decoration level	functional level	layout level	finishing level	decoration level
#	Code	addition of bath and kitchen equip. and service lines	exterior relocation of partitions, openings		ext. replacement of finishing, fixtures and built-in furniture	exterior painting, free-standing furniture	renovation of bath and kitchen equipment and service lines	interior relocation of partitions, openings	Int. replacement of finishing, fixtures and built-in furniture	interior painting, free-standing furniture
		extra bath/kitchen	dwelling expansion	balcony enclosure	ext. finishing / fixtures	exterior decoration	bath & kitchen equip.	interior partitions	int. finishing / fixtures	interior decoration
1	RTA01	0	1	1	1	1	1	1	1	1
2	RTA02	0	1	1	0	1	1	1	1	1
3	RTA03	0	0	0	0	1	1	1	1	1
4	RTA04	0	1	0	0	1	1	1	1	1
5	RTA05	0	0	0	0	0	1	0	1	1
6	RTA06	0	0	0	1	1	1	1	1	1
7	RTA07	0	0	0	1	1	1	1	1	1
8	RTA08	0	0	0	0	1	1	1	1	1
9	RTA09	0	0	0	0	0	1	1	1	1
10	RTA10	0	1	1	1	1	1	1	1	1
11	RBH01	0	0	1	1	1	1	1	1	1
12	RBH02	0	0	1	1	1	1	1	1	1
13	RBH03	0	0	0	1	0	1	1	1	1
14	RBH04	0	0	0	1	1	1	0	1	1
15	RBH05	0	0	0	1	1	1	0	1	1
16	RBH06	0	0	1	1	0	1	0	1	1
17	RBH07	0	0	0	1	1	1	0	1	1
18	RBH08	0	0	0	1	1	1	0	1	1
19	RBH09	0	0	1	1	1	1	1	1	1
20	RBH10	0	0	0	1	1	1	0	1	1
21	RKD01	0	0	1	0	1	1	1	1	1
22	RKD02	0	1	0	0	1	1	0	1	1
23	RKD03	0	0	1	0	1	0	1	1	1
24	RKD04	0	0	1	0	1	0	0	1	1
25	RKD05	0	0	1	0	1	0	1	1	1
26	RKD06	0	0	0	0	0	0	0	1	1
27	RKD07	0	0	1	0	1	0	0	1	1
28	RKD08	0	0	0	0	1	0	0	1	1
29	RKD09	0	1	1	0	0	0	1	1	1
30	RKD10	0	0	0	0	0	0	0	1	1
31	RPE01	0	1	1	1	1	1	0	1	1
32	RPE02	0	1	1	1	1	1	1	1	1
33	RPE03	0	1	1	1	1	1	0	1	1
34	RPE04	0	1	1	1	1	1	0	1	1
35	RPE05	0	0	1	0	1	1	0	1	1
36	RPE06	0	0	1	0	1	1	0	1	1
37	RPE07	0	0	1	0	1	0	0	1	1
38	RPE08	0	0	1	1	1	1	0	1	1
39	RPE09	0	0	0	1	1	1	0	1	1
40	RPE10	0	0	1	1	1	1	0	1	1
41	JRA01	0	0	0	0	0	0	0	1	1
42	JRA02	0	0	0	0	0	0	0	1	1
43	JRA03	0	0	0	0	0	0	0	1	1
44	JRA04	0	0	0	0	0	0	0	1	1
45	JRA05	0	0	0	0	0	0	0	1	1
46	JRA06	0	0	0	0	0	0	0	1	1
47	JRA07	0	0	0	1	0	0	0	1	1
48	JRA08	0	0	0	1	0	0	0	1	1
49	JRA09	0	0	0	1	0	0	0	1	1
50	JRA10	0	0	0	1	0	0	0	1	1
51	JRB01	0	0	0	0	0	0	0	1	1
52	JRB02	0	0	0	0	0	1	0	1	1
53	JRB03	0	0	0	0	0	0	0	1	1
54	JRB04	0	0	0	0	0	0	0	1	1
55	JRB05	0	0	0	0	1	0	0	1	1
56	JRB06	0	0	0	0	0	0	0	1	1
57	JRB07	0	0	0	0	0	0	0	1	1
58	JRB08	0	0	0	0	0	0	0	1	1
59	JRB09	0	0	0	1	0	0	0	1	1
60	JRB10	0	0	0	0	0	1	0	1	1

3.1.6.2 Dwelling Expansion

Table 3.6 explains characteristics of dwelling expansion observed within our samples. There are 4 types of adding spaces, one type of connecting units and of enclosing open space. The extended room defines these 4 types that are, the front yard, the attic roof, the common space (hall, void, corridor), and the kitchen. These types depend on the story on the floor height of the units: the ground floor, middle stories or the top of building. Among 60 samples, there were 10 expanded spaces, while 9 cases connect units and 15 enclosed open balconies. Especially, the extensions to outside building –from kitchen – are found mostly at lower floors. It can be assumed that extending outside can hardly happen on upper floors because conventional construction works well for low-rise building.

Table 3.6 Correlation Between Story and Additional Floor Area Allocation

	Expansion Towards	Expansions per Story Allocation									Additional Floor Area (m^2)						
		Ground	1st	2nd	3rd	4th	5th	7th	Attic	Total	~5	5~	10~	20~	30~	40~	Total
1	Front Yard	3	0	0	0	0	0	0	0	3	0	0	12	29	0	44.8	3
2	Attic Roof	0	0	0	0	0	0	0	2	2	0	0	0	0	33.45	0	2
3	Common Space	0	0	1	0	0	0	0	0	1	0	7.5	0	0	0	0	1
4	Kitchen	0	2	2	0	0	0	0	0	4	1.7	0	0	0	0	0	4
5	Neighboring Unit	0	2	3	1	3	0	0	0	9	0	0	18.5	0	37	0	9
6	Balcony	0	3	4	3	2	1	2	0	15	0	0	0	0	0	0	17

Table 3.7 explains the measurement of extension area. As mentioned above, the location of units influence on the size of the addition. The widest addition is found at ground floor (3 units) and below building roof (2 units). There are 4 units with extension from kitchen space, which are only found at R. Petamburan. The addition of this type is only 1.7m2, because the space for addition is limited inside the narrow eaves. This outside boundary wall of kitchen is consisted of brick and wooden lattice, so it can easily be removed and modified by a contractor.

Table 3.7 Correlation Between Housing Tenure, Original Area and Expansion Allocation

	Code	Floor Plan	Tenure	Original Area (m^2)	Expansion Towards						Expanded units	Total samples
					Front yard	Attic Roof	Common space	Kitchen	Neighboring units	Balcony		
1	RTA	1LDK	Ownership	34.5	3	0	1	0	0	0	4	10
2	RBH	1K	Ownership	24	0	0	0	0	0	3	3	10
3	RKD	2R	Ownership	18.5+L	0	2	0	0	9	5	9	10
4	RPE	1LDK	Ownership	22.2	0	0	0	4	0	7	7	10
5	RJRA	2LDK	Rental	37.8	0	0	0	0	0	0	0	10
6	RJRB	2LDK	Rental	27.6	0	0	0	0	0	0	0	10

+ The number of total units is less than the sum of left columns because of double count.

R. Kemayoran has many cases of connecting units, because of the smallest unit size and the common kitchen system. There are two methods of connecting. One is to make a hole on the boundary wall, and another is to remove the partition of balcony. The former way is found in 2 cases, while the latter is 4. And 2 cases adopt both methods and one case with no modification.

These extensions are only found at ownership RS, because dwellers have the right to remodel their own units. The important point is that the extension is not found at private apartments. This is because the building management rule at private apartment is more rigid, prohibiting the extension. The announcement of homeowners association of R. Bendungan Hilir-2 and R. Petamburan has the renovation rule that restricts modification at exterior wall. But according to dwellers' interview, they modify exterior wall with informal agreement of neighbors. Some dwellers paid money for neighbors to maintain other common part of their block building.

3.1.6.3 Customizing Regulations

At ownership RS, interior renovation is legal. Exterior renovation was forbidden in apartment samples 2 and 4 and was allowed with legal permission in the samples 1 and 3. As for rental RS, dwellers have obligation to clean and repair their dwelling unit and living space but are prohibited to add or change form/structure and service lines line (plumbing, etc.). Table 3.8 explains interior and exterior customizing regulations in the five RS complexes we visited.

Table 3.8 Housing Improvement Regulations in Each Surveyed Location

	Location	Tenure	Customizing Regulation	
			Interior	Exterior
1	TA	Ownership	N/A	Prohibited: dwelling expansion; private use of common part; change dwelling unit shape without legal permission
2	BH	Ownership	Plastering and Painting; Floor Tiling; Installing Lattice	N/A
3	KD	Ownership	N/A	N/A
4	PE	Ownership	Avoid leak problem from toilet renovation; Water drainage and sanitary maintenance	Prohibited: modified rear wall and front wall
5	JR	Rental	Obligation to clean & repair dwelling unit and living space	Prohibited: adding form/structure, utility line and installation

- **Infill Customization**

Despite of the regulations, due to the original bare-finishing, almost 100% of the RS units, both ownership and rental types, have their walls and floor customized. Wall plastering and painting and floor tiling are common customization works. Other popular works are placement of vinyl mat on the floor; molding decoration on the walls and ceiling boards (Table 3.9).

Table 3.9 Infill Customization Types

Location	Finishing Type for Wall, Floor, Ceiling (unit samples)					
	Wall Plastering / Painting	Floor Tiling	Vinyl Flooring	Wallpaper	Ceiling Board	Molding Decoration
TA	10	9	1	1	2	1
BH	10	8	2	0	0	0
KD	10	9	0	1	4	3
PE	10	8	2	0	3	0
JR	20	18	2	0	4	4
Total	60	52	7	2	13	8

- **Support Customization**

Dwelling expansion into common space area, as implication of floor plan arrangement often occurs at low-rise building for owned unit (Figure 3.7). Dwellers at middle-rise buildings also customize common space near their dwelling unit by painting, replacing openings, placing furniture (Figure 3.8).

Figure 3.7 Dwelling Expansions in RKD01 and RKD08

Figure 3.8 Individual Use of Common Space in RBH07 and RBH09

Dwelling customization by simply hiring contractors is popular in among different levels of household income in RS. Table 3.10 shows assisted customization is often connected to self-building for low income; however, the same couldn't be proved to middle high income cases.

Table 3.10 Household Income and Customization Method

Income (thousand IDR)	Units	Production Method			
		Professional Management + Hired Contractor	Self-Built	Self-Management + Hired Contractor	N/A
< 1,000	5	4 (80%)	3 (60%)	2	
1,000– 2,500	22	19 (86%)	9 (47%)	7	1
2,550– 4,500	19	16 (84%)	3 (19%)	1	1
4,550– 15,000	13	9 (69%)	3 (23%)	2	3
N.A	1	1			
Total	60	49 (82%)	18 (30%)	12	5

According to interview, it doesn't matter if the customization involves heavy work or just painting. If the dwellers have any crafting interest or crafting skill, they prefer doing the customization works by themselves. The customization cost for new construction is up to 1,000 (thousand rupiah), also the choice that made for material quality and component design will have impact at modification cost.

3.1.6.4 Industrialization of Infill Components

Contractor wages might be different according to their specialties, such as carpenters, masons and plasterers. Average wages for skilled contractors are higher than for ordinary contractors (Table 3.11 and Table 3.12). Skilled carpenters have wages between IDR 70,000 to IDR 100,000 per day. Skilled masons and plasterers have wages varying from IDR 55,000 to IDR 70,000 per day. Ordinary contractors have lower wages around IDR 30,000 to IDR 45,000 per day. According to BPS Monthly Statistical Bulletin of February 2010, general construction workers have nominal daily wage of IDR 56,864 and real daily wage of IDR 48,043.

Table 3.11 Cost of Building a Kitchen in Indonesia

No	Made-to-Order Suppliers	Contractor's Specialty	Daily Wage (IDR)	Production Cost (IDR)
1	Caravelle Kitchen	Kitchen Maker	> 75,000	3,400,000 /m3
2	CV. Mustika Maesa	Kitchen Maker	> 75,000	2,500,000 /m3
3	UD. Sinar Kasih	Wooden Housing Maker	75,000 – 100,000	2,000,000 – 3,000,000 /m2
4	Depot Jaya Board	Ceiling Board Maker		85,000 /m2
		Partition Board Maker		150,000 /m2

* Interviews held in 2009

Table 3.12 Different Labor Wages for Onsite Construction in Indonesia

No	On-site Works	Specification	Daily Wage (IDR)
1	Publicly Supplied Construction	Skilled Contractor	55,000 – 60,000
		Ordinary Contractor	40,000 – 45,000
2	Privately Supplied Construction	Mason	50,000
		Ordinary Contractor	30,000 – 45,000
		Carpenter	70,000
3	General Construction	General Contractor	56,864 (nominal) 48,043 (real)

* Source: Statistic Indonesia, Economic Indicators February 2010

Contractor wages might impact production costs. For instance, made-to-order kitchen sets are costlier than standard kitchen sets (Table 3.11 and Table 3.13). As a result, RS dwellers prefer self-managed building methods, by hiring ordinary contractors, because it is a user-oriented option with low production costs. In turn, wealthier dwellers, which can afford hiring skilled contractors, will not mind higher production costs because that will provide user-oriented options with additional quality value.

Table 3.13 Cost of Different Works in Indonesian Public Housing

No	Works	Specification	Production cost (IDR)
1	Finishing	Ceramic	82,000 /m2
		Plaster	26,000 / m2
		Interior Painting	16,000 – 19,000 /m2
		Exterior Painting	29,000 /m2
2	Construction	Brick Wall	83,000 /m2
		Counter kitchen, fitting: sink, faucet, ceramic	942,000 / item

* Rental Rumah Susun Division, Public Works Department, Jakarta, 2009

The original bare-finishing of RS units creates a demand for dwelling customization right after the dweller moves in. Without proper remodeling regulations and effective decision-making management, dwelling customizations do not present any design or technical streamline. A design streamline, for instance, could be defined by user choices for building components shape, material and sub component mechanism. Once the quality level of customizations relies on the contractor's skills, our analysis has revealed that customization in private apartments has higher quality than in RS. However, in terms of user choice, they have similar aspect, except for the quality of the chosen components, which might be related to amount of money the dweller is willing to spend. As the contractor's wage is low, dwellers can choose to hire them or not, and still have full control of decisions about the design, materials and manufacturing methods they will use. Hence, user choice in customization of RS barely depends on the contractor's ability or the designer's expertise (Table 3.9).

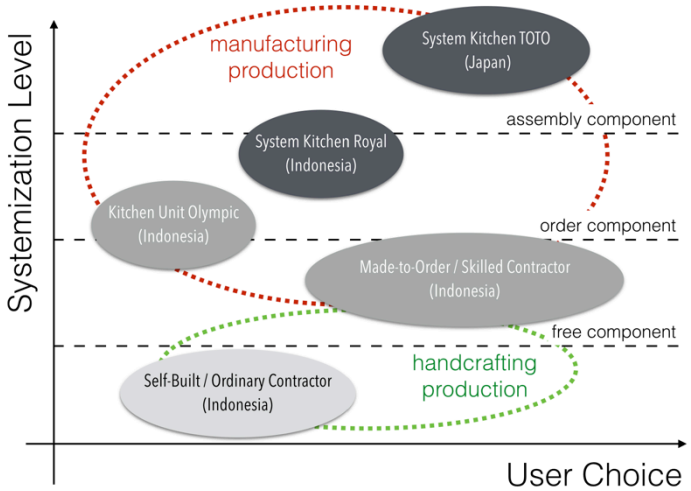


Figure 3.9 User Choice and Systemization of Indonesian Kitchen Sets

The analysis on customization of kitchen sets has shown different design quality levels relating three types of manufactured components: free components (independent, delivered separately), order components (interdependent, delivered separately) and assembly components (interdependent, delivered as a package). To exemplify, standard kitchen counters in RS and private apartments include handcrafted concrete counter top (free component) with manufactured stainless sink (assembly component), and walls finished with ceramic tiles (order component).

Without systemization, kitchen parts might reduce possibilities of variation to dwellers that can only afford hiring ordinary contractors and/or purchasing inexpensive materials. Instead, made-to-order customizations planned by design professionals, or skilled contractors offer a wider range of variations, such as materials and finishing methods, cabinet models and built-in appliances.

Even though assembly components are currently produced in Indonesia, the user choices they offer still encompass a narrow range of options. For instance, standard parts such as cabinet and sink can only gave their color and shape chosen. Although kitchen cabinets are generally regarded as system products, with high variability, in the case of Indonesia, since the industry produces few variations of its standard components, the combination possibilities are still reduced.

3.1.7. Conclusions About Apartment Customization Practices in Jakarta

In Indonesia, the distinction between skeleton and infill parts is unclear, leading to risky works, such as accidental removal of bearing walls or addition of wing walls overloading the structure. Improving quality of dwelling adaptations in Indonesia requires decoupling the building parts and establishing proper regulation of levels of decision-making and utilization (Table 3.10).

Figure 3.10 Decision Making Levels in Jakarta

SI System	Skeleton			Infill
4 parts	Base Building	Common Elements	Boundary Elements	Interior Elements
Use	Common	Semi-Exclusive		Exclusive
Guidelines	Collective	Intermediate		Individual
Decision	HOA	Group of dwellers (i.e. by block)	Sub-group of dwellers (i.e. by floor)	Dwellers

Due to its clear span floor, and flexible pipe system, the support infill system may provide the quality and adaptability level required in Indonesian dwellings. The unfinished and half-finished approaches employed in the public housing supply may suit the short-term home personalization needs of lower income populations, but for long-term purposes, the room areas should be increased, or provide expansion buffers to prevent structural overload caused by uncontrolled expansions.

Moreover, self-managed customization is very popular in RS because lowers production cost and makes the customization works affordable for middle to low income community. However, low cost production is typically associated with ordinary labor assistance and lack of law enforcement during customization process, inhibiting the creation of a quality streamline to protect the integrity of buildings.

Finally, from the management perspective, Indonesian public housing skeleton design consists of two levels: the individual and the collective, corresponding respectively dwelling unit and common space. In order to improve the quality of customization works and housing development in Indonesia, it is required the regulation of these levels through decision-making and utilization.

3.2 THE CASE STUDY OF SEOUL

3.2.1 Background of Korean Housing Market

Within a few decades of the Korean War in the early 1950s, Korea had turned its economy into one of the largest in the world, even though, by then, it was one of the poorest. In the 1960s, rapid industrialization began, and at the same time, the housing supply did not meet the demand of a growing population with rising income. The prices of housing and land in Seoul during the 1970s and 1980s were extremely high. As a result, the government made a massive investment in new housing supply, announcing, in 1988, a two-million-unit housing project and a plan to develop five new satellite cities around the Seoul Metropolitan Area.

This action stabilized the housing prices, but also produced unwanted side effects in the national economy. Koh and Kim (2002) indicate that, in order to cool down the construction market, the government implemented policies based on the criticism that over-investment in the housing sector lead to consequences such as rocketing material prices, labor shortage and fraudulent construction using unqualified materials such as unwashed (salty) sand from the sea.

In 2000, eighty percent of the population was living in urban areas, and without an adequate housing supply, an urban housing shortage would always be the likely natural consequence of the increasing population. The overall economy had recovered from the temporary shock but the housing market did not fully recovered. Sudden drops in the housing supply led to price run-ups in the early 2000s. House prices showed spikes and apartment prices in particular soared very rapidly.

In response to these price variations, the government announced a series of policies in order to 'eradicate housing speculation' (Chung, 2006; and Du et al., 2007). For instance, the Korean government has been encouraging the shift of the housing fund systems from pre-sale to post-sale. In the pre-sale system, housing construction firms could sell houses before the construction began and the customers had to pay about 80% of the housing price. But, in the post-sale system, construction firms can sell the units after 40% of completion, and thus, they need to raise funds before selling the housing units, bearing loan interests until they are sold out (Shin et.al.,2008).

Finally, homeownership corresponds to 56% of housing tenure in Korea. Another 37% of the households live under two unique types of rental contracts: Jeongsei and Wolsei. Under a Jeongsei contract, a tenant pays an upfront deposit at the beginning of the contract term and makes no monthly payments during the contract period (usually two years). Under Wolsei a tenant pays a lower upfront deposit than a Jeongsei tenant would, but then pays monthly rent based on the difference between the Jeongsei deposit and the Wolsei deposit multiplied by a market interest rate. Jeongsei and Wolsei tenants take their deposits back at the end of the contract period. There is yet another type of rental contract, Sagulsei, under which the tenant pays the full rent up front.

3.2.2 User Oriented Housing Provision

In Korea, dwelling customization can happen in three different stages according to the contractual relationship between dwellers, designers, developers, construction companies, and interior renovation service providers (Figure 3.11).

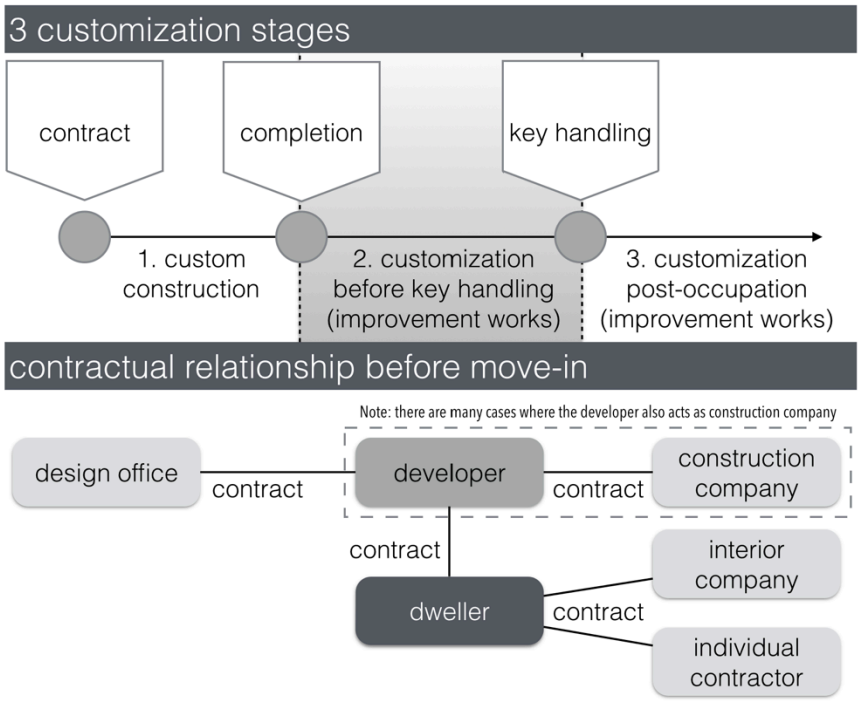


Figure 3.11 Infill Delivery Systems in Korea

1. Custom construction (services offered by the developer until building completion);
2. Customization before key handling (services offered by interior suppliers between completion and move-in period);
3. Customization post-occupation (services hired autonomously after move-in period);

In before move-in customization (cases 1 and 2), the purchase contract separates residential development from interior services, allowing distinct relations between purchaser vs. developer, and purchaser vs. interior company. That makes possible to coordinate dwelling unit customization works during the construction period, with relative freedom of choice. It is also common that, before the move-in period, interior design companies rent one apartment unit from a homeowner, and create a sample room or "showroom", which will be open for exhibition to attract prospective clients about one month to the end of the construction activities. The benefit in rental housing is to have carpentry work at low costs.

3.2.3 Urban Context of Seoul

Seoul is the capital and the largest metropolis of Korea, constituting the core of the Seoul Capital Area, which includes the surrounding Incheon metropolis, and Gyeonggy province. Its metropolitan area has become the most densely populated in the OECD in Asia, in 2012, and the second worldwide, after Paris.

Seoul used to be surrounded by a massive circular stonewall to protect its citizens from wild animals, thieves and attacks, until the 19th century, when its gates were open for international trade and modernization. In 1910, the city walls were removed, the city roads were paved, and the buildings were westernized, after an annexation treaty that incorporated the Korean territory to the Empire of Japan. The city was liberated after the World War II, but a few years later, during the Korean War, it changed hands again, between Russia and North Korea, becoming heavily damaged, having the capital temporarily relocated to Busan. After the war, Seoul began a reconstruction process. In 1960, as Korea's economy started to grow rapidly, stimulating the urbanization process, and attracting people to Seoul and other larger cities. Now, Seoul is the economic, political and cultural hub of Korea, being the headquarters of large companies, such as Samsung, Hyundai, POSCO, and LG.

Seoul has faced a housing boom in 2006, when its housing prices rose almost 20%, then the government took some cooling measures, imposing controls on housing loans, and increasing capital gain taxes on "speculative areas". These were followed by house price declines, triggered by a large number of unsold newly built housing and the global crisis in the mortgage market in 2008. Since 2010, the government has implemented several measures to ease real estate lending restrictions and restore confidence in Korea's house building companies reducing the number of unsold newly built housing from 123,297 units in 2009 to 69,807 units, in 2011.

Table 3.14 Housing Finance Information of Seoul

Entry	Data	Source
City:	Seoul	-
Country:	Korea	-
Population:	9,794,304	SMG (2010)
Territory (km^2):	605.25	SMG (2010)
Density (people/km^2):	16,182	SMG (2010)
Number of households:	3,577,497	SMG (2010)
Average household size (people/household):	2.74	SMG (2010)
Urban population (%/total, national):	82	WDI (2013)
Urban population growth (%/year, national):	0.6	WDI (2013)
Annual average % change in median house prices (national):	0.38	IMF (2014)
Monthly rent prices (in USD) for		
1 Bedroom Apartment in City Center:	1,012.27	NUMBEO (2015)
1 Bedroom Apartment Outside of City Center:	629.59	NUMBEO (2015)
3 Bedroom Apartment in City Center:	2,999.71	NUMBEO (2015)
3 Bedroom Apartment Outside City Center:	1,850.45	NUMBEO (2015)
Purchasing price per m^2 median quality apartment (in USD)		
In the city center:	11,370.33	NUMBEO (2015)
Outside the city center:	4,252.48	NUMBEO (2015)
Average monthly disposable salary:	2,828.02	NUMBEO (2015)
Mortgage interest rate (%/year):	4.1	NUMBEO (2015)

3.2.4 Survey Outline

Built on the observation of 34 multi-story dwelling units within Seoul and Incheon a fieldwork was carried through user interviews, floor plan measurement, photo and video shooting of the units and the condominium environment. In addition, it was carried interviews with condominium management offices in order to clarify general management procedures, and details about balcony expansion and remodeling activities. Construction companies, design firms, interior suppliers and kitchen makers were also interviewed regarding remodeling works and issues. In the first survey (November, 2011) the samples were relatively larger and nearer to Han River; while in the second survey (October, 2011), in order to widen sampling diversity, narrower samples were chosen away from the Han River (Figure 3.12).

Figure 3.12 Seoul's Survey Map

Table 3.15 Sample Locations in Seoul

#	Code	Location	Year	Blocks	Households	Observations	Floor Plan	Unit Area (m²)
1	PN	Songdo	2005	18	1048	3	3LDK	108.9
2	PO	Songdo	2009	6	1596	3	4LDK	141.9
3	TU	Songpa	2007	46	3696	1	3LDK	108.9
4	GU	Gangnam	1979	7	560	3	4LDK	148.5
5	SO	Gangnam	1983	7	644	1	4LDK	120.5
6	DE	Gangnam	1999	1	19	2	`5LDK	254.1
7	BA	Seocho	1983	6	481	2	4LDK	181.5
8	GA	Yongsan	1998	9	1001	1	4LDK	141.9
9	ED	Songpa	2008	72	5678	2	3-4LDK	148.5
10	LE	Gangnam	2006	34	30002	4	4LDK	141.9
11	WO	Nowon	1992	16	180	2	1-3LDK	59.4
12	MO	Yang-cheong	1988	33	2276	1	3LDK	89.1
13	DD	Dongjak	2003	7	613	1	3LDK	108.9
14	DF	Seongbuk	1972	7	357	1	2DK	49.5
15	SA	Nowon	2006	4	225	1	3LDK	105.6
16	DU	Nowon	1998	25	690	1	3LDK	79.2
17	FA	Nowon	2000	11	436	1	3LDK	105.6
18	IP	Seongbuk	2005	15	782	1	3LDK	79.2
19	SH	Yongsan	1970	9	228	1	2DK	49.5
20	PU	Nowon	2001	14	1601	1	3LDK	75.9
21	HA	Nowon	2001	25	3003	1	4LDK	148.5

3.2.5 Sampling Characterization

3.2.5.1 Household Profile

From the dwelling units observed, 17 are owned, and 17 are rented (Jeongse). Within these cases, there were seven units that were rented after purchasing another residence. Within the group of homeowners, 60% of the users pursuit permanent residence. Within home tenants, in households that do not own a second house, 30% of the users pursuit permanent residence; whereas, households with a second house described a temporary sense of staying until they raise their children and chose the living environment to suit the family's life stage. The reason for move-in, regardless of the tenure type pointed the children's education in many cases. In addition, there was no correlation between household income and renovation costs, but from interview, it was often observed fund raising through parents support and resale profit. Households' structure is majorly composed of nuclear families, and the numbers of dwellers per household usually vary from 2 to 4 people.

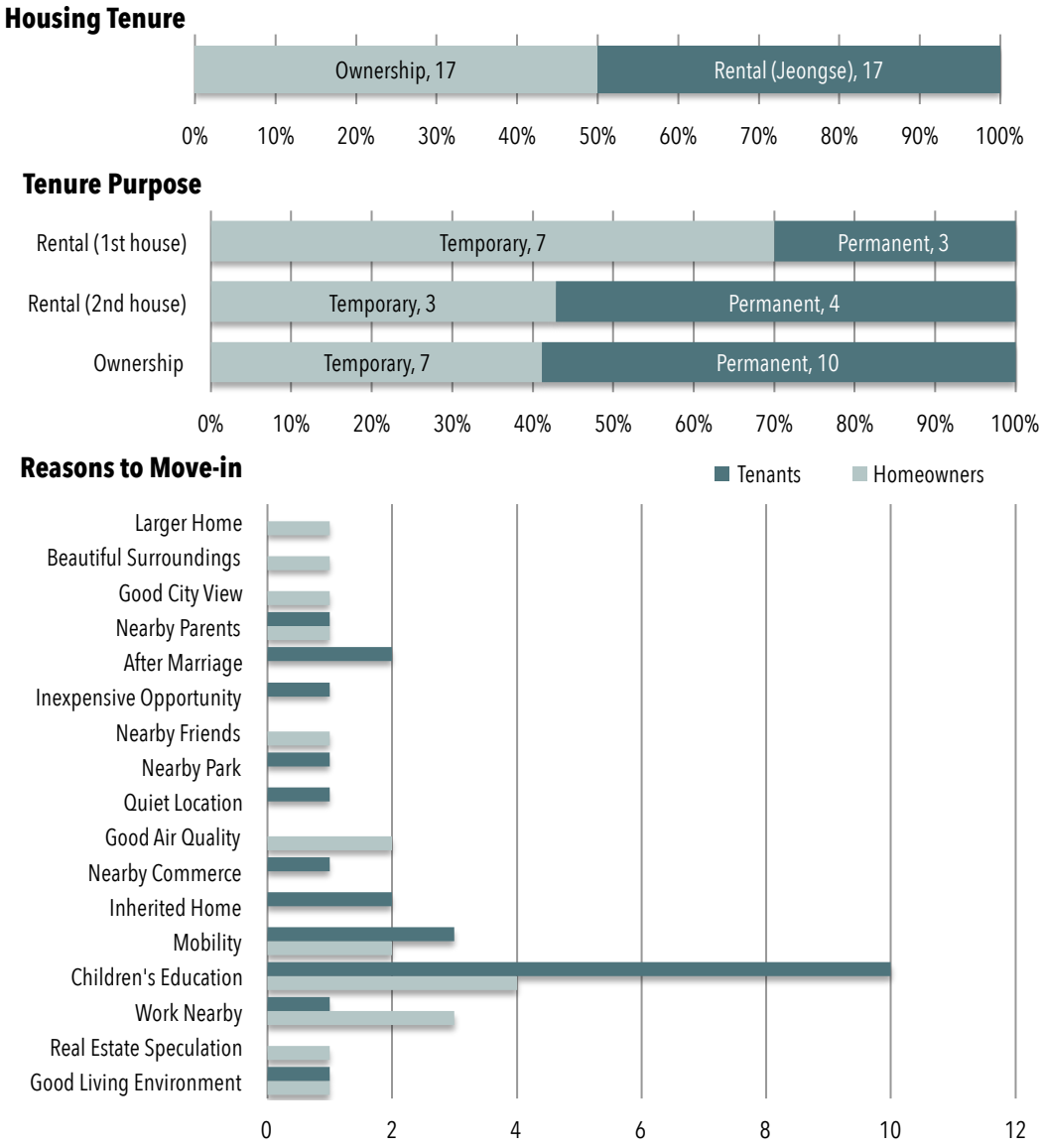


Figure 3.13 Household's Tenure and Purpose

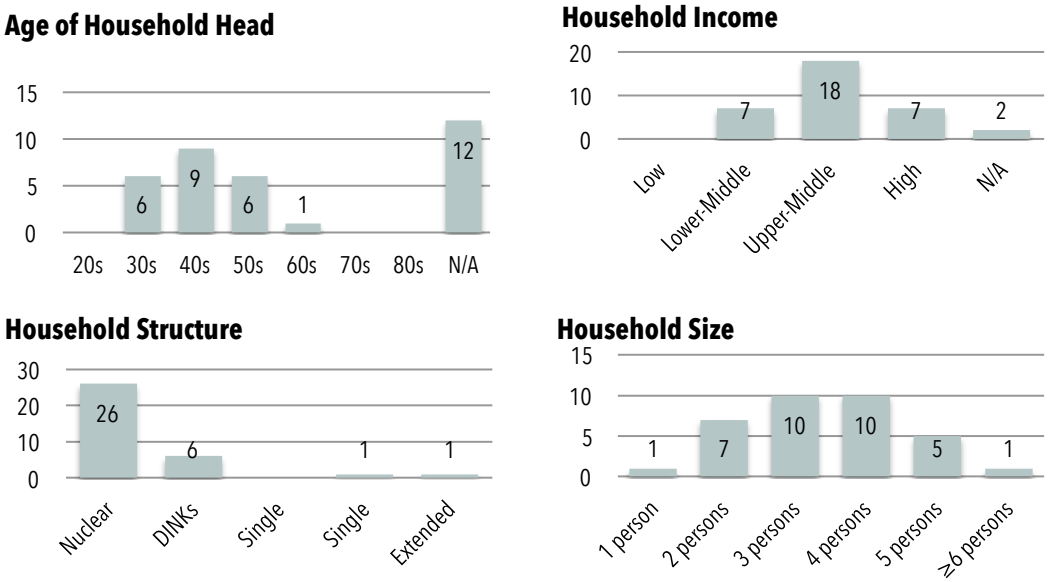


Figure 3.14 Household's Profile

3.2.5.2 Original Floor Plan Classification

In Seoul it was observed the prevalence of high-rise buildings up to 64 stories, with an average of 20 towers and 2600 households per complex. Building ages vary from 2 to 30 years, and years of residence vary from 15 years to less than 1 year. Dwelling unit areas vary from 100 to 165 square meters mostly composed of three to four bedrooms.

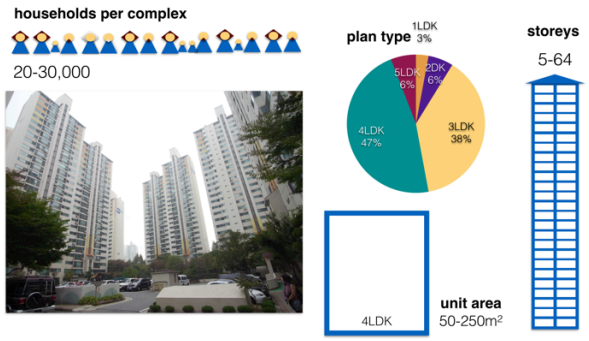


Figure 3.15 Original Design Features

3.2.6 Research Findings

3.2.6.1 Individual Decisions

Within 34 samples, it was found 6 cases of custom construction, 8 cases of custom finishing, 8 cases of primary post-occupancy improvements and 17 cases of secondary post-occupation improvements.

1) Custom construction (before completion)
In a total of 6 samples built in 2006 or later, most renovations consist of balcony expansion including complementary services such as built-in furniture, or partition walls. Finishing replacement is also popular.

2) Custom finishing (between completion and move-in period)
Renovations include wide range of works from balcony expansion to finishing replacement and built-in furniture. Works such as wallpaper and tile replacement, as well as installation of floor heating, including handcraft activities at the construction site are prominent.

3) Primary post-occupation improvements
There were many cases in which the owner did renovation works prior to the dwelling sale or lease, for investment purposes. Together with the usual services, like balcony enclosure, built-in furniture, and finishing replacement, exchange of plumbing equipment and components" are also being carried out.

4) Secondary post-occupation improvements
Regardless of the housing tenure, at this point, the renovation works aim to suit the current resident's lifestyle and hobbies, even in rented apartments, there is user investment mainly focusing on finishing and furniture replacement.

Table 3.16 Seoul's Dwelling Customization Data Base

		base building / common elements / boundary elements (unclear)					interior elements			
		functional level	layout level		finishing level	decoration level	functional level	layout level	finishing level	decoration level
#	Code	addition of bath and kitchen equipment and service lines	exterior relocation of partitions, openings		exterior replacement of finishing, fixtures and built-in furniture	exterior painting, free-standing furniture	renovation of bath and kitchen equipment and service lines	interior relocation of partitions, openings	interior replacement of finishing, fixtures and built-in furniture	interior painting, free-standing furniture
		extra bath/kitchen	dwelling expansion	balcony enclosure	ext. finishing / fixtures	exterior decoration	bath & kitchen equip.	interior partitions	int. finishing / fixtures	interior decoration
1	PN1	0	1	0	1	0	0	0	1	1
2	PN2	0	1	1	1	1	0	0	0	1
3	PN3	0	1	1	1	1	1	0	0	1
4	PO1	0	1	1	1	0	0	0	0	0
5	PO2	0	1	0	1	0	0	0	0	1
6	PO3	0	1	1	1	0	0	0	0	0
7	TU1	0	1	0	1	0	0	0	1	1
8	GU1	0	0	0	0	0	0	0	1	0
9	GU2	0	1	1	1	0	0	0	1	1
10	GU3	0	0	1	1	0	0	1	1	1
11	SO1	0	1	0	1	0	1	0	1	0
12	DE1	0	1	1	1	0	0	0	1	1
13	DE2	0	1	0	0	0	0	0	1	1
14	BA1	0	0	1	1	0	1	1	1	1
15	BA2	0	1	0	1	1	0	1	1	0
16	GA1	0	0	1	1	1	1	1	1	1
17	ED1	0	1	0	1	0	0	0	1	0
18	ED2	0	0	1	1	0	0	0	0	0
19	LE1	0	1	0	0	0	0	0	0	1
20	LE2	0	0	1	1	0	0	0	1	0
21	LE3	0	1	1	1	1	0	1	1	0
22	LE4	0	1	1	1	0	0	0	1	0
23	WO1	0	1	0	1	0	1	0	1	1
24	WO2	0	0	0	0	0	1	0	1	1
25	MO1	0	0	1	1	0	1	1	1	1
26	DD1	0	0	0	1	1	0	0	0	1
27	DF1	0	1	0	0	1	0	0	1	0
28	SA1	0	1	1	1	1	0	0	1	1
29	DU1	0	0	0	0	0	0	0	1	1
30	FA1	0	1	0	1	0	1	0	1	1
31	IP1	0	0	0	1	0	0	0	1	1
32	SH1	0	0	0	0	0	1	0	1	1
33	PU1	0	1	0	1	0	1	0	1	1
34	HA1	0	0	1	1	1	1	0	1	1

3.2.6.2 Remodeling Troubles

1) When asked to the interior supplier
Mainly, these are troubles that cannot be handled by the interior suppliers' after-service (hereinafter AS). However, there were also cases where the supplier can setup a company to pay the full cost of construction when AS period is over (Table 3.16). In addition, there were observed troubles related to unqualified contractors, such as accidental removal of bearing walls during balcony expansion project.

2) Troubles associated with balcony expansion
There were found issues directly related to the balcony expansion such as heat loss on winter and condensation. In cases which the previous owner did the expansion, there were troubles such as not being able to grow plants, or it simply does not match the user lifestyle (Figure 3.16). In addition, there were found cases of condensation caused by incompatibility in the choice for balcony enclosure or not in upper and lower stories.

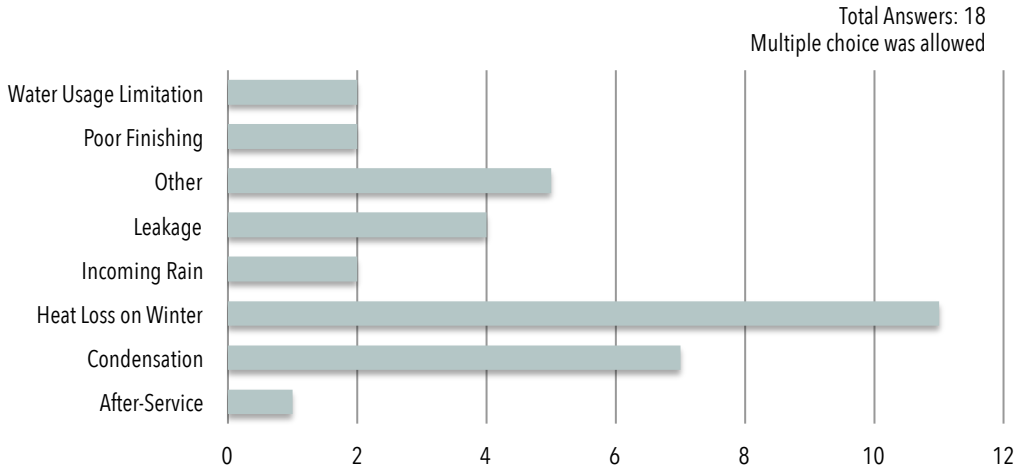


Figure 3.16 Remodeling Troubles

3.2.6.3 Permissions associated with the extended balcony

Post-occupancy improvements require permission by the condominium management office, in order to prevent problems such as noise, expansion of neighboring balconies, and so on. Further, since 2006, balcony expansions require permit application in the ward office. It could be observed, in some of the case studies, that the interior company takes care of all of the procedures associated with construction.

Sample 8 (GA1)	Ownership / Existing Dwelling
Family Structure	DINKs (50s)
Year of Move-in / Customization Period	2000 / before move-in and post occupation
Story Allocation / Unit Area	7F / 141.9
Household Income (monthly)	KRW 10,000,000 (USD 9,000)
Remodeling Work Duration	Before move-in: 2 months

Notes:
Built in 1998, it was rented for two years. The first customization work was carried out right after the construction completion, after the tenants had moved-in. The wallpaper replacement cost around KRW 10,000,000 (USD 9,000).
The interior company inspected every day of construction, and also included after-service warranty of one year. This after-service was required within the one-year period.

Customized content:
Balcony enclosure, replacement of plumbing and wirings, relocation of partitions, finishing and furniture replacement.

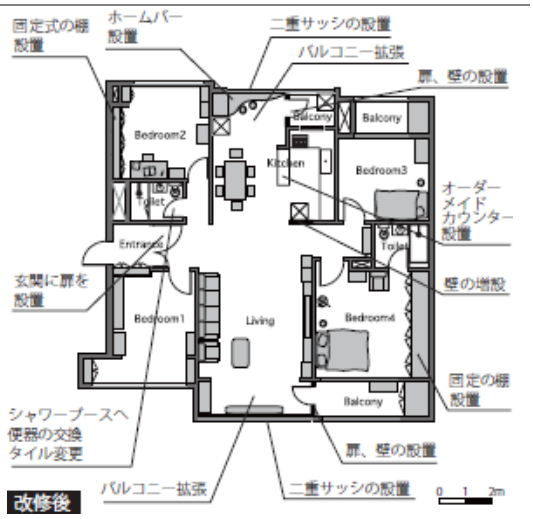


Figure 3.17 Remodeling Example

3.2.6.4 Remodeling Motivations

From interview, it could be assumed remodeling motivations can be classified into six categories: 1) room optimization, 2) sense of cleanliness, 3) lifestyle adaptation, 4) investment purposes, 5) appearance improvement, 6) fixing prior remodeling issues (Figure 3.18).

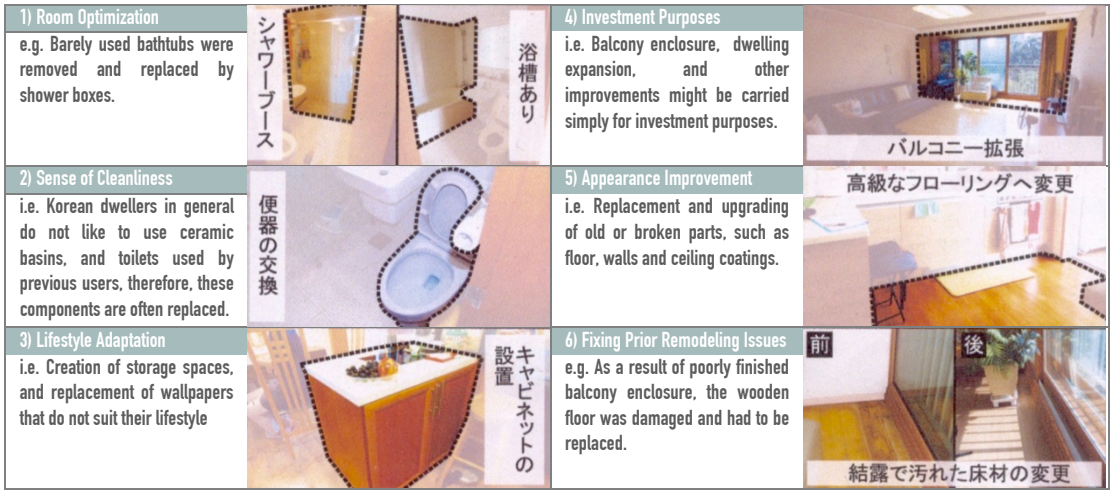
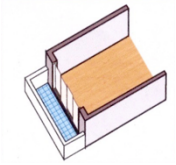
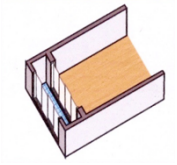
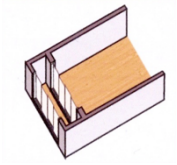
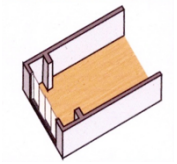
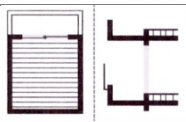
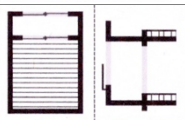
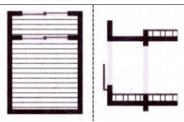
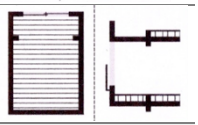


Figure 3.18 Remodeling Motivations

3.2.6.5 Considerations about SI Division Through Balcony Analysis

Balcony use could be classified according to Table 3.17

Table 3.17 Balcony Types According to Usage

	Standard Type	Type A	Type B	Type C
Sketch Model				
Floor Plan /Cross Section				
Addition of exterior glazing	X	O	O	O
Glass door removal	X	X	X	O
Removal of floor drain and curb	X	X	O	O
Spatial feature	None in particular	Treated as an outdoor space. Activities usually involve water usage, such as laundry and gardening.	Treated as an indoor space. Generally used as a solarium.	Treated as a dwelling expansion resource. Used as an extended portion of a contiguous room.

Type C is common often in living rooms and small rooms (R2, R3). Type A is common in master bedrooms. Service balconies (kitchen and laundry rooms) are mostly classified into A and B type. In the case of C type, there is a tendency of connection with the neighboring balcony.

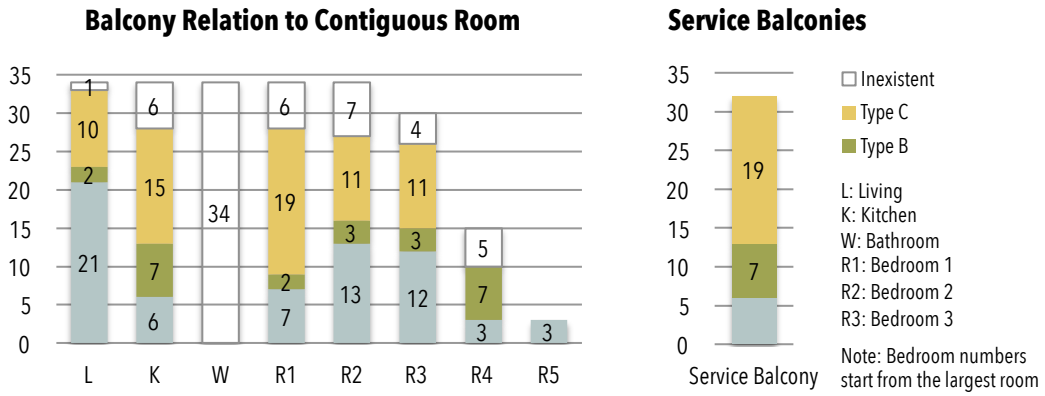


Figure 3.19 Classification of Balcony Samples

1) Type A: Usually connected to master bedrooms or kitchens. Expanded living rooms connected with balconies mostly present partition wall isolating the master bedroom to avoid direct access, protecting couples privacy.

2) Type B: Common in service balconies, it is possible to control the air temperature by closing the inner sash.

3) Type C (extended): Usually related with expansion of living, room 2 and room 3. There were two dwelling units (samples 22, 23) that had furniture, such as bookshelves, separating rooms next to each other in L-shaped balconies.

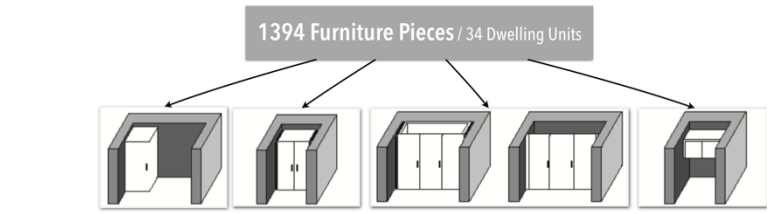
3.2.6.6 Industrialization of Infill Components

The purpose of this section is to investigate, by photo and video analysis of the dwellings visited, how much handcraft work is added to build the households furniture and equipment in order to clarify the level of development of the infill industry.

First, we identified 1394 furniture pieces within 34 dwelling units and classified into three categories according to their architectural linkage:

- Free-standing furniture: built for independent use and arrangement, entirely movable;
- Molded furniture: modular pieces with external adjusting board frames, partially movable;
- Built-in furniture: built as part of the building, fixed.

However, because of the absence of superficial gaps between the furniture and the walls, in some samples, we could not distinguish if the furniture is mounted or built-in, so we preferred to put these samples in another category, that we named "fit furniture". Also, minimal gaps (about 1cm) were disregarded in the classification process. Therefore, the classification was performed in two stages. In the first stage we classified the furniture in the three types mentioned above.



Name	Free-Standing Furniture	Molded Furniture		Built-in Furniture
Definition	movable, independent	modular piece, adjusted with frames	modular piece, adjusted with frames, without visible gaps between walls, and ceiling	built as part of the building
Example	sofas, beds, desks, shelves	wardrobes, shoeboxes, cabinets	wardrobes	wardrobes, cabinets, counters

Figure 3.20 Furniture Classification According to Architectural Linkage Level

The second stage classification is focused on sorting the furniture considered "fit". In order to classify the pictures into categories, we plotted them into a frame using the Cartesian method. In the latitudinal axis we evaluate the furniture dependence in terms of integration with the architecture and how easy it is to move it. In the longitudinal axis we evaluate the furniture production according to how close to standard or custom design. The results were the following: in 34 adapted dwellings, we could identify 1394 furniture pieces, from which 1124 are classified as entirely movable standard furniture, 11 pieces are entirely movable custom furniture, 42 pieces are custom furniture, 56 pieces are built-in furniture and 161 pieces are fit furniture, with buried surfaces (about 4.7 items/household). According to interview, storage space is not enough in Korean dwellings and there is meaningful demand of furniture for this purpose. Mounted and built-in furniture pieces are very common, with 259 in total (about 7.6 items/household).

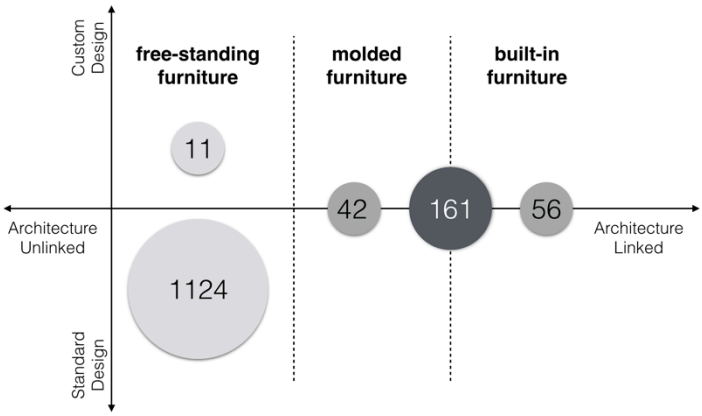


Figure 3.21 Furniture Classification According to Standardization Level

Continuing the classification by sorting the 161 furniture pieces understood as fit furniture at the first classification. By looking to these furniture pieces we want to clarify how much of the construction is performed by the workman onsite and offsite in order to create this perfect fit. Using again the Cartesian plot, we classified the samples into four groups according to their level of standardization and demand of onsite works. Summing the samples classified as groups 1, 2, and 3 we got 159 furniture pieces with high demand of onsite works. As of group 4, we found only 2 furniture pieces.

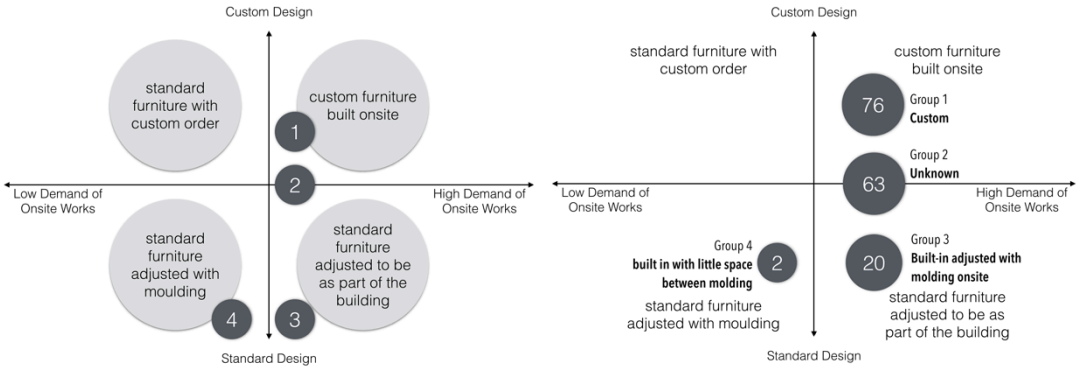


Figure 3.22 Furniture Classification According to Demand of Onsite Works

As a result, we conclude that, whether the furniture is built-in or modular, the tight gaps between the ceiling and walls reveal that it was used handcraft work onsite to make the adjustments. This suggests hiring a contractor to make the fitting work might also be affordable to the Korean user.

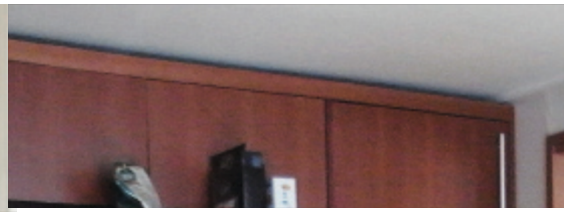


Figure 3.23 Example of Handcraft Fitting (left)
Figure 3.24 Example of Manufactured Fitting (right)

On the other hand, looking at the renovation of sanitary fixtures, although it was found the presence of conventional construction methods as of replacement of plumbing and bathroom equipment, the large amount of component replacements, such as tiles, toilets, basins and sinks reveals advances in the production of sanitary components.

Table 3.18 Renovation Regarding Sanitary Fixtures

		Ownership Apartments (17 samples)		Rental Apartments (17 samples)				
		Owner's Investment		Owner's Investment		Tenant's Investment		Unclear
		Newly Built	Existing	Newly Built	Existing	Newly Built	Existing	
Bathtub	Bathtub removal and conversion into shower box	0	4	0	1	0	2	1
	Bathtub replacement	0	1	0	0	0	0	0
Wash basin	Wash basin replacement	0	3	0	0	0	0	0
Toilet bowl	Toilet bowl replacement	0	5	0	0	0	0	0
Sink	Kitchen sink replacement	0	7	0	1	0	1	2
Other	Plumbing replacement, or relocation	0	1	0	0	0	1	0
	Installation of kitchen counter with built-in induction cooktop stove	0	1	0	0	0	0	0
	Tile replacement	1	6	0	1	0	1	0

Observing the workers wage across South Korea, a large income gap can be noticed. In comparison with the average monthly income of a tile craftsman and a carpenter to the average monthly income of a person who lives in Seoul, hiring their service can be considered affordable (Figure 3.25). In addition, there is a wide range of autonomous contractors, making craftsman services affordable even for families with low-income.

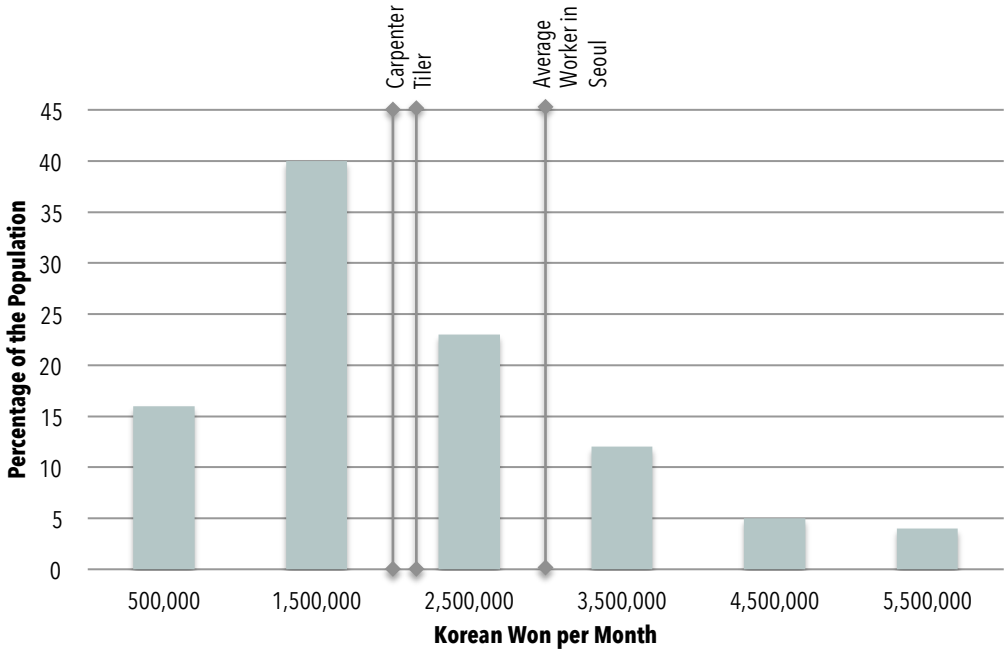


Figure 3.25 Wage of Construction Labor Compared to General Population in Korea (KOSIS, 2010)

3.2.7 Conclusions About Apartment Customization Practices in Seoul

Due to a series of political measures, dwelling customization has become commonplace, both in purchasing and renting agreements. Understood as an investment, it has increased housing improvement activities, and created new opportunities in the Korean housing market. However, the trivialization of dwelling customizing activity has led to the development of informality in the construction chain, resulting in problems such as building pathologies caused by irregular dwelling expansions, and interior design companies deprived of skilled professionals.

Technological development and marketing mechanisms such as individual contractors subcontracted by a major interior design company enable distinct remodeling sites on simultaneous undergoing construction within periods of two or three months. Moreover, with a user-oriented market approach that supports individual decisions to reach boundary elements has enhanced dweller's freedom of choice, increasing the range of customizing housing elements, such as balconies, entrance doors, window sashes.

Finally, although it can be observed a meaningful progress in the production of furniture and bathroom and kitchen equipment, the social gap in Korea still makes affordable to people of any income hiring a contractor (highly skilled or ordinary) to carry out handcraft finishing works to fit off-the-shelf furniture modules, or make small adjustments to suit the user's needs.

Table 3.19 Decision Making Levels in Seoul

SI System	Skeleton		Infill	
4 parts	Base Building	Common Elements	Boundary Elements	Interior Elements
Use	Common		Semi-Exclusive	Exclusive
Ownership Housing				
Guidelines	Collective		Intermediate	Individual (Homeowner)
Decision	Homeowners Association (HOA)		Homeowner	
Rental Housing With Homeowner's Guidelines				
Guidelines	Collective		Intermediate	Individual (Homeowner)
Decision	Homeowners Association (HOA)		Homeowner	Tenant
Rental Housing With Tenant's Guidelines				
Guidelines	Collective		Intermediate	Individual (Tenant)
Decision	Homeowners Association (HOA)		Tenant	

3.3 THE CASE STUDY OF DALIAN

3.3.1 Background of Chinese Housing Market

Providing shelter for as many people as possible has been a key goal for every Chinese dynasty and regime since ancient times. Despite this long history, the promotion of private ownership of homes did not become a primary policy goal until after 1978. During the period between the founding of the People's Republic of China and 1978, all land was publicly owned. According to the Chinese Constitution, "No organization or individual may appropriate, buy, sell or lease land or otherwise engage in the transfer of land by unlawful means." When deemed appropriate, the government has provided the free right to use land without a time limit. This right, however, could not be transferred to other users. Resources were allocated through a working unit-employee linkage.

Things changed, however, with economic reforms that began in 1978. Since that year, China has gone a long way toward commercializing homes for its citizens. An important early step was allowing foreign investors to establish factories in several "special territories." A land occupancy charge was imposed on foreign enterprises in those territories and coastal cities in 1980 — the first time that the use of land had a price attached. It soon became clear that this action would lead to the privatization of land and the shelter on it. In the earlier era of a planned economy, housing, hidden compensation and other assistance measures were links between the working unit and the employee. To privatize state-owned enterprises, such links had to be broken — and an alternative housing system introduced.

Since 1998, there are three types of shelters for Chinese households: commodity houses, economically affordable houses and rental properties. In 2010, economically affordable houses accounted for merely 3% of all homes built, compared to nearly 25% at its peak in the late 1990s. Urban households can purchase either economically affordable or commodity houses. Local governments determine prices of economically affordable houses before these projects commence. Such residences are usually sold for 3% to 5% above total costs and targeted at families with low and medium incomes. Commodity houses are purchased and/or rented at prices determined by the market.

Currently, more than 80% of homes are privately owned. However, in China, ownership of residential properties is limited to a period of 70 years. Under current law, after this period expires, the right to use land and property will no longer belong to the current owner. Effectively, therefore, the owners are users of the property who lease the land for 70 years. There is some ambiguity about the law in this regard and its implication for property taxes, which has been the focus of some debate in recent years.

3.3.2 User-Oriented Housing Provision

In China, there are four basic approaches of user-oriented housing supply that differ according to the final cost and target consumer (Table 3.20).

Table 3.20 User-Oriented Housing Plan Types in China

1. Minimum Finishing Plan (Public Supply) Housing with minimum finishing was publicly provided from 1978 until the 1990s. State-owned, these dwellings had simple interior finishing and service lines and were ready-to-move after completion.	
2. Unfinished Plan (Private Supply) Unfinished plans are deprived of any interior finishing and provided only of service lines built regardless of a layout. Residents take charge of the finishing services, by hiring contractors, or interior companies before they can move in.	
3. Half-Finished Plan (Private Supply) This model came out after the release of fully finished plans, as an alternative of delivering ready-to-move skeleton dwellings to residents, while excusing them of the responsibility of carrying out these services. Therefore, after the skeleton is complete, and before handling the dwelling to the dweller, the developer takes charge of all the finishing, fixtures, service lines, bathroom and kitchen equipment.	
4. Fully Finished Plan (Private Supply) Delivered with the same aspect of half-finished dwellings, the interior of fully finished dwellings is planned before the skeleton construction.	

3.3.3 Urban Context of Dalian

Dalian is a harbor city in the south of Liaoning Province. Dalian is the province's second largest city, after the capital Shenyang. According to the Dalian Statistics Bureau (DSB), the total registered population in 2011 was 5,864 million households, with a net increase of 16 thousand over the previous year, of which the urban population accounts for 62 percent.

Throughout history, Dalian has experienced much foreign influence by the British, Russian and Japanese occupations, especially, in its peninsular portion, where is located Port Arthur. Named after the brief occupation by the British, Port Arthur was the main interest of its foreign occupiers, because of its warm waters, which wouldn't freeze in wintertime. The Russians and the Japanese, between battles and enormous civilian massacres, invested heavily in Dalian with the aim to transform it into a modern commercial port city. The Chinese government could only reincorporate the city, in the 1980s.

Dalian has had a continuous annual double-digit percentage GDP increase since 1992, and nowadays, it has been regarded as a financial, shipping and logistics center for Northeast Asia. In the city center, housing purchasing prices vary from USD 2,041 to USD 5,496 per square meter, while housing renting prices average is USD 486, for 1 bedroom apartments, and USD 1,001, for 3 bedroom apartments.

Table 3.21 Housing Finance Information of Dalian

Entry	Data	Source
City:	Dalian	-
Country:	China	-
Population:	6,690,432	NBSC (2010)
Territory (km^2):	12,573.85	NBSC (2010)
Density (people/km^2):	532.09	NBSC (2010)
Number of households:	5,864,000	DSB (2011)
Average household size (people/household):	2.98	NBSC (2013)
Urban population (%/total, national):	53	WDI (2013)
Urban population growth (%/year, national):	2.9	WDI (2013)
Annual average % change in median house prices (national):	-5.1	IMF (2014)
Monthly rent prices (in USD) for		
1 Bedroom Apartment in City Center:	487.11	NUMBEO (2015)
1 Bedroom Apartment Outside of City Center:	286.76	NUMBEO (2015)
3 Bedroom Apartment in City Center:	1,001.71	NUMBEO (2015)
3 Bedroom Apartment Outside City Center:	589.24	NUMBEO (2015)
Purchasing price per m^2 median quality apartment (in USD)		
In the city center:	3,744.97	NUMBEO (2015)
Outside the city center:	1,594.88	NUMBEO (2015)
Average monthly disposable salary:	514.61	NUMBEO (2015)
Mortgage interest rate (%/year):	5.52	NUMBEO (2015)

3.3.4 Survey Outline

For the present study we chose to work with contemporary dwellings with minimum finishing, unfinished, and half-finished plans. We obtained collaboration of 15 households, but 2 of them had to be excluded from our analysis because they remain with original aspect. Fieldwork activities were carried from August 11~23, 2013, in the metropolitan area of Dalian City, by the observation of 13 apartment units located in twelve housing complexes as shown below (Figure 3.26). We learned about their apartment customization practices, such as balcony enclosure, relocation of partitions, etc., and sketched before and after plans, based on actual measurement, accompanied by interior and exterior photo shooting. In addition, we interviewed two condominium management companies, two interior design companies, and one furniture maker.

Figure 3.26 Dalian's Survey Map

Figure 3.27 Sample Locations in Dalian

#	Code	Location	Construction	Observations	Floor Plan	Unit Area (m^2)
1	JI	Ganjingzi	2009	2	1LDK	58.5
2	JN	Ganjingzi	2009	1	2LDK	78.31
3	JH	Jinzhou	2010	1	1LDK	65.25
4	KY	Xigang	1994	1	2LDK	75.86
5	BU	Zhongshan	2003	1	1LDK	62.81
6	SI	Shahekou	1997	1	1LDK	49.91
7	PE	Ganjingzi	2009	1	2LDK	79.5
8	HO	Ganjingzi	2002	1	2LDK	85.62
9	RN	Ganjingzi	2009	1	2LDK	101.34
10	RA	Shahekou	2000	1	2LDK	99.36
11	DA	Shahekou	2012	1	1LDK	61.8
12	RH	Ganjingzi	2010	1	2LDK	87.9

3.3.5 Sampling Characterization

3.3.5.1 Household's Profile

12 out of 13 of the dwelling samples are owned, from which 7 were purchased by nuclear households pursuing a better place to accommodate the family. The other 6 households constitute of newly weds that had moved to their first home, and an elder person that moved into a new home with elevator access. The heads of household are mostly composed of people ageing around forty and fifty years old, with monthly wages averaging USD 1,500. Therefore, according to the World Bank classification of 2012, these households are mostly composed of lower-middle income families (Figure 3.28).

Figure 3.28 Household's Tenure and Purpose

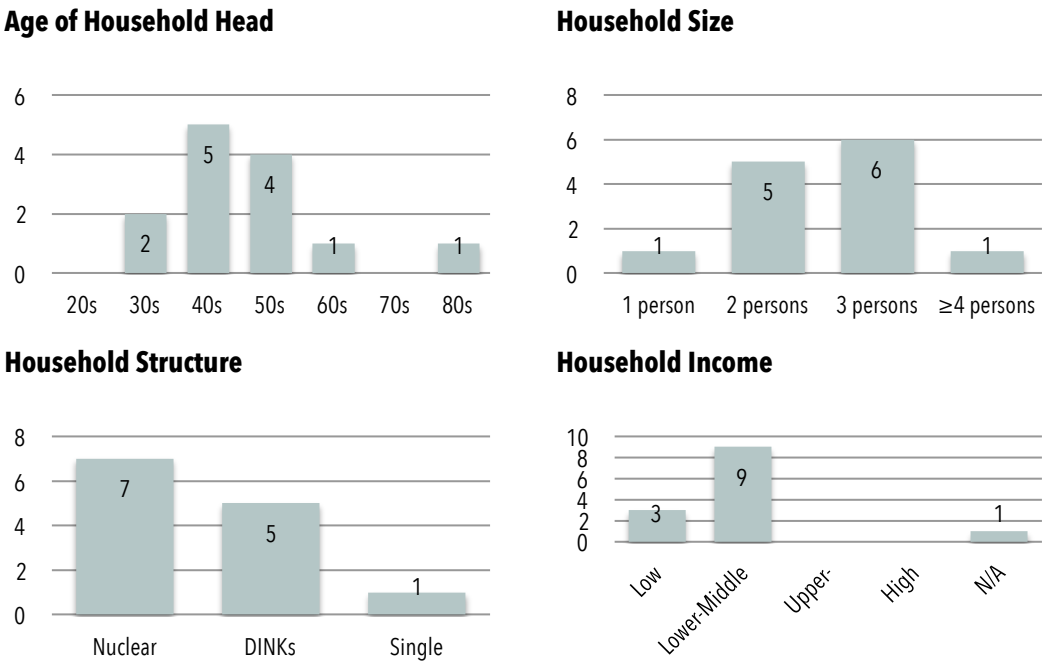


Figure 3.29 Household's Profile

3.3.5.2 Original Design Features

Regarding the architectural characteristics of the samples, 10 out of 13 dwelling were built in the 2000s and 2010s, privately supplied, and delivered deprived of any finishing, while 3 units were built in the 1990s in the old public supply system, which provided minimum finishing. In accordance with small family sizes, the number of bedrooms per dwelling unit varies between 1 and 2 bedrooms, with total area averaging 75m^2. Building heights vary from low and mid-rise, reaching up to 30 stories. The sample units' allocation will be used for the upcoming analysis.

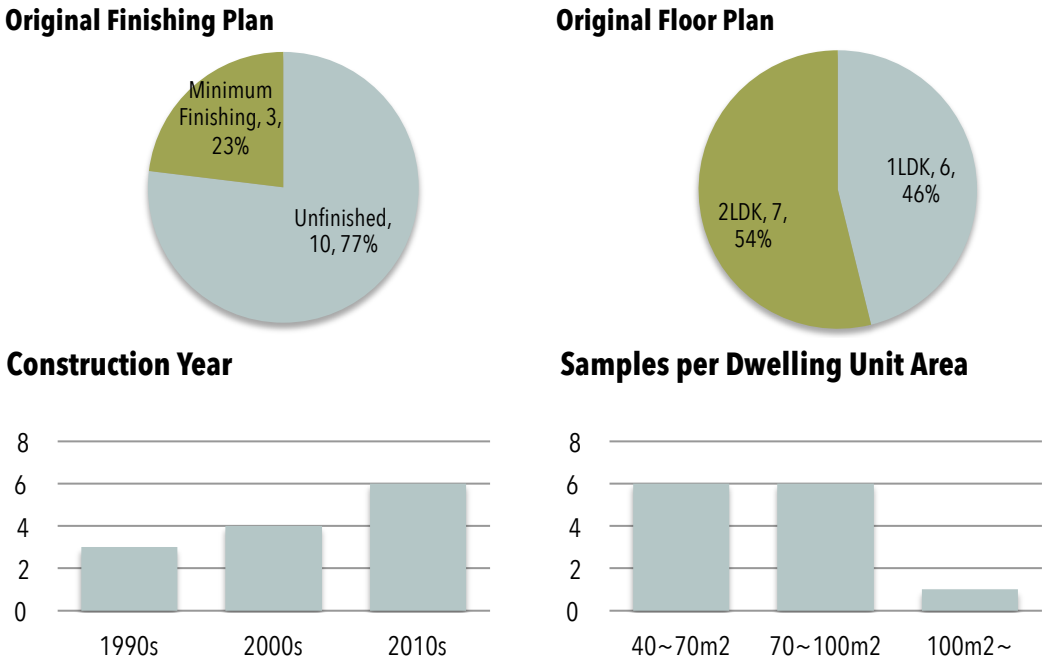


Figure 3.30 Original Design Features

3.3.6. Research Findings

3.3.6.1 Correlation Between Customization Expenditures and Households Income

According to interviews with interior design companies, an affordable interior plan service package in Dalian costs around USD 110 per square meter, while a high-class service package costs around USD 250 per square meter. Considering affordable packages as a basis, they generally include works such as wall plastering, simple ceiling decoration, painting, and placement of wooden floorboards, with the use of inexpensive materials.

Among our samples, 5 units were customized with costs under USD 110 per square meter, 6 units customized with costs between USD 110 and USD 160 per square meter, and 2 units customized with costs between USD 160 and USD 210 per square meter (Figure 3.31). Sample No. 3, which underwent full customization, was the most expensive, with an average cost of USD 210 per square meter.

According to Dalian Municipal Market Index Report, the average monthly of a contractor is about USD 750, which make their service affordable to the majority of lower middle-income households within our samples. The total customization investment average might vary between 1.2 to 12 times the monthly stipend of a lower-middle income family, and between 3.6 to 14 times the monthly stipends of a low-income family.

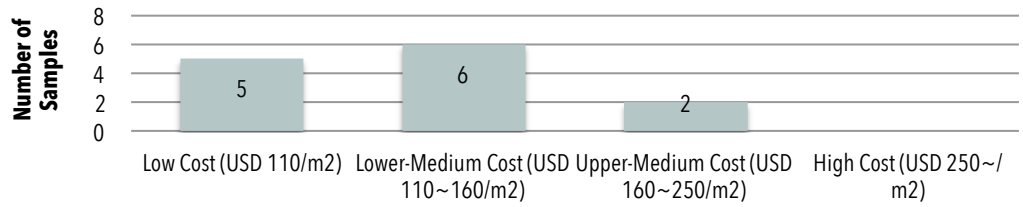


Figure 3.31 Dwelling Customization Costs

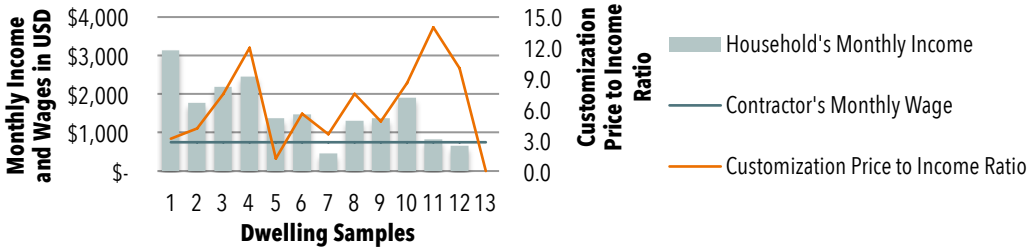


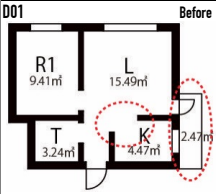
Figure 3.32 Customization Expenditures per Household

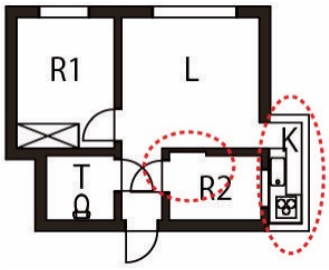
3.3.6.2 Customized Content

Dwellings that were originally provided of minimum finishing had minor superficial renovation. In turn, unfinished dwellings underwent relocation of service lines such as electric wires and water pipes, placement of wooden floorboards, wall coating with painting or wallpaper, ceramic tile coating of kitchen and bathroom areas, installation of shower boxes and toilets, and installation of various types of furniture (Table 3.22 and Table 3.23).

Table 3.22 Dalian's Dwelling Customization Database (1-2)

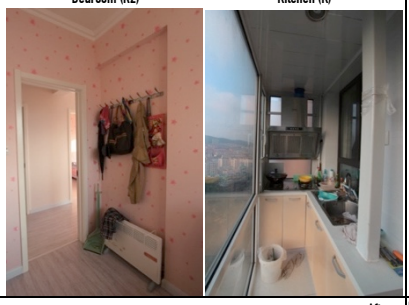
D01 Before / After



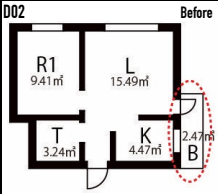


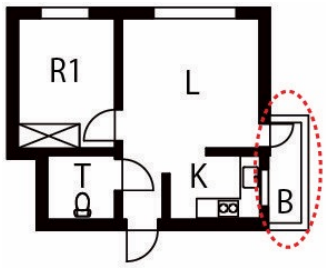
Remodeling Information
- I) Electricity, plumbing, heating system
- II) Balcony enclosure and conversion into kitchen
- III) Relocation of Partitions: R2
- IV) Wooden floorboard: R1, R2, L; Ceramic Tiles: T, K
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Bedroom (R2) / Kitchen (K)



D02 Before / After

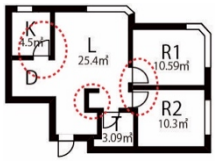


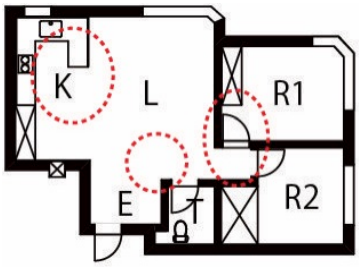


Remodeling Information
- I) Electricity, heating system
- II) Balcony enclosure and conversion into storage room
- III) –
- IV) Wooden floorboard: R1, L, K; Ceramic Tiles: T, B
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Kitchen (K) / Balcony (B)

D03 Before / After

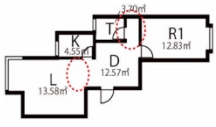


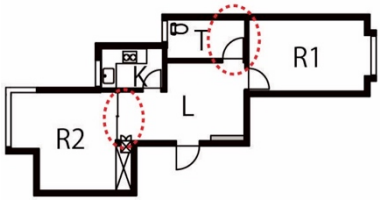


Remodeling Information
- I) Electricity, heating system
- II) –
- III) Relocation of Partitions: K, R2, E
- IV) Wooden floorboard: L, K, R1, R2; Ceramic Tiles: T
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Kitchen (K) / Access to Bedrooms

D04 Before / After

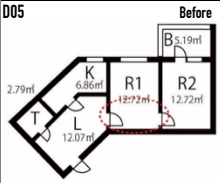


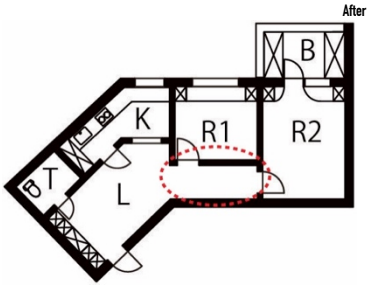


Remodeling Information
- I) Electricity, plumbing, heating system
- II) –
- III) Relocation of Partitions: R2, T
- IV) Wooden floorboard: L, R1, R2; Ceramic Tiles: T; Stone E
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Bathroom (T) / Bedroom (R2)

D05 Before / After

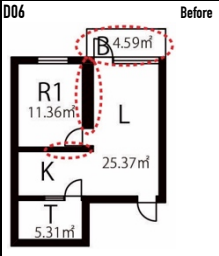


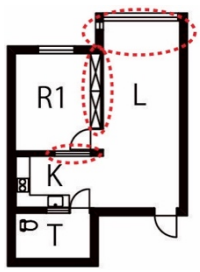


Remodeling Information
- I) Electricity, heating system
- II) –
- III) Relocation of Partitions: R1
- IV) Wooden floorboard: L, R1, R2; Ceramic Tiles: T, K
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Bedroom 1 (R1) / Bedroom 2 (R2)

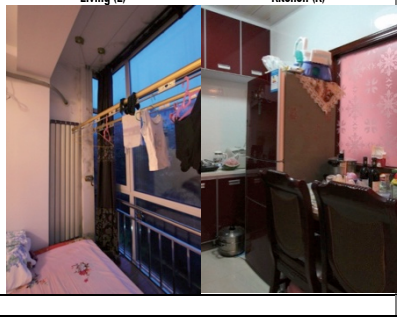
D06 Before / After





Remodeling Information
- I) Electricity, plumbing, heating system
- II) Balcony enclosure and living extension
- III) Relocation of Partitions: L, R, K
- IV) Wooden floorboard: L, R1; Ceramic Tiles: T, K
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

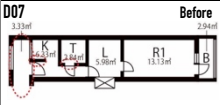
Living (L) / Kitchen (K)

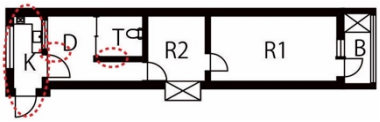


L(living); D(dining); K(kitchen); R(bedrooms); T(bathroom); B(balcony);

Table 3.23 Dalian's Dwelling Customization Database (2-2)

D07 Before / After

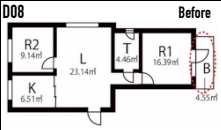


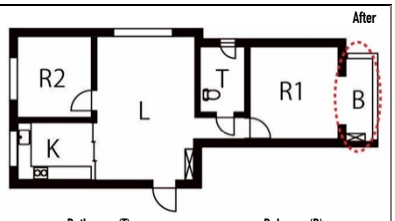


Remodeling Information
- I) Plumbing, heating system
- II) Dwelling expansion through common hall
- III) Relocation of Partitions: K, T
- IV) Wooden floorboard: R1, R2, B, D; Ceramic Tiles: T, K
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Entrance Hall / Kitchen (K)

D08 Before / After

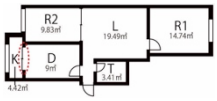


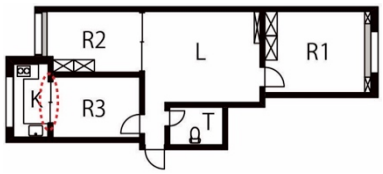


Remodeling Information
- I) Electricity, plumbing, heating system
- II) Balcony enclosure and conversion into storage room
- III) –
- IV) Wooden floorboard: L, R1, R2; Ceramic Tiles: T, K, B
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Bathroom (T) / Balcony (B)

D09 Before / After

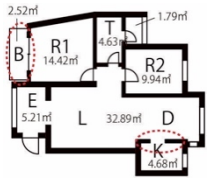


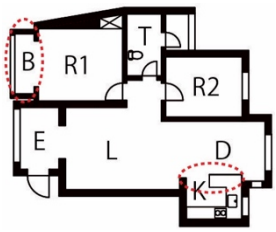


Remodeling Information
- I) Electricity, heating system
- II) –
- III) –
- IV) Wooden floorboard: L, R1, R2, R3; Ceramic Tiles: T, K
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Kitchen (K) / Master Bedroom (R1)

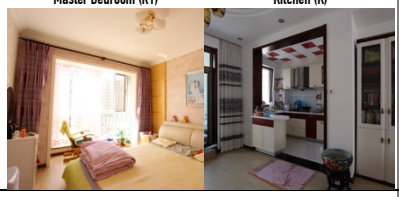
D10 Before / After



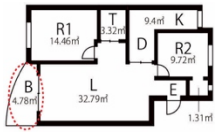


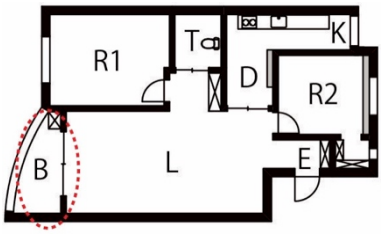
Remodeling Information
- I) Electricity, heating system
- II) Balcony enclosure and bedroom extension
- III) Relocation of Partitions: K, B
- IV) Wooden floorboard: L, B, R1, R2, D; Ceramic Tiles: T, K, E
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Master Bedroom (R1) / Kitchen (K)



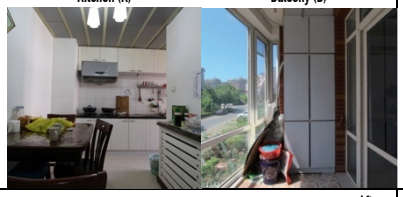
D11 Before / After



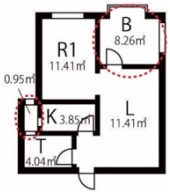


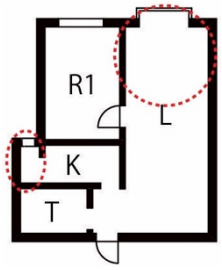
Remodeling Information
- I) Heating system
- II) Balcony enclosure and conversion into storage room
- III) –
- IV) Wooden floorboard: L, R1, R2; Ceramic Tiles: E, T, D, K, B
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Kitchen (K) / Balcony (B)



D12 Before / After

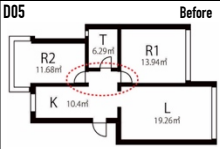


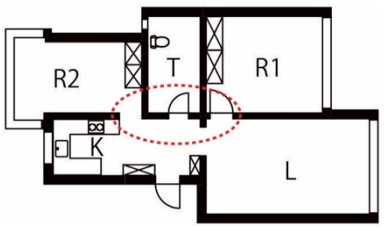


Remodeling Information
- I) Electricity, plumbing, heating system
- II) Balcony enclosure and living extension
- III) Relocation of Partitions: K
- IV) Wooden floorboard: L, R1, R2; Ceramic Tiles: T, K
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Kitchen (K) / Living (L)

D05 Before / After





Remodeling Information
- I) Plumbing, heating system
- II) –
- III) Relocation of partitions: T
- IV) Wooden floorboard: L, R1, R2; Ceramic Tiles: T, K
- V) Doors
- VI) Bathroom and kitchen equipment
- VII) Furniture

Entrance / Bathroom (T)

3.3.6.3 Grey Zones of Decision

- **Balconies**

It was observed that all the dwelling units that originally had open balconies (7 samples total) had them enclosed during customization (Table 3.22 and Table 3.23). Balcony enclosures could be classified in two types regarding the removal or conservation of the window frame that formerly separated the interior and exterior portion of the dwelling. Type A conserves the window frame, developing spaces such as storage rooms, laundry rooms, and kitchens. Type B removes the window frame developing extension of contiguous rooms (Table 3.24).

Table 3.24 Balcony Enclosure Types

	Floor Plan	Photo	Exterior Frame	Interior Frame	Floor Finishing	Uses	Samples
Original		-	No	Yes	None	-	-
Type A			Yes	Yes	Ceramic Tiles	Storage Room, Laundry Room, Kitchen	3
Type B			Yes	No	Ceramic Tiles, Wooden Boards	Living Room, Bedroom Extension	4

- **Entrance Hallways**

Entrance hallways in Chinese apartment buildings generally constitute collective property shared by the entire group of homeowners of a given building block. Real estate management companies often maintain these spaces, by carrying out cleaning services, replacing broken lights, repairing windows, etc., after notifying the dwellers. The primary function of entrance hallways is giving access to the apartment units. But, depending on the condominium, it might also be used for storing personal things, and in specific cases, it might be used for unit expansion.

For instance, in sample 7, which was remodeled in 1998, the owners of the two units that occupied that floor (1F) had talked to each other during the customization process, and made an agreement of dividing the entrance hallway in a half for their exclusive use. The owner of sample 7 chose to expand the area of his dwelling unit by merging part of the entrance hallway, and converting it into a kitchen (Table 3.3.4, 2-2). His neighbor preferred to increase his storage space, by building a shoebox in the hallway. Another example is sample 13, which was remodeled in 2010. Again, the owners of the two units in the top floor had talked to each other during the customization process, and made an agreement of converting the common entrance into exclusive entrance. It is important to notice, that the common portions that were turned into exclusive in both cases were not used by dwellers other than those involved in the agreement.

3.3.6.4 Industrialization of Infill Components

The purpose of this section is to clarify the development level of the infill industry by investigating how much onsite handcraft production is necessary to build infill components such as furniture and bathroom and kitchen equipment.

The furniture found within our samples could be classified into three types according to the production method: built-in, modular, and standard (Table 3.3.6). Figure 3.3.7 summarizes the results of this classification for each furniture type.

Table 3.25 Furniture Classification

Furniture Type	Built-in	Modular	Standard
Photo			
Production Place	Onsite	Off site	Off site
Production	Independent Contractor	Employed Contractor	Employed Contractor
Design	Contractor / Dweller	Designer / Dweller	Designer
Characteristics	• Without gaps between ceiling and walls, and thus, fixed. • The good finishing makes it look expensive, although it is actually cheap.	• Without gaps between ceiling and walls, and thus, fixed. • Compared to built-in furniture, it is a little bit costlier, but has better finishing.	• Independent, and movable. • Has good finishing, but it is the most expensive.

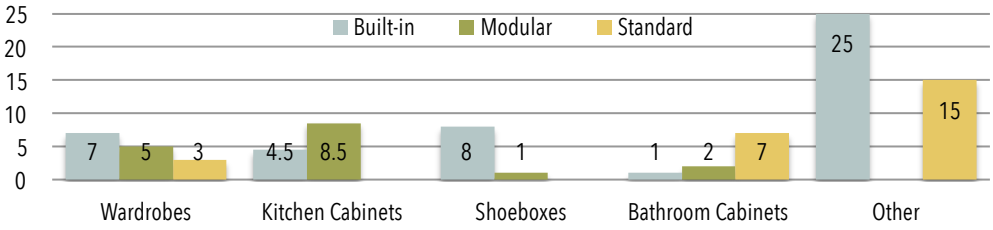


Figure 3.33 Furniture Classification

From the interviews, we have learned that built-in furniture was trendy until the 1990s. Since 2000, modular furniture has become commonplace. Regarding the production of wardrobes and cabinets, the doors are generally standardized for custom assembly, and depending on the producer, sometimes the wardrobe body can be customized onsite, during assembly stage. In fact, we found a total of 13 kitchen cabinets, from which 3 were classified as built-in. However, within the remaining 10 samples, 3 had their built-in bodies with modular doors, therefore these cabinets were accounted as 0.5 in the two categories.

It was observed a major preference for built-in furniture, justified for being the most affordable option, especially in the case of shoeboxes, and balcony storage cabinets. Modular furniture is a bit costlier than built-in furniture, but has better finishing, therefore, it was found mostly as bedroom wardrobes and kitchen cabinets. Similarly, standard furniture was found as bedroom wardrobes and bathroom cabinets. In spite of its higher price compared to other furniture, dwellers often pointed that they like their mobility and beautiful finishing.

3.3.7 Conclusions About Apartment Customization Practices in Dalian

The present study revealed that in Dalian, enclosing balconies, and turning entrance hallways into areas of exclusive use is a normal practice between dwellers of multi-family housing. Balcony enclosures can happen through individual decisions, while incorporation of hallway areas demand agreement between the homeowners who share that space as an access to their dwelling units (Table 3.3.7).

Table 3.26 Decision Making Levels in Dalian

	Support		Infill	
4 parts	Base Building	Common Elements	Boundary Elements	Interior Elements
Examples	Columns, beams, foundations	Waterproofing, exterior appearance, elevators	Window frames, entrance hall, doors, balconies	Partitions, int. finishing, fixtures, furnit. & equip.
Life Span	Long	Short		
Space Use	Common		Exclusive	
Property	Shared		Individual	
Decision Making	Group of Dwellers	Subgroup of Dwellers	Dwellers	

Moreover, the level of user choice might depend on the original plan type and the subsequent interior service contract. Table 3.3.8 summarizes the advantages and limitations of each dwelling customization service scheme.

Table 3.27 Considerations About Dalian's Dwelling Customization Schemes

high level

user choice

low level

Dwelling Customisation Schemes		Advantages	User Participation	Limitations	
Unfinished Plan	DIY	Allows full choice of interior components at inexpensive costs	Full participation (design, selection of materials, etc.)	There is no consideration at all about the dwelling unit layout during planning stage, often requiring relocation of pipes and electrical wires, as well as construction of partitions, causing some impact in the structural safety of the building; Dwelling customization takes a lot of time;	A minimum degree of expertise level is necessary; There is no warranty for the interior components after customization completion;
	Interior Plan Service (Affordable Package)				
	Interior Plan Service (Mid-Range Package)	Allows full choice of main interior components, at relatively inexpensive costs	Design and Selection of Materials		
	Interior Plan Service (High End Package)	No need to hire individual contractors, and interior services are warranted	Design		There is no warranty for the interior components after completion; The cost is expensive;
Half-Finished Plan		The dweller can move-in right after receiving the keys, and the interior components are warranted for 2 years	None	There is no warranty for the interior components, and the purchasers feel unease when signing the purchasing agreement; The cost is expensive; The interior plan is standard, without customisable items;	
Fully Finished Plan					

Unfinished plans can be considered the Chinese housing supply with highest level of user choice. In order to make it able to safely undergo customizations hold by people without any design expertise, we suggest that real estate companies coordinate the planning of parts that might affect the integrity of the building before handing the apartment keys to the dweller. Later on, the dweller can carry out simpler customization works that express his/her own individuality (Table 3.3.9).

Table 3.28 Proposal for a Two-Step Interior Plan Housing Supply

	Customization Coordinator	Planning Content
1st Step	Real Estate Company	Electrical wires, pipes, interior partitions, and other parts that may damage the building
2nd Step	Dwellers	Interior finishing, fixtures, furniture, and other parts that won't damage the building

3.4 THE CASE STUDY OF SAO PAULO

3.4.1 Background of Brazilian Housing Market

In Brazil, multistory buildings used to be regarded as intangible symbols of modernization, progress, and economic development of the metropolis. This scenario started to change in 1928, with the Federal Decree No. 5481, which dealt with the partial sale of buildings with more than five floors, thereby setting standards of co-ownership. This decree gave institutional basis for actions of incorporation, i.e., the buildings could be built with resources provided by parties other than the entrepreneur. Later in the 1930s, there was a large increase in the production of apartment buildings for rent. However, such architectural solution was still rejected by the target user, because it was associated with *'cortiços'* (Brazilian ghettoes). Until then, low and middle-income families obtained housing through the rental markets, while for the upper classes housing was mainly privately supplied.

Two other events were sore to the consolidation of massive urbanization in Brazil. The installment sales system, in 1937; and the Tenancy Act, which discouraged the rental market by making it a bad business both for owners and tenants. These measures aid the promotion of homeownership in formal markets as the best way of meeting the housing needs of the population, assigning an inferior status to rental units until today. Therefore, the crisis in the rental market made formal housing less affordable, pushing the poor into informal housing markets. But, these actions also encouraged urban renewal and the construction of multistory dwellings, as an alternative of living in the city center.

Nowadays, compared to the sum of detached dwellings, apartment availability is still very low at national (9% of total housing stock) and metropolitan levels (18%, in the case of Sao Paulo, for instance). Also, it is important to notice that the existing apartments are concentrated in the city center and mostly belongs to the upper-middle class income population.

Historically, the government barely took part in the construction of the urban space. Private initiatives had clearer purposes, assuming functions from which the government often remained absent. Thus, once dwellings became a good for sale and instead of housing provision, the housing issue gained the purpose of ensuring profits with the urban sprawl. As a result, multi-story dwellings have long been dismissed from housing programs as unable of providing decent home conditions for low-income people. Hence, historically, the high-income families were the ones that always experienced the newest housing concepts. Even though multi-storey housing was not supposed to have a sophisticated and elitist connotation in its origin, it used to be a made to order product for the middle-high classes.

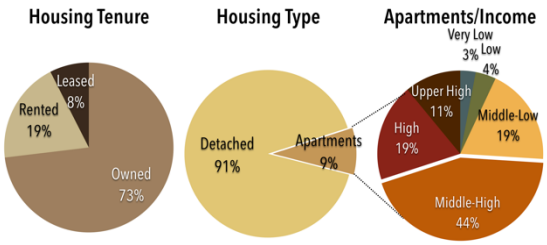


Figure 3.34 National Housing Stock Classification

3.4.2 User-Oriented Housing Provision

Currently, the structure and partitions of Brazilian apartments are primarily built with masonry, because this method is inexpensive and meets the low-income housing demand. However, the technique offers low adaptability and unclear support and infill distinction. Furthermore, regardless of the household's income, most renovations are self-managed, and it should be noticed that, even though remodelling regulations exist, decision-making in condominiums is typically organized in homeowners associations (HOAs)[1], and thus, usually managed by unskilled chairpersons (Law 4,591, 1964). Such, informal construction management has come to threaten the individual and collective scale of multi-family buildings. Based on previous studies and company interviews in Sao Paulo, Figure 3.4.2 illustrates the contemporary multi-family housing production chain in Brazil. User-oriented production can happen before and after key delivery stages.

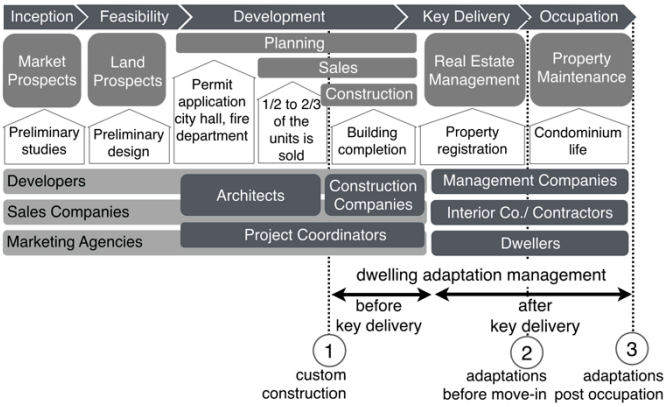


Figure 3.35 Adaptation Management and Key Agents (by the author)

1) Adaptations before Key Delivery (custom construction)
Company interviews revealed adaptation management before key delivery is based on pre-set design options, from which the dweller can choose the floor plan layout (free of charge) and finishing options, such as wood flooring, ceramic tiles, basin, toilet, sink, and so on (with additional fees).

2) Adaptations after Key Delivery
Although after key delivery, most works are self-managed, some modalities of contract include professional management. For the upcoming analysis, adaptations after key delivery were classified by the engagement of technical expertise on design, building, or onsite management stages (Table 3.4.1).

Table 3.29 Management Methods According to Contract Type

Contract	Design	Building	Management	Method
DIY	Dweller	Dweller	Dweller	Self-Management
B	Dweller	Contractor	Dweller	
DB	Designer Contractor	Contractor	Dweller	
BM	Dweller Contractor	Contractor	Contractor	Professional Management
DBM	Designer	Contractor	Contractor/Designer	

[1] According to Brazilian Law (Civil Code, Art. 1331-1356; Condominium Act, law. 4191/1964), condominium management is led by a Syndic (chairperson) and an advisory board of three members elected between the householders. Management guidelines are set by condominium Convention (master deed) and Bylaws (HOA document). Decisions are taken in committee meetings, with the approval of a quorum fixed by condominium convention.

3.4.3 Urban Context of Sao Paulo

Sao Paulo is a metropolitan city located in southeastern Brazil. With a total of 11,895,893 inhabitants, it is the most densely populated city in Brazil, in the Americas, in the Western and Southern hemisphere. Since 1870 to 2010, around 2.3 million immigrants arrived in the state, from all parts of the world. Today, it is the city with the largest populations of ethnic Italian, Portuguese, Japanese, Spanish, Lebanese and Arab outside of their respective countries.

The expansion of coffee production had a major role in the development of the city, as it became the region's chief export crop. From 1869 onwards, Sao Paulo was connected to the port of Santos by the Railroad Santos-Jundiai. In the late 19th century, several other railroads connected the interior to the state capital. Sao Paulo became the point of convergence of all railroads from the interior of the state. Currently, it is the corporate, financial and commercial leader city in South America, and home to the Sao Paulo Stock Exchange (Brazil's official stock and bond exchange). Sao Paulo is also home to research and development facilities and attracts companies due to the presence of several regionally renowned universities. The city exerts strong national influence in commerce, finance, arts and entertainment. With about 12% of the national wealth, Sao Paulo has the highest GDP in the country. Yet, the resources are not evenly distributed. The second largest helicopter fleet in the world is in the same city where there are 8 million people boarding the bus daily.

Table 3.30 Housing Finance Information of Sao Paulo

Entry	Data	Source
City:	Sao Paulo	-
Country:	Brazil	-
Population:	11,895,893	IBGE (2014)
Territory (km^2):	7,943.8	IBGE (2014)
Density (people/km^2):	1,497.5	IBGE (2014)
Number of households:	3.933.448	IBGE (2010)
Average household size (people/household):	3.2	IBGE (2011)
Urban population (%/total, national):	85	WDI (2013)
Urban population growth (%/year, national):	1.2	WDI (2013)
Annual average % change in median house prices (national):	1.19	IMF (2014)
Monthly rent prices (in USD) for		
1 Bedroom Apartment in City Center:	492.07	NUMBEO (2015)
1 Bedroom Apartment Outside of City Center:	328.07	NUMBEO (2015)
3 Bedroom Apartment in City Center:	951.10	NUMBEO (2015)
3 Bedroom Apartment Outside City Center:	675.71	NUMBEO (2015)
Purchasing price per m^2 median quality apartment (in USD)		
In the city center:	2,368.78	NUMBEO (2015)
Outside the city center:	1,569.58	NUMBEO (2015)
Average monthly disposable salary:	482.54	NUMBEO (2015)
Mortgage interest rate (%/year):	11.75	NUMBEO (2015)

Sao Paulo traditionally had poor suburbs and rich center. However, the central districts suffered a historic abandonment by the elites and were occupied by low-income population during the second half of the twentieth century. But, since the late 1980's, downtown Sao Paulo has been through a process of modernization to keep it in the network of global cities. These renewal strategies implied increase of property value, resulting in urban gentrification. Such communities experience conflicts of interest between state, market and popular classes, often relating segregation to safety issues. Figures 3.4.3 and 3.4.4, illustrate the correlation between the apartment stock and wealth distribution in Sao Paulo, due to the gentrification condition, resulting on a concentration of apartment units in the city center, hold by wealthier families.

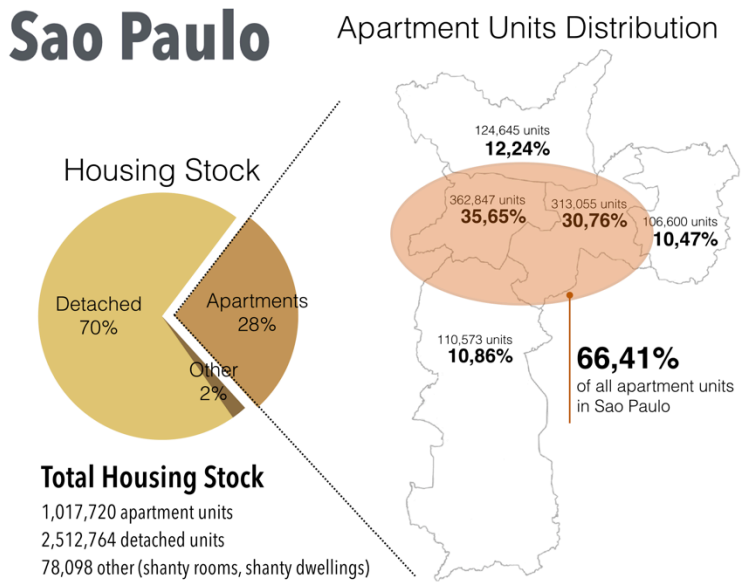


Figure 3.36 Apartment Stock
(Sao Paulo Healthcare Department, 2010)

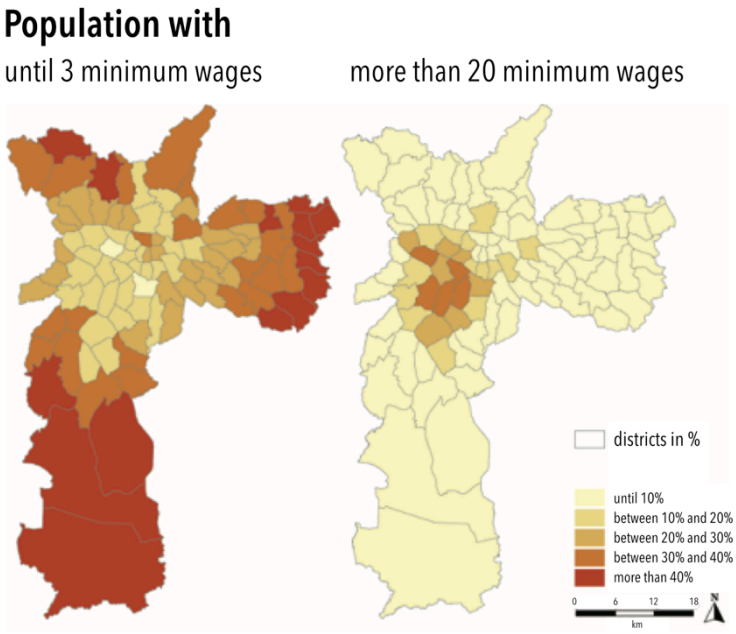


Figure 3.37 Wealth Distribution in Sao Paulo
(Sao Paulo Municipal Planning Department, 2004)

3.4.4 Survey Outline

This research is focused on middle-high class owned apartments that underwent remodeling work, in the center of the city of Sao Paulo. Fieldwork activities were carried from July 11 to 31, 2012, as outlined in Table 3.4.4, with the help of two architecture students. The investigation was built on the observation of 16 remodeled homes introduced by friends. Due to social gap and urban issues already mentioned, people from Sao Paulo are very suspicious of outsiders. Though this factor impacted the samples' availability, the data had little bias, as showed in Figure 3.4.6, which confirms user profile coherent to the nationwide condition, as is shown in Figure 3.4.1, 3.4.3 and 3.4.4.

Figure 3.38 Sao Paulo's Survey Map

Table 3.31 Sampling: 10 condominiums; 16 customized units

#	Code	Location	Year	Blocks	Households	Observations	Floor Plan	Unit Area (m^2)
1	MG	Pinheiros	1970	1	20	5	3LDK	120.60
2	MR	Moema	1973	2	80	1	3LDK	102.64
3	IS	Alto de Pinheiros	1975	6	480	3	3LDK	143.03
4	PM	Jardim Paulista	1976	1	28	1	4LDK	188.70
5	IC	Vila Olimpia	1983	1	32	1	2LDK	62.54
6	GE	Vila Madalena	1986	2	24	1	4LDK	129.36
7	MV	Vila Madalena	1987	1	14	1	3LDK	123.42
8	RI	Moema	1987	1	32	1	3LDK	125.33
9	MQ	Itaim Bibi	1991	1	32	1	1LDK	61.49
10	ST	Santana	1999	1	68	1	3LDK	83.32

Table 3.32 Survey Outline

Schedule	2012/07/11-17	2012/07/18-22	2012/07/23-31
Purpose	background info.	preparation work	observation
Subject	3 developers 2 furniture makers 1 management company	research team / work introduction apartment plans at city hall other relevant data	16 apartments (10 condominiums)
Activities/ Documents	interviews, booklets, flyers, digital data	condominium floor plans, legislations, books, magazines	interviews, photos, videos, sketches, measurements,

3.4.5 Sampling Characterization

3.4.5.1 Household's Profile

From 16 dwelling units observed, 15 are owned, and 1 is rented. Traditional core families purchased 10 of the owned units. These families, however, have matured or developed into other arrangements and now are equally distributed in four major family structures. Building ages range from 23 to 44 years, and years of residence vary from 41 years to 2 years. Dwelling units vary from 61.5 to 188.7 square meters, and the number of dwellers per unit ranges from 1 to 5 people (Table 3.4.6).

Table 3.33 Households Profile

Sample Code	Move-in	Number of Customizations	Tenure	Family Structure		Number of Dwellers		Household Income[2]
				Original	Current	Original	Current	
MG1	N/A[3]	1	Owned	Nuclear	Nuclear	4	3	High
MG2	1973	1	Owned	Single Parent	Single	3	1	Lower Middle
MG3	1990	3	Owned	Nuclear	Couple	4	2	Upper Middle
MG4	2006	1	Owned	Nuclear	Nuclear	4	4	Upper Middle
MG5	N/A[3]	1	Owned	Single	Single	1	1	Lower Middle
MR1	2007	1	Owned	Couple	Couple	2	2	High
IS1	2011	1	Rented	Nuclear	Nuclear	4	5	Upper Middle
IS2	2010	1	Owned	Single Parent	Single Parent	5	4	Upper Middle
IS3	1993	5	Owned	Nuclear	Single Parent	5	4	Upper Middle
PM1	1999	1	Owned	Nuclear	Single Parent	5	3	Upper Middle
IC1	2012	1	Owned	Single Parent	Single Parent	2	2	Lower Middle
GE1	1986	3	Owned	Nuclear	Couple	3	2	Upper Middle
MV1	1988	3	Owned	Nuclear	Nuclear	5	5	High
RI1	1988	3	Owned	Nuclear	Couple	4	2	Upper Middle
MQ1	2009	1	Owned	Single	Single	1	1	Lower Middle
ST1	1992	4	Owned	Nuclear	Single	5	1	Lower Middle

Still, according to interviews, 50% of the householders pursue temporary residence. Within households with permanent purpose, the move-in reason was mostly associated with enhancing relationships such as having a larger space to raise children, or living nearby the householder's parents. In turn, within households with temporary aspect, the reason to move-in was more associated with evading from a previous condition, i.e., personal independence, changing jobs and being apart from other neighborhoods for safety issues (Figure 3.4.6).

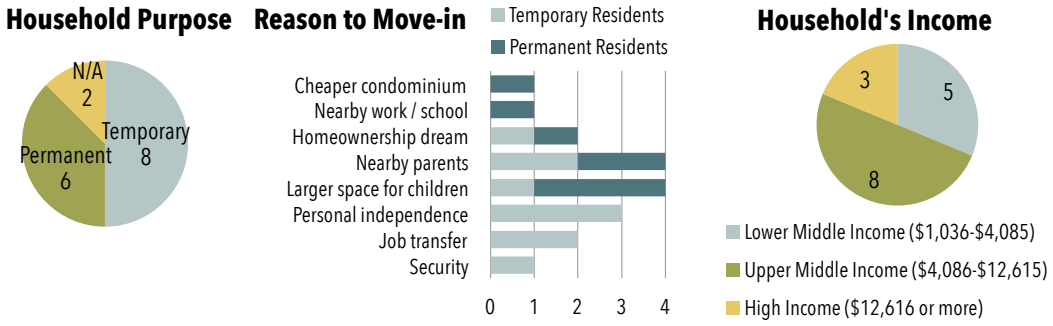


Figure 3.39 Household's Purpose, Reason to Move-in and Income

[2] Monthly Wages in Brazilian Real (BRL) were converted in US dollar exchange value in Brazil at the moment of the survey and classified according to the World Bank Atlas income division of 2013.
[3] The homeowners were absent. The maid of (MG1), and the neighbor of (MG5) gently hosted our visit.

The dweller's age composition is mainly adult ageing between 30 to 59 years old (16 people), followed by elderly or over 60 years old (10 people). There were 9 cases of prior residents that grown up, or divorced and moved out, or passed away, indicating households' maturity. Considering the families' monthly wages, they could be divided in three groups: high, upper-middle and lower-middle income.

3.4.5.2 Original Floor Plan Features

The model of most contemporary Brazilian dwellings is based on the 19th century bourgeois concept of three parts: social, service and personal. The sampling showed trivial floor plans, mostly with three-bedrooms, which one is a suite. Suite comprises of a master bedroom, often larger than the others, and includes a private bathroom. Also, the presence of maid's room indicates another set of bedroom and toilet. Therefore, the number of bathrooms is the characteristic that better reflects standard of the dwelling units. The largest samples IS, PM, GE, MV and RI, with over 120m^2 have 4 to 5 bathrooms. Table 6 provides an overview of the apartments before and after adaptation.

3.4.6 Research Findings

3.4.6.1 User's Needs and Renovation Purposes

Observations revealed that the first adaptation is mostly related to fixing territory during the move-in stage and includes customization of interior components, such as furniture, bath & kitchen equipment, fixtures, and cladding. Later, motivations could include family needs, such as adapting rooms to receive new family members, or repurposing empty rooms after one has moved away. But, in general, the main need is renovation and maintenance, primarily of interior cladding, bath and kitchen equipment, and home furniture (Figure 3.4.7 and Table 3.4.7).

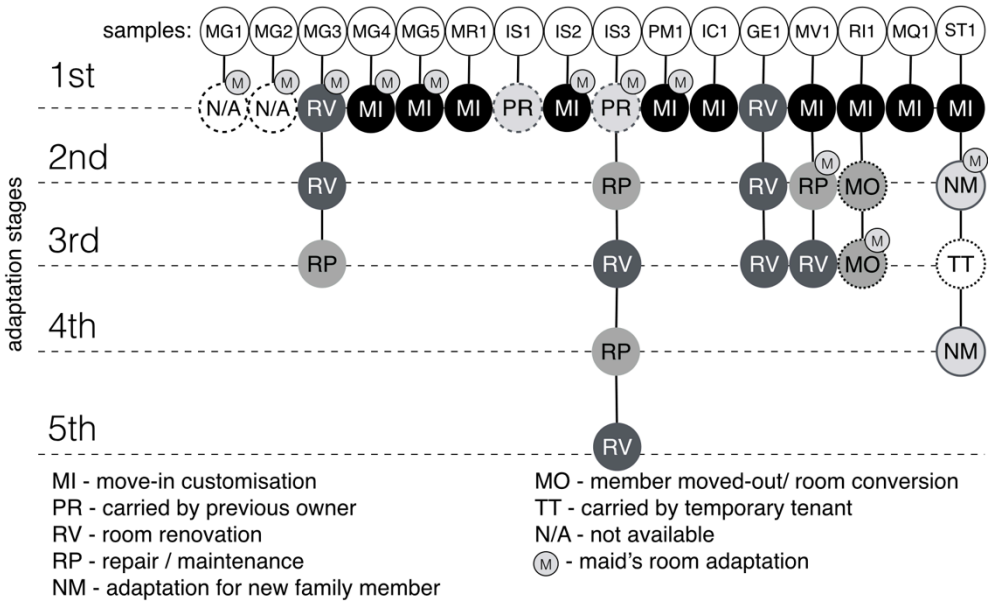
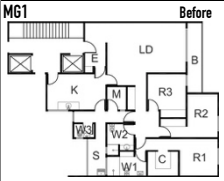


Figure 3.40 Adaptation Stages and User's Motivations

Table 3.34 Sao Paulo's Dwelling Customization Database (1-2)

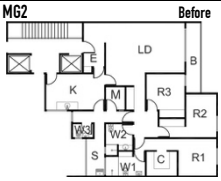
MG1 Before / After



Remodelling Information
I) Electricity, gas, plumbing;
V) E (door), all windows;
VI) LD, K, M, W3;
VII) All rooms (tiles, wood, plaster);
VIII) All rooms (doors replaced);
IX) W1 (bathtub removed), W2, K;
X) K, R1, R2, R3, C;

Home-Theatre (HT) | Kitchen (K)

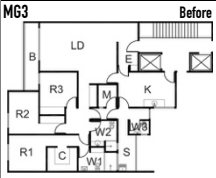
MG2 Before / After



Remodelling Information
I) Plumbing;
V) E (door), R1, R2, R3 (windows);
VI) K, M;
VII) K, S, W1, W2, HO (tiles, wood, plaster);
VIII) K, S, HO;
IX) K, W1, W2;
X) K, HO;

Kitchen (K) | Home-Office (HO)

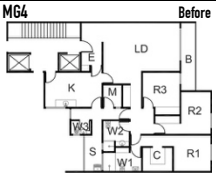
MG3 Before / After

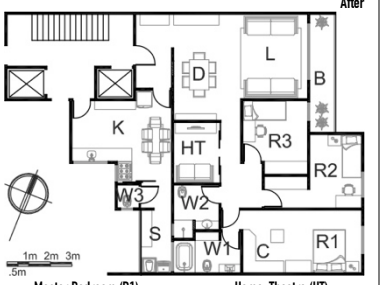


Remodelling Information
I) Gas, plumbing
II) L, R3;
III) L, R3;
IV) L, R3;
V) E, B;
VI) LD, K, M, C;
VII) K, W1 (tiles);
VIII) W3;
IX) W1;
X) K, R1, R2, R3, HO;

Living Room (L) | Home-Office (HO)

MG4 Before / After

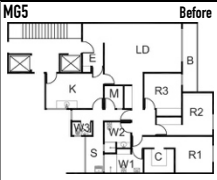


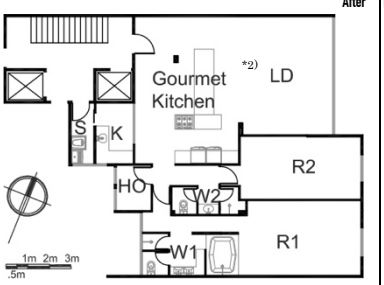


Remodelling Information
I) Plumbing;
V) E (door), all rooms (windows);
VI) M, W3, C;
VII) All rooms (tiles, wood, plaster);
VIII) All rooms;
IX) K, W1, W2;
X) K, R1, R2, R3, HT;

Master Bedroom (R1) | Home-Theatre (HT)

MG5 Before / After

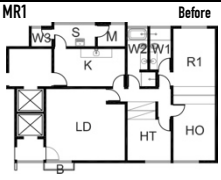




Remodelling Information
I) Electricity, gas, plumbing;
II) LD;
III) LD;
IV) LD;
V~X) All rooms;
Note: This sample was completely demolished and rebuilt, and was observed during construction.

Living Room (L) | Bathroom 1 (W1)

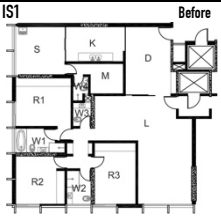
MR1 Before / After

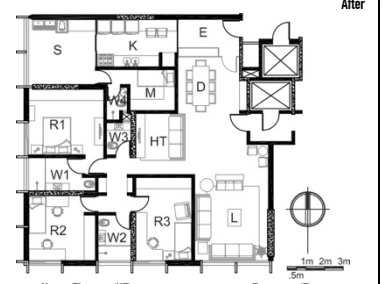


Remodelling Information
I) Electricity, plumbing;
VII) S (plaster ceiling removed);
VIII) K (window), All rooms (door handles replaced);
IX) W1, W2;
X) K, HO;

Kitchen (K) | Bathroom 2 (W2)

IS1 Before / After

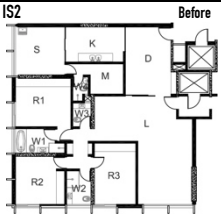


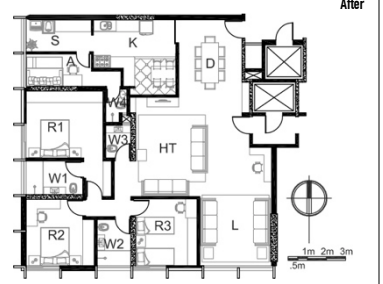


Remodelling Information
V) All rooms, except W (windows);
VI) D, K;
VII) All rooms (tiles, wood, plaster);
VIII) All rooms (doors);
IX) K, W1, W2;
X) K, R1, R2, R3, M, S, E;

Home Theatre (HT) | Entrance (E)

IS2 Before / After





Remodelling Information
I) Electricity, plumbing;
V) All rooms (windows);
VI) LD, K, R3, S;
VII) All rooms (tiles, wood, plaster);
VIII) All rooms (doors);
IX) K, W1, W2;
X) K, R1, R2, R3, A;

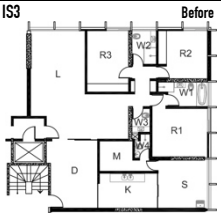
Kitchen (K) | Laundry (S) & Atelier (A)

I)serv.lines; II)d.expansion; III) ext.cladding; IV)balcony enclosure; V)ext.fixtures; VI) int.partitions; VII)int.cladding; VIII)int.fixtures; IX)bath & kitchen equip. X)furniture

Table 3.35 Sao Paulo's Dwelling Customization Database (2-2)

IS3

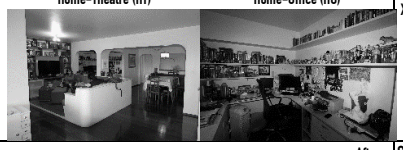
Before



After

Remodelling Information
I) Plumbing;
VI) L, D, M;
VII) All rooms (tiles, wood, plaster);
IX) K, W1, W2;
X) HT, HO;

Home-Theatre (HT) | Home-Office (HO)



PM1

Before

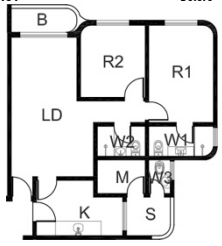
After

Remodelling Information
I) Electricity, gas;
V) All rooms (windows);
VI) K, W2, W3, W4, W5, M1, M2;
VII) All rooms (tiles, wood, plaster);
VIII) All rooms (doors);
IX) K, W1, W2, W3, W4, W5, W6;
X) All rooms;

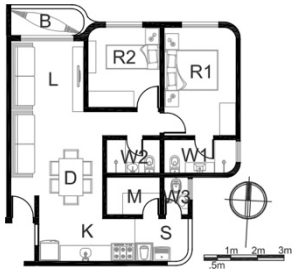
Kitchen (K) | Bedroom 5 (R5)

IC1

Before



After



Remodelling Information
V) All rooms (windows);
VI) K;
VII) All rooms (tiles, wood, plaster);
VIII) All rooms (doors);
IX) K, W1, W2;
X) K, R1, R2;

Living Room (L) | Kitchen (K)

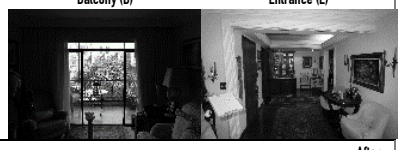
GE1

Before

After

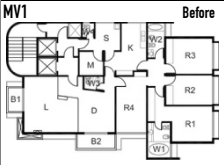
Remodelling Information
IV) B;
V) B;
VI) E;
VII) K, W1, W2, W3, S (wall tiles, plaster);
IX) K, W1, W2;
X) K, R1, R2, R3, R4;

Balcony (B) | Entrance (E)

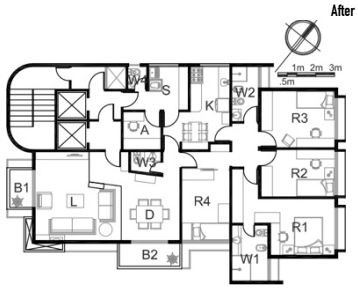


MV1

Before



After



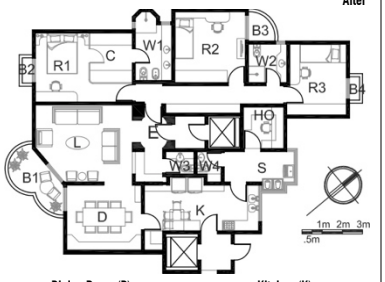
Remodelling Information
I) Fireplace removed, plumbing;
VI) R4;
VII) All rooms, except LD (tiles, wood, plaster);
VIII) R4;
IX) W1(bathtub removed);
X) R2, R3, R4;

Living Room (L) | Bedroom 4 (R4)

RI1

Before

After

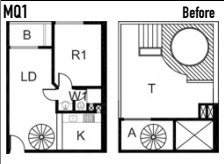


Remodelling Information
I) Gas;
III) Entrance hall (floor tiles);
VI) LD, K, R1, W3, W4;
VII) All rooms, except LD (tiles, wood, plaster);
VIII) All rooms (door handles);
IX) K, W1, W2, W3;
X) D, K, R2, R3, C;

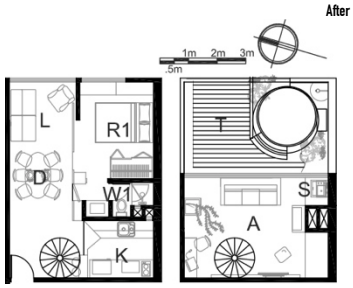
Dining Room (D) | Kitchen (K)

MQ1

Before

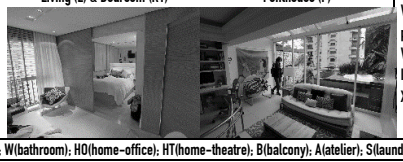


After



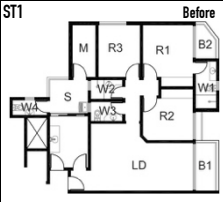
Remodelling Information
I) Electricity, plumbing;
II) B, T;
III) B, T;
III) B, T;
V) All rooms (windows);
VI) R1;
VII) All rooms (tiles, wood, plaster);
VIII) All rooms (doors);
IX) K, W1;
X) All rooms;

Living (L) & Bedroom (R1) | Penthouse (P)



ST1

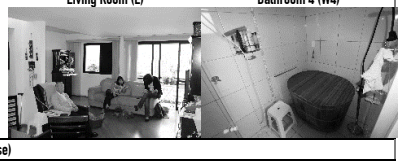
Before



After

Remodelling Information
I) Plumbing;
II) W4;
VI) M, R3, W3;
VII) All rooms, except K (tiles, wood, plaster);
VIII) All rooms;
IX) W4;
X) S;

Living Room (L) | Bathroom 4 (W4)



L(living); D(dining); K(kitchen); R(bedrooms); W(bathroom); HO(home-office); HT(home-theatre); B(balcony); A(atelier); S(laundry); M(maid's room); T(terrace); P(penthouse)

3.4.6.2 Maid's Room on the Way to Extinction

Within the dwelling adaptations, there were not only demands, but there was also a functional retirement. It was observed that the maid's room was removed from 11 of 15 samples[4] (Table 6, MG1; MG2; MG3; MG4; MG5; IS2; IS3; PM1; MV1; RI1; ST1). Therefore, it was judged necessary to investigate the reasons and outcomes of this particular adaptation. Maid's rooms that remain with the original design are due to two reasons: either because the maid still lives with the family (IS1), or because it is adjacent to toilet or laundry room (MR1, IC1, GE1). Maid's room adaptations could be divided into two types: demolition to expand adjacent rooms, or renovation to change purpose (Figure 3.4.8).

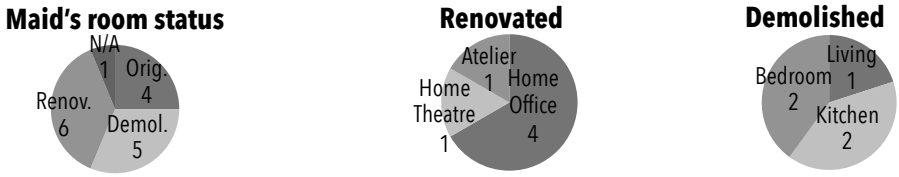


Figure 3.41 Maid's Room Adaptation

Brazil has been relying on an abundant domestic work for around 200 years. Even before the abolition of slavery, in 1888, people from all races migrated from the countryside to the cities to work for wealthy families and escape from poverty. The maids market remained dependent of unequal income distribution over Brazilian regions and the number of uneducated people. These factors assured, until recent days, a constant offer of people willing to work for very low salaries, enough to fit in the middle classes pockets (Figure 3.4.9). But in the past decade, Brazil's professional classes have burgeoned and a lower-middle class has emerged (Figure 3.4.10).

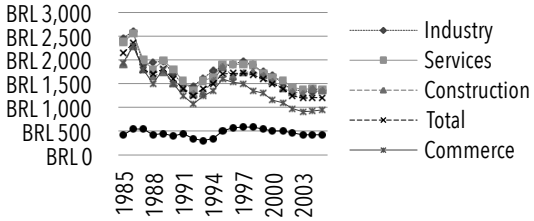


Figure 3.42 Domestic Labor Wage Compared to Others, Sao Paulo (left)

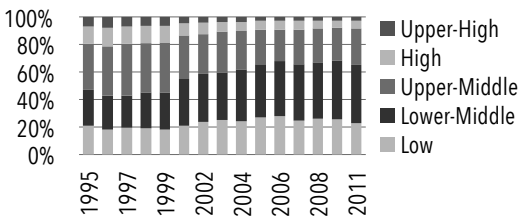


Figure 3.43 Brazilian Population by Income Groups 1995-2011

The maid's room is a design reminiscence of an old servant culture. Once the domestic service stops being made by hired servants; that opens the maid's room to other purposes. Aware of this fact, some Brazilian developers started offering multipurpose rooms as an alternative to housing adaptability. Nevertheless, since this solution could not forecast that the room size would not be appropriate for some activities, as well as that service toilet, always paired with, would be unneeded, or require pipe relocation[5]. As a result, these tiny rooms in inappropriate layouts remain idle, or utilized for storage.

[4] Sample MQ1 does not have maid's room in its original plan.

[5] Typical buildings in Brazil have mechanical and wiring pipes and ducts embedded into the load bearing structure. Pipe relocation or renovation is difficult, because the building components are assembled with no regard to their different life cycles and functional purposes in the building. For instance, bathroom pipes are built within cavities inside the bricks, covered with a layer of concrete, and another of ceramic tiles. Therefore, it is basically impossible to replace one component without disturbing its relation with other components, or demolishing them all completely.

3.4.6.3 SI System Division through Analysis of Individual Decisions

In order to clarify the SI System division in Brazil, we investigated the range of individual decisions within different building levels. Hence, by analysis of fieldwork data, several adaptation types were distinguished and sorted according to the SI System division. Figure 3.4.11 shows the rate of different dwelling adaptations in the selected sample. According to the SI System theory as well as the Civil Code of Brazil[6], adaptations on the left side of the chart should be more related to collective decisions, while in the right side, adaptations should be more related to individual decisions. However, dwelling observation has shown these adaptations were all made by individual decisions.

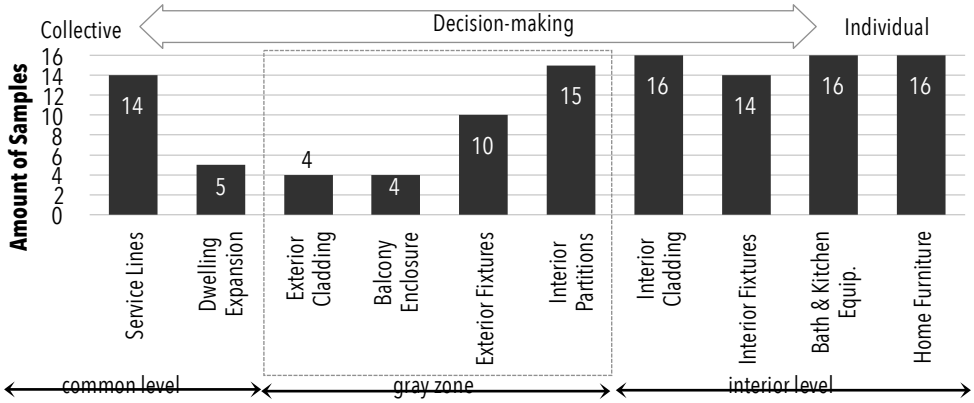


Figure 3.44 Adaptation Works According to SI System Division

3.4.6.4 Grey Zone of Decision and Policy Incompatibilities

Although condominium management policies in Brazil may suggest a decision-making pattern similar to the SI System division, they are incompatible with the actual building process. For instance, partition elements should belong to the interior level and freely arranged according to individual decisions, but most dwelling construction in Brazil employs load-bearing walls as partitions, with the same body of independent walls causing ambiguity between structural and non-structural components. Therefore, demolition of partitions demands permission.

Instead, balcony enclosure is generally illegal, because it implies addition of construction potential. Moreover, considering it carefully, balcony enclosure may include one or more of the following actions: (1) installation of exterior glass sash; (2) removal of interior glass sash; (3) placement of floor cladding with the same material and height as the dwelling interior. Thus, the sum of (1) with (2), and / or (3) would imply dwelling expansion with modification of common level components, and thus, be considered illegal. However, in the case of (1) only, decision-making could be individual, but guided by common rules, and following the SI System division, balcony enclosure could be considered legal. Hence, it could be assumed that interior partitions, exterior fixtures, balcony enclosure, and exterior cladding are in a grey zone between individual and collective decision-making (Figure 3.4.11).

[6] According to the Civil Code of Brazil, Art. 1,336, there are duties of condominium dwellers: I) To contribute with condominium expenses according to their shares of property; II) Do not realize any construction work that could compromise the building safety; III) Do not modify the facade shape and color, as well as its parts, and exterior frames; IV) Keep the original purpose of the building, and do not use in any way that would disturb peace, health, safety and moral of other homeowners.

3.4.6.5 Self and Professional Management Analysis

To assess informality in dwelling adaptation market, it was studied the involvement of technical expertise in support and infill adaptation. Adaptation management methods were arranged according to the modality of contract (Table 3.4.7). Then, through interview, it was investigated the rate of these methods on each adaptation type. It is important to notice that in samples (MG1), (IS1), (IS2), and (MQ1), the adaptation was managed by a family member qualified in the construction sector. These cases were classified as DBM contract instead of DIY. The results revealed experts' involvement is more related to the common level (Figure 3.4.12).

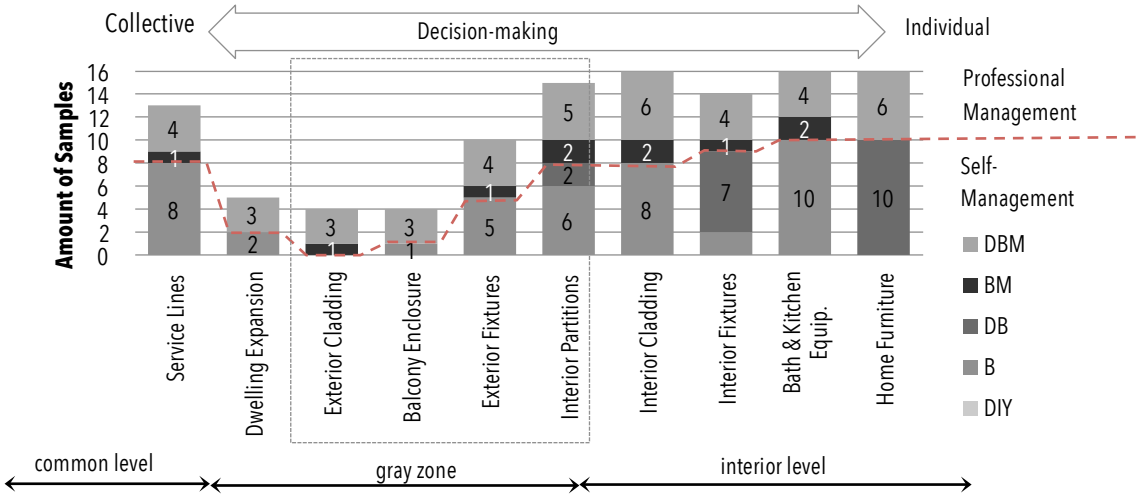


Figure 3.45 Support and Infill Adaptation Management

Table 3.36 Summary of Dwelling Adaptations and Management Methods

Sample Code	I	II	III	IV	V	VI	VII	VIII	IX	X
	Service Lines	Dwelling Expansion	Exterior Cladding	Balcony Enclosure	Exterior Fixtures	Interior Partitions	Interior Cladding	Interior Fixtures	Bath & Kitchen	Home Furniture
MG1	B				B	DB	B	DB	B	DB
MG2	B				B	B	B	DB	B	DB
MG3	B	DBM	DBM	DBM	DB	DB	B	DB	B	DB
MG4	B				B	B	B	DB	B	DB
MG5	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM
MR1	B						B	B	B	DB
IS1					DBM	DBM	DBM	DBM	DBM	DBM
IS2	DBM				DBM	DBM	DBM	DBM	DBM	DBM
IS3	BM					BM	BM		BM	DB
PM1	B				BM	BM	BM	BM	BM	DB
IC1					B	B	B	B	B	DB
GE1		B		B	B	B	B		B	DBM
MV1	DBM					B	DBM	DB	B	DBM
RI1	B		B			B	B	DB	B	DB
MQ1	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM
ST1	B	B				DBM	DBM	DB	B	DB

Note that support adaptations generally demand technical expertise, but that our samples include cases of self-management at this level. It could be assumed that it may be difficult to hire a professional to handle these adaptations, since they are mostly illegal.

3.4.6.6 Industrialization of Infill Components

According to the production method, the furniture could be classified into six types (Table 3.4.8):

Table 3.37 Furniture Production Classification

Production	Definition
DIY	Made and assembled by the dweller;
Self-Assembly	Standard goods bought in parts to assemble (ex.: IKEA®);
Full Custom	Made according to individual specifications (Made to order).
Semi-Standard	Standard parts and custom made parts combined to attend individual specifications (ex.: Brazilian Furniture Makers);
Custom Assembly	Standard parts assembled according to individual specifications (ex.: System Furniture).
Standard	Standard parts and assembling in general.
Built-in	Built to be permanent part of the building.

By observation of bedrooms and kitchens of the visited units, we found that most furniture is custom-made, semi-standard or built-in (Figure 3.4.13). In the case of bedroom design, built-in furniture is more popular. However, within these, there were seven cases of built-in furniture adapted by carpenters.

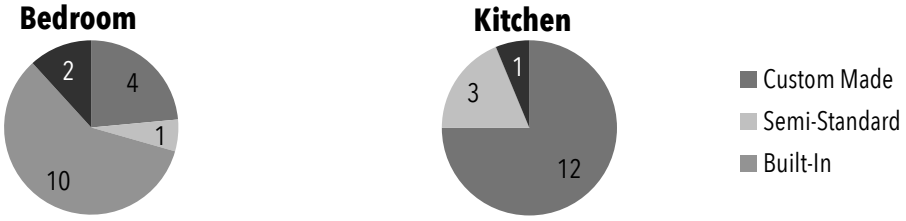


Figure 3.46 Bedroom and Kitchen Furniture Sampling

In the case of kitchen design, custom-made furniture was predominant, but semi-standard furniture is also very popular, and the results could differ with the sampling income level. In semi-standard kitchens produced in Brazil, the furniture is usually made in modules to assemble. For instance, Cabinet tops are often made of marble, requiring an onsite measurement, after the assembling stage, for perfect fit.

DIY and standard furniture are also popular in Brazil, but could not be found within these samples, probably because of the dwellers income and age. However, self- and custom-assembly are not popular, suggesting a market profile of low level of industrialization, highly dependent on carpenter work.

3.4.7 Conclusions About Apartment Customization Practices in Sao Paulo

The findings of this study revealed that the apartment customization purposes in Sao Paulo are more related with the need for demarcating the family's territory, during the move-in stage and the need for preserving a home identity as the dwelling evolves along with the families' status.

Moreover, from the decision-making perspective, the laws governing renovation of multi-family buildings in Brazil do not match the actual decision-making code observed in Sao Paulo. Since such laws are not being enforced, it could be assumed that the government is simply denying the existence of any problem and is transferring related responsibilities to the dweller. Instead, we believe the government oversight of balcony enclosure as a means to enable dwelling expansion should be turned into a formal measure to control and prevent the issues caused by informal management and ensure safer adaptations.

Finally, the infill industry in Sao Paulo shows clear signs of progress. However, the finishing parts still include a high amount of handcraft works, in a scheme of coexistence of prefabrication and onsite construction. This could be explained by the remaining income gap that keeps the construction workforce affordable to the upper middle class that lives in apartments in the metropolitan area of Sao Paulo.

Our investigation on customized apartments in Sao Paulo suggests that the Open Building concept should include flexible boundaries, with flexible facades, and pre-set design patterns, in a way dwellers can enjoy decision-making freedom beyond the inner space of their homes, while keeping condominium rules (Table 3.4.10).

Table 3.38 SI System Segmentation in Sao Paulo[7]

	Support	Infill		
4 parts	Base Building	Common Elements	Boundary Elements	Interior Elements
Examples	Columns, beams, foundations	Waterproofing, exterior walls, cladding, elev.	Window frames, entrance hall, doors, balconies	Partitions, int. cladding, fixtures, furnit. & equip.
Life Span	Long	Short		
Space Use	Common		Exclusive	
Concern	Collective		Individual	
Decision Making	Small works: syndic		Dwellers under common rules	Dwellers
	Large works: HOA			

Even though the management of common and exclusive parts of multi-family dwellings is covered by Brazil's civil laws, the relationship between individuals or groups of dwellers within these boundaries may vary depending on the country region. For instance, the climate difference between the north and south might implicate a different user relationship with balconies. Therefore, it is recommended a review of local building policies, regarding the definition of boundaries between common and exclusive parts of multi-family buildings. Also, in order to build a housing system that will include a broader group of users, future studies should consider other income groups, with a larger amount of customized apartment samples and/or detached dwellings, covering the nation's five climatic subtypes.

[7] Adapted from: Kobayashi, H, and Fujimoto, H. (2003). What is Skeleton Housing? Considerations about the development of long-lasting housing. Ministry of Land, Infrastructure, Transport and Tourism of Japan (in Japanese).

3.5 THE CASE STUDY OF SANTOS

3.5.1 Urban Context of Santos

Santos is a harbor city, and it is the hub of the Baixada Santista Metropolitan Area, which is contiguous to the Greater Sao Paulo, and together with other five conurbation areas, composes the Megalopolis of Sao Paulo. Although the density registered by census is of 1,492.2 people/km^2, there are parts of the city with over 25,000 people/km^2, because the continental portion is barely occupied. Thus, Santos presents the only national case where the stock of apartments exceeds the stock of detached homes (Figure 3.5.1).

The economy used to be based in the coffee market, preserved in the local memory by the inheritance of the Official Coffee Stock Exchange, in the city center. Nowadays, tourism and services play a great role in the local economy, but the Port of Santos is the city's largest asset, accounting for more than 25% of the Brazilian trades. In 2006, with the discovery of the pre-salt layer in the region, the oil exploration has driven a series of investments and development to Santos. According to the municipal planning department, since that period, it was built 83.61% of the dwellings produced in the past 20 years (35,374 units, from 1993 to 2013).

Table 3.39 Housing Finance Information of Santos

Entry	Data	Source
City:	Santos	-
Country:	Brazil	-
Population:	433,966	IBGE (2015)
Territory (km^2):	280,674	IBGE (2015)
Density (people/km^2):	1,546.16	IBGE (2015)
Number of households:	177,243	IBGE (2010)
Average household size (people/household):	3.2	IBGE (2010)
Urban population (%/total, national):	85	WDI (2013)
Urban population growth (%/year, national):	1.2	WDI (2013)
Annual average % change in median house prices (national):	1.19	IMF (2014)
Monthly rent prices (in USD) for		
1 Bedroom Apartment in City Center:	348.94	NUMBEO (2015)
1 Bedroom Apartment Outside of City Center:	267.79	NUMBEO (2015)
3 Bedroom Apartment in City Center:	730.34	NUMBEO (2015)
3 Bedroom Apartment Outside City Center:	590.35	NUMBEO (2015)
Purchasing price per m^2 median quality apartment (in USD)		
In the city center:	1,947.56	NUMBEO (2015)
Outside the city center:	1,399.81	NUMBEO (2015)
Average monthly disposable salary:	486.89	NUMBEO (2015)
Mortgage interest rate (%/year):	11	NUMBEO (2015)

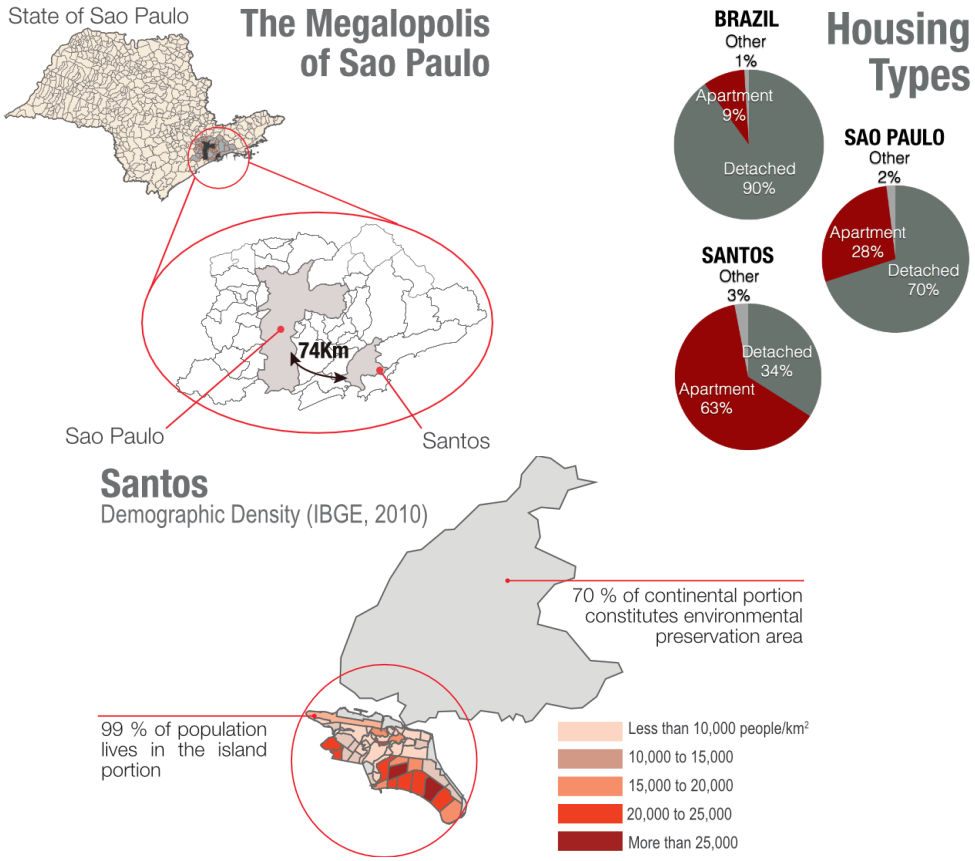


Figure 3.47 Housing Stock and Urban Context of Santos[15)]

3.5.1.1 Tilted Apartments

In Santos, the height of buildings used to be limited by the soil. Below a superficial layer of compact sand, there is a deep bed of slippery clay. Since the beginning of the coastline occupation, in the 1940s, engineers were aware of this soil condition, and built buildings above 12 storeys with shallow foundations of 1.5m to 2.0m deep. Instead, the building foundations should be about 50m deep to reach bedrock, but that was unfeasible for technological and economic reasons. Later, urban densification has raised building heights, exceeding the bearing capacity and the soil consolidated, leaving gaps of until 120cm. As a result, a string of tilted apartment buildings has appeared in Santos' waterfront (Fig.2). In 1968, after the problem became visible, the authorities added a requirement on Santos building code to use deep foundation for tall buildings (Dias, 2010).

Figure 3.48 Tilted Apartments in Santos Coastline (Azevedo, 2007)

3.5.2 Survey Outline

This research is focused on customized apartments located in Santos. Fieldwork activities were carried in 20 days (Feb. 5~24, 2015). With between 2~3 dwelling visits a day, our interviews were based on a questionnaire with 70 inquiries related to the family profile, condominium profile, peculiarities of the customization works, remodeling troubles and complications, domestic repair and maintenance behavior, family lifestyle, and satisfaction with the current home space. Photographing and measuring activities were carried simultaneously to the interviews, with the help of two of the author's family members. In total, we have visited 46 households, in 29 condominiums in Santos (Table 3.5.2).

Table 3.40 Sample Locations

#	Code	Year	Blocks	Households	Obs.	Plan	Area (m^2)
1	RH	2002	1	72	15	3LDK	127-148
2	AR	1973	1	20	1	3LDK	180.30
3	NC	2012	5	390	1	2LDK	53.00
4	CL	1982	1	42	1	2LDK	80.53
5	JL	1979	1	15	1	3LDK	110.00
6	EN	1954	1	240	1	1LDK	39.60
7	AS	1967	1	6	1	2LDK	70.17
8	BM	1964	1	32	1	3LDK	175.00
9	TM	1985	2	80	1	2LDK	67.00
10	OV	1957	1	24	1	3LDK	162.00
11	AQ	1972	1	30	1	1LDK	57.22
12	SF	1993	2	15	1	2LDK	110.00
13	AB	1982	2	48	1	3LDK	149.98
14	SH	1954	2	60	1	3LDK	174.60
15	PI	1992	1	30	2	3LDK	193.37
16	GB	1992	1	36	1	3LDK	277.00
17	VM	1986	2	78	1	3LDK	175.73
18	SJ	1982	2	72	1	1LDK	54.44
19	CC	1989	2	72	1	3LDK	138.10
20	CM	1972	1	20	1	3LDK	133.60
21	OL	2002	1	36	1	3LDK	114.69
22	CF	2011	1	140	2	4LDK	190-210
23	VL	1984	1	54	1	2LDK	155.00
24	SL	1974	1	40	1	1LDK	49.65
25	PG	2012	1	150	1	2LDK	78.60
26	PE	2013	1	34	1	3LDK	150.94
27	SV	1979	1	24	1	3LDK	154.51
28	UI	1975	1	30	1	2LDK	122.00
29	AL	1975	1	36	1	3LDK	149.00

3.5.3 Results

3.5.3.1 Households Profile

Although only 1 of the 46 apartments we visited is rented, 15 of them are temporary properties. Most reasons why people want to move out are related to the aspirations of buying their dream house, or the needs of having larger space in near future. But, when these temporary residents had chosen to move-in, their motivations were mainly related to the financial opportunity of purchasing a home or simply moving to a place they liked. In turn, permanent residents were primarily concerned about having a larger space, or simply purchasing a home after marrying. Less common reasons to move in included the privilege of an ocean view, and the availability particular home configurations, such as individual parking space, extra room for working at home, or terrace pool for leisure.

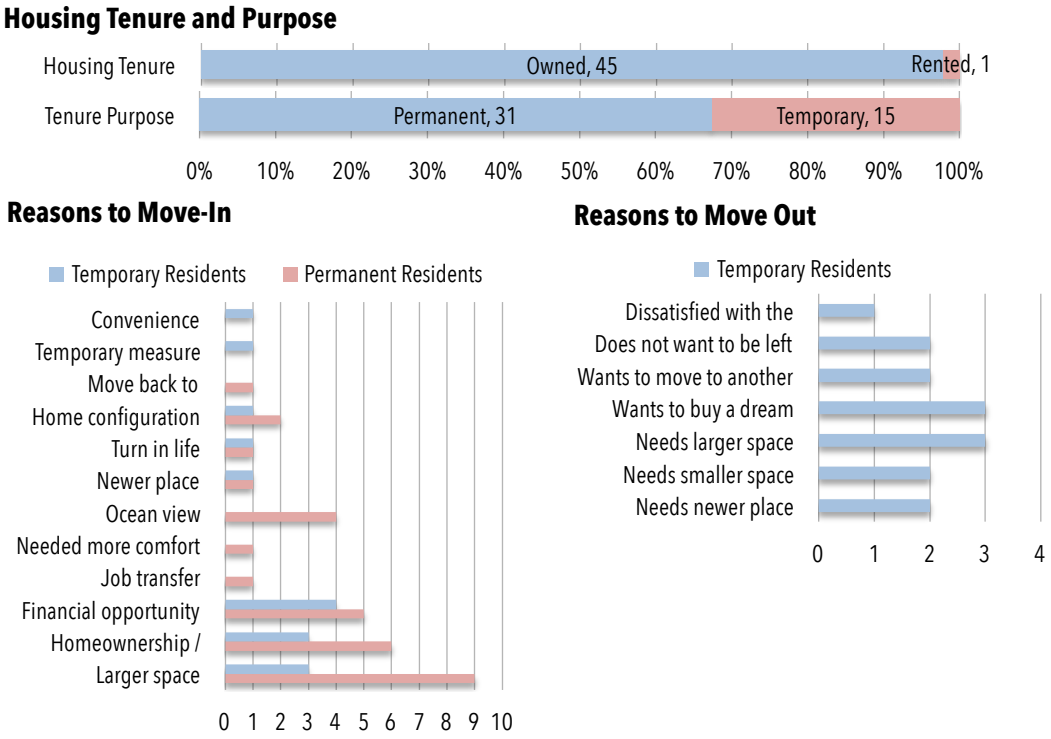


Figure 3.49 Housing Tenure and Purpose

Household structures could be classified into five categories, with majority of nuclear families and "double income, no kids" (DINKs) at the purchasing stage. 60.8% of the household heads were older than 55 years old, and the average household sizes slightly shrunk from 2.76 to 2.32 persons per home from move-in period to now, with cases of family members that grown up and left, divorced and moved out, passed away etc. Therefore, the distribution between household's structures is more even. Also, based on the monthly income, most families could be classified as upper-middle, followed by lower middle class (Fig.4).

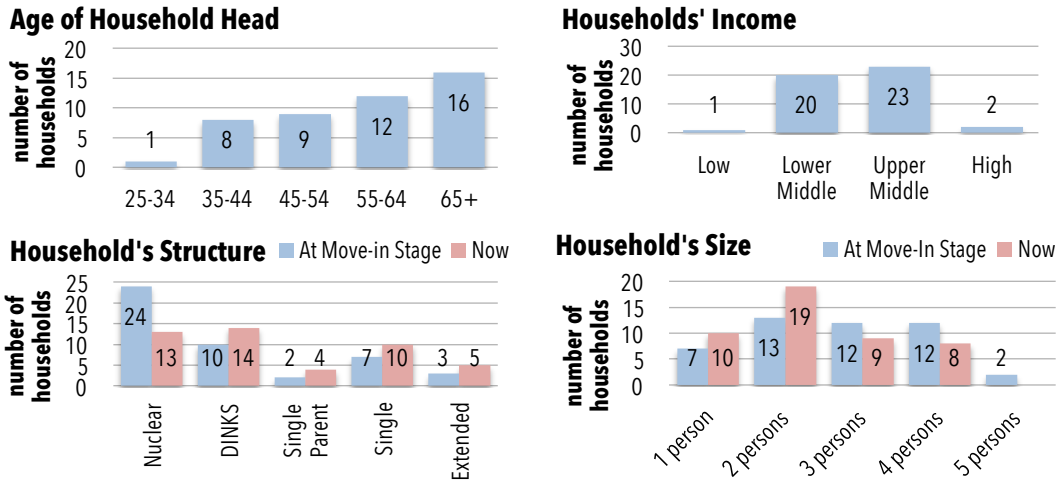
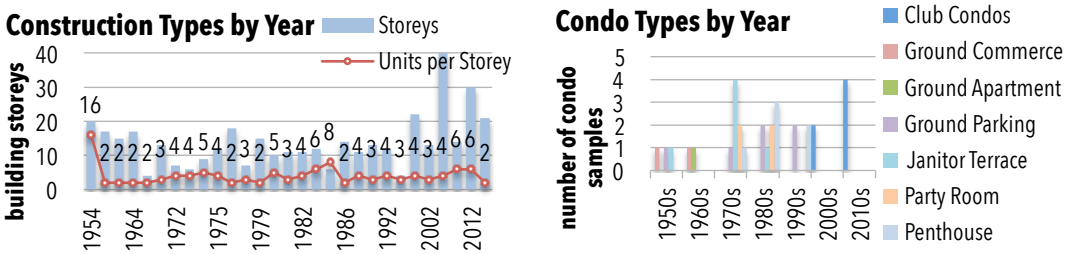


Figure 3.50 Household's Profile

3.5.3.2 Original Design Features

Typical samples were built in RC with red brick partitions, with 2 or 4 dwelling units per story, and up to 11 and 15 stories, until the 1990s. Flats built after the 2000s, have more than 20 stories. Also, the samples could be classified into seven categories according to uses that might have trended over the years: ground floor with commercial, residential, or parking function (1950s~60s), top floor with janitor's apartment and common terrace (1970s), top floor with penthouse apartments, or duplexes (1980s~90s), and ground plus/or top floor with a number of shared amenities, alias club condos (2000s~now). According to interviews, condo fees vary from 100 to 1680 BRL per month, and are unrelated to the number of households or shared facilities. Instead, the fees are linked to the privilege of the location; i.e., they become higher as they get closer to the ocean.



Condo Types	Ground Commerce	Ground Apartment	Ground Parking	Party Room	Janitor Terrace	Penthouse	Club Condos
Schematic Definition	11.OV x1 tower shops/ parking 1957	8.AS x1 tower last unit parking/ 1st unit 1967	10.TM x2 towers units parking 1985	7.EN x1 tower belvedere units party room /parking 1954	29.UI x1 tower janitor/ terrace units parking 1975	14.AB x2 towers penthouse units standard units parking 1982	1.RH x1 tower amenities units amenities parking 2002
Samples	1	1	5	4	6	6	6
Total Units	24	6	15~80	20~240	15~72	24~72	34~340
Condo Fees	300	100	200~1200	320~1500	440~900	490~1680	280~1200

Figure 3.51 Condos Profile

3-bedroom apartments represent the majority of our samples (65%), with areas varying between 100m² to 160m² (58%). It is important to notice the number of bathrooms may exceed the number of bedrooms in typical dwellings. This is justified by the presence of at least one suite, or master bedroom, which incorporates a bathroom and a closet, another bathroom shared by the other family members and sometimes the guests, if not, there is a washroom for guests, and finally, there is a service bathroom, usually linked with a maid's room or the laundry room.

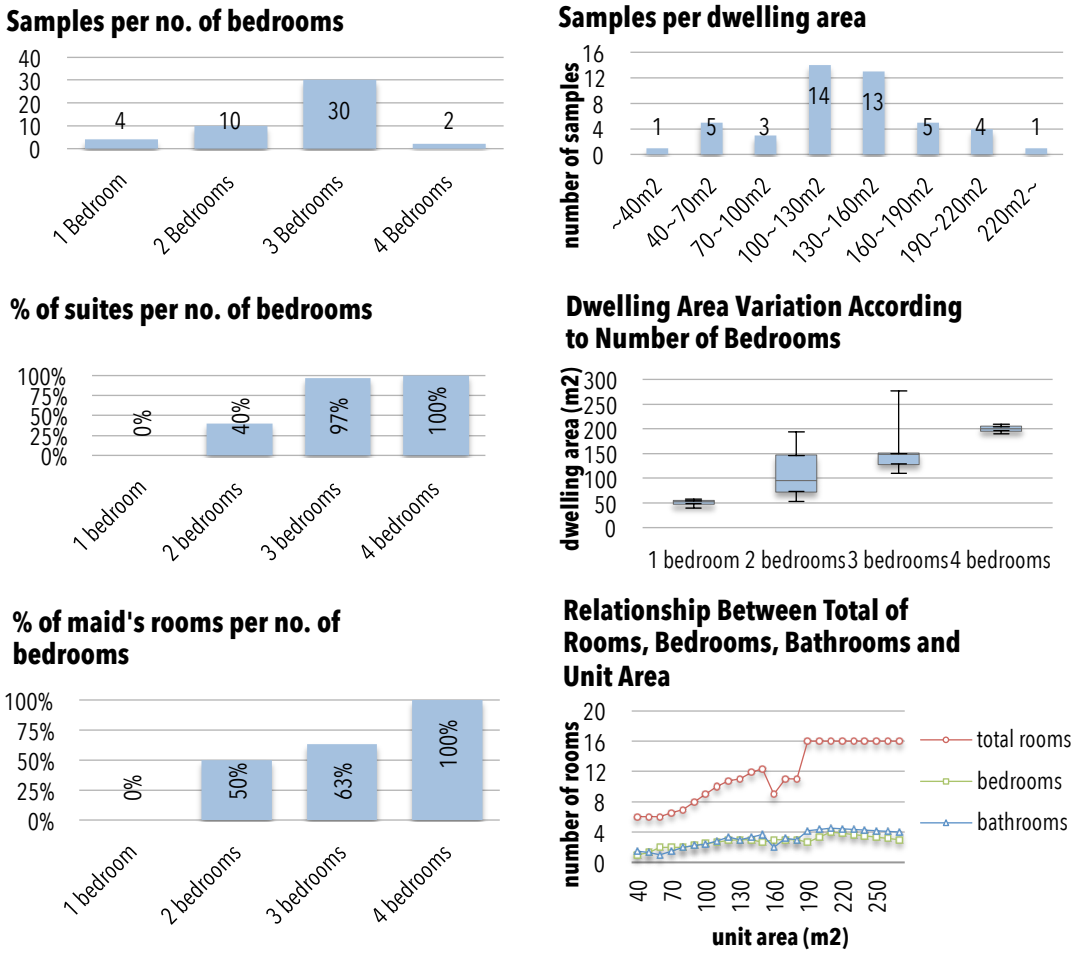


Figure 3.52 Dwelling Units Profile

3.5.3.3 Customization Works

Customization works could be carried in three different stages, according to the property hold and usage:

1. *Custom construction*: it includes dweller decisions during construction and could be based on design negotiations managed by the developer, before key handling.
2. *Before Move-in*: it includes dweller decisions after key handling, and could be self or professionally managed.
3. *Post Occupation*: it includes dweller decisions after dwelling occupation, and could be self or professionally managed.

From the observations, it was found that the majority (76%) of the dwellers have customized their homes before moving in. In turn, post occupation customizations are more numerous than the others (65%) and, thus, it was divided into two categories: PO1, early and PO2, late occupation. Finally, custom construction has a expressive input (26%) at the first stage of customization, but is not fulfilling the user needs, because in all cases it is immediately followed by a customization before move-in. Fig.7 illustrates the customization progression patterns developed in our samples.

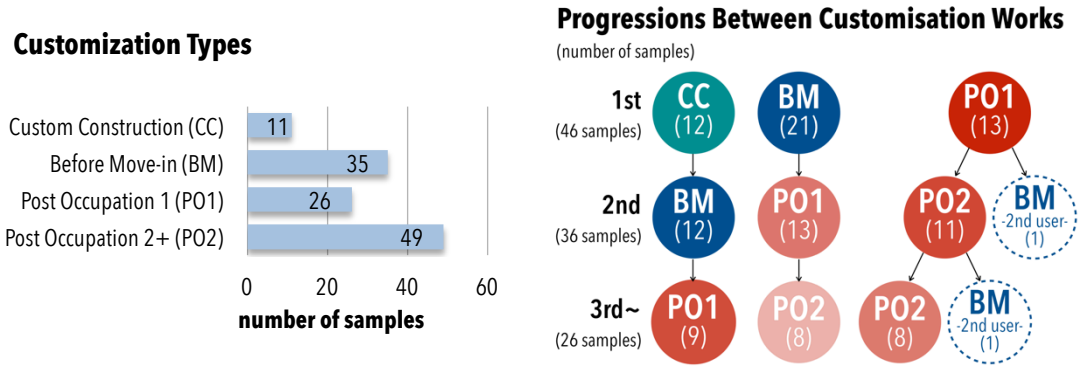
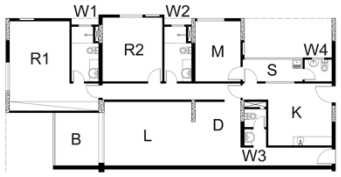


Figure 3.53 Dwelling Customization Stages

Custom Construction (CC):

Unlike in Sao Paulo, the samples in Santos showed custom construction, which happens in the layout and finishing level, and involves relocation of interior openings and placement or removal of partitions to accommodate the needs of the family. These works often implicate reverting the maid's room into a home office, or extra bedroom by simply changing a door position, but in some cases maid's rooms and third bedrooms were completely removed to expand a contiguous room. As an additional option, some dwellers could dismiss the placement of standard washroom sink and floor finishing in some rooms. Some construction companies have also accepted to place floor tiles bought by the consumer.

RH04 Before



After

Customization Content:

- The maid's room was demolished and replaced by a dining room.
- Floor tiles placement was dismissed in all rooms, except bathrooms, kitchen and laundry. Instead, slate tiles were applied after key handling, before move-in.
- The originally planned washroom sink was also rejected and another was placed before move-in.

Washroom (W3)

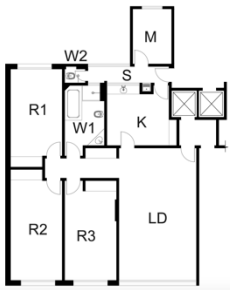
Dining Room (D)

Figure 3.54 Example of Custom Construction

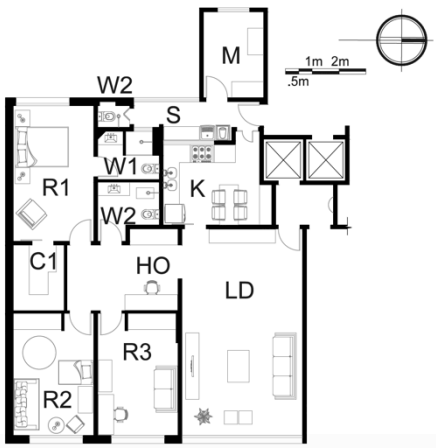
Customization Before Move-in (BM):

In case of customizations before move-in that happened after custom construction, these are focused in completing the parts that were dismissed from the original plan, to make the dwelling functional. But overall, before move-in customizations generally include the installation of built-in furniture, changing floor-covering material, plastered ceiling with built-in lighting, and replacement of old hydro-sanitary equipment. The works may be planned by the dweller, or a designer and carried by individually hired contractors (e.g. carpenters, tillers and plasterers), but sometimes they begin as furniture maker proposals that develop into a bigger project, by inspiring the dweller with sketches that incorporate additional content, leading to subsequent hires.

OV01 Before



After



Customization Content:

- Built-in furniture renovation in bedrooms, bathrooms and kitchen.
- Plastered ceiling, doors and windows replacement (all rooms, but laundry).
- Bathroom converted in two, with full replacement of service lines, hydro sanitary equipment and tiles.
- Removal of floor carpet layer that covered original wooden boards, with subsequent polishing and sealing.

Bedroom 2 (R2) Bathroom 2 (W2)

Figure 3.55 Example of Customization Before Move-in

Customization Post Occupation 1 (PO1):

These customizations have the general purpose of fulfilling the needs that could be noticed only post occupation period. They involve installation of air conditioning equipment in the largest rooms shared by the family (living and dining), and placement of doors to insulate them from contiguous rooms or corridors. Moreover, they include floor and wall coverage replacement for materials of easy cleaning, as well as replacement of broken window shutters. Smaller works include carpentry to adjust built-in furniture (specially in kitchen and bedrooms) to better suit the dweller's convenience, by changing dividers, and opening systems.

GB01 Before

After

Custom Construction Content:

- The maid's room was demolished and replaced by a dining room.
- Floor tiles placement was dismissed in all rooms, except bathrooms, kitchen and laundry. Instead, slate tiles were applied after key handling, before move-in.
- The originally planned washroom sink was also rejected and another was placed before move-in.

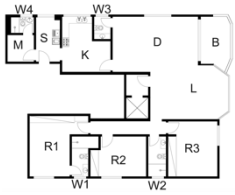
Dining Room (W3) Bedroom 2 (R2)

Figure 3.56 Example of Customization Post Occupation 1

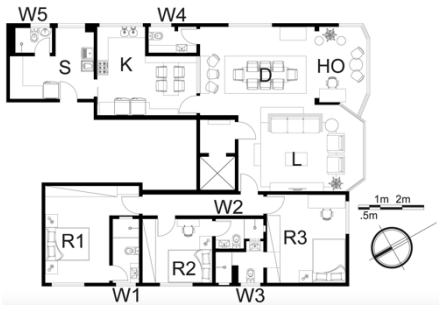
Customization Post Occupation 2 (PO2):

In later stages of post occupation, it was observed customizations below the finishing level, are usually focused on repair and maintenance, but beyond that, they were more focused in upgrading for contemporary fashion, or changes in family lifestyle. Growing families have bathrooms converted in two, to create bedroom suites for grown children, together with furniture upgrading to improve their study space, while shrinking families have vacant bedrooms converted into home-offices. Other works include balcony enclosure, painting and floor coverage renewal.

VM01 Before



After



Custom Construction Content:

- The maid's room was demolished and replaced by a dining room.
- Floor tiles placement was dismissed in all rooms, except bathrooms, kitchen and laundry. Instead, slate tiles were applied after key handling, before move-in.

Washroom (W3) Dining Room (D)

Figure 3.57 Example of Customization Post Occupation 2

3.5.3.4 SI System Detachment

These customizations have the general purpose of fulfilling the needs that could be noticed only post occupation period. They involve installation of air conditioning equipment in the largest rooms shared by the family (living and dining), and placement of doors to insulate them from contiguous rooms or corridors. Moreover, they include floor and wall coverage replacement for materials of easy cleaning, as well as replacement of broken window shutters.

Table 3.41 Customization and Building Levels

		Skeleton Level				Infill Level									
		Base Level		Common Level		Functional Level		Layout Level		Finishing Level			Decoration Level		
		Adaptation beyond individual boundaries				Adaptation with addition or demolition of parts				Renovation by replacement of old parts					
		XIV	XIII	XII	XI	X	IX	VIII	VII	VI	V	IV	III	II	I
#	Move-in Year	Dwelling Expansion	Exterior Cladding	Exterior Fixtures	Balcony enclosure	Service Lines	Bath and Kitchen Equip.	Relocation of Partitions	Relocation of Int. Openings	Built-in Furniture	Openings and Frames	Interior Cladding	Free-Standing Furniture	Wallpaper	Painting
1	2004					PO1	PO1		CC	BM	PO1	PO1			PO2
2	2002	PO1	PO1	PO1	PO1		BM			BM		BM		PO1	
3	2003					PO1	BM			BM		CC			
4	2003			PO1	PO2	BM	BM	CC		BM	PO2	BM		BM	
5	2013			BM	BM	BM	CC			BM		BM			BM
6	2003				PO1	BM	BM	PO1	CC	BM		CC			
7	2012	BM	BM	BM	BM	BM	BM	CC	BM	BM	BM	BM			
8	2005					PO1	PO1			BM	PO1	BM			BM
9	2003					PO1	PO1		PO2	BM		BM			
10	2003				PO1	PO1	BM			BM		CC			BM
11	2012	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM		BM	
12	2003			PO1					CC	BM					
13	2006					PO1	PO2			PO1		BM		PO2	PO2
14	2006	PO2	PO2	BM	PO2				CC	BM		CC			
15	2003				PO1	BM	PO1		CC	BM		CC			
16	2005			PO1		BM	BM			BM		BM			
17	1974					PO1	PO2	PO1		PO1		PO1			PO2
18	2012			PO1		PO1	PO1			PO1	PO1	PO1	PO1		PO1
19	2005					BM	BM			BM	BM	BM	BM		BM
20	1979			PO2			PO1			BM		PO1			PO2
21	2011					BM				BM	BM	BM			
22	1976	PO1	PO2	PO1	PO2	PO1	PO1	PO1	PO1	PO2	PO1	PO1			
23	2000			BM		BM	BM			BM		BM			
24	1985			PO1		PO1	PO1	PO1		PO1		PO2			
25	2012			PO1		PO1	BM	BM		BM	PO1	PO1			
26	1975						PO2	PO1		PO1	PO1	PO1			PO1
27	2015			BM		BM	BM	BM	BM	BM	BM	BM			
28	2000	PO2	PO2	PO2	PO2	BM				BM	PO1				BM
29	2006	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM			
30	2001		PO2				PO1				PO1	PO2	PO2		PO2
31	2013	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM			
32	2002	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1			
33	1993	PO2	PO2	PO2	PO2	PO2	PO2	PO2	PO2	PO1	PO2	PO1			
34	2001					PO1	PO1					PO1			
35	2007					BM				BM	BM	PO1	PO1		BM
36	1980			PO1		PO2	PO1			PO2	PO2	PO1			
37	2001			PO2						PO1	PO1	PO1			
38	2011				BM	BM		CC	CC	BM		BM			
39	2011				BM	BM	BM	CC	CC	BM		BM			
40	1997					BM	BM			BM	PO1	BM	PO2	PO1	PO1
41	2005					BM	BM	BM		BM	BM	BM	PO1		PO1
42	2015					BM	BM			BM	BM	BM			
43	2014				BM	BM	BM	CC	CC	BM		BM		BM	BM
44	1979	PO2	PO2	PO2	PO2	PO1	PO1		BM	BM	BM	BM			
45	2013					BM	BM	BM	BM	BM	BM	BM			
46	1975			BM		BM	BM	PO1	PO1	BM	BM	BM			

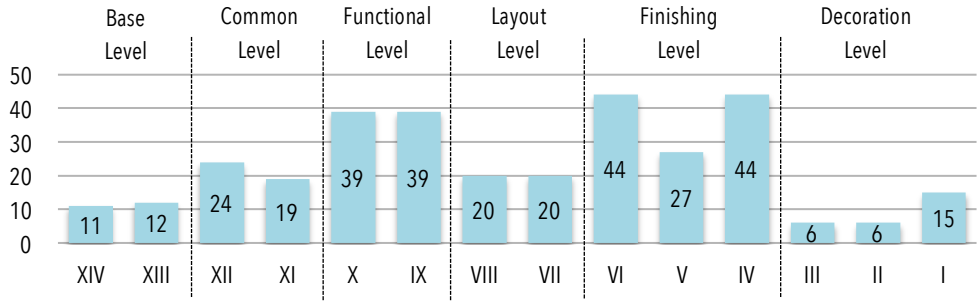


Figure 3.58 Customization Works According to SI System

3.5.3.5 Balcony Enclosure

Balconies Connected with bedrooms tend not to be enclosed.
Balconies connected with living dining and service areas tend to be enclosed.
Since the balcony is incomputable when it is open and occupies until 10% of the floor coverage, and this actual value in square meters is unclear to the users, they may assume that if the neighbors are enclosing their balconies, perhaps it is ok to enclose their own too.

3.5.3.6 Industrialization of Infill Components

In order to clarify the level of industrialization of infill components in Santos, we have choose to study amount of user decisions, and the skill level of the personnel involved in furniture production. Since furniture selection is generally not isolated, but the entire room composition we chose to analyze the furniture according to the room they compose in a way an equal amount of rooms can be summed from each dwelling sample. Each of Santos' dwelling samples have at least 1LDK, which includes at least 1 pair of bedroom + bathroom. But, considering that the furniture employed to configure living and dining rooms is generally standard furniture bought off-the-shelf, and does not offer user participation in its process, we preferred to exclude them from this analysis. Therefore, we chose to work with the main kitchen, master bedroom and bathroom. Table 3.5.4 summarizes the main furniture production methods available within or samples, according to user participation and professional skill level involved.

Table 3.42 Furniture Production Methods in Santos' Samples

Production	Definition
DIY	Made and assembled by the dweller, or a relative.
Standard	Standard parts and assembling in general.
Semi-Standard	Standard parts and custom made parts combined to attend individual specifications.
Made-to-Order	Made according to an individual's specifications.

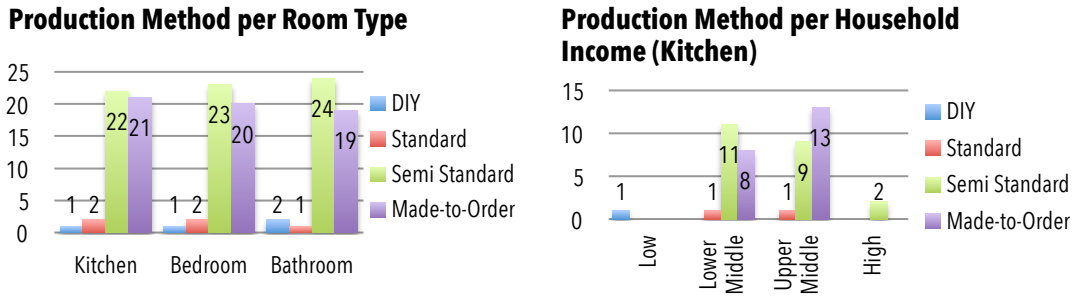


Figure 3.59 Furniture Samples Classification

Kitchen, Bedroom and Bathroom can be considered as social, private and service areas in a Brazilian home, and therefore, the respective gaps of 1, 3 and 5 points between semi-standard and made-to order choices could be interpreted as user's priorities in terms of aggregating status by the improvement of these rooms. In this case, made-to-order furniture could represent the highest added value in the production chain. But this would only be true if the high-income households also had chosen made-to-order furniture. Since it was found semi standard furniture in the high-income household samples, it suggests the production of semi standard furniture might be adding value in the production chain, by enhancing the consumer experience with high quality finishing levels, or through branding. Moreover, made-to-order furniture has unequal quality levels, because it depends on the skills of the hired personnel producing it.

3.5.4 Conclusions About Apartment Customization in Santos

The findings of this study revealed that the dweller's motivations for apartment customization in Santos are similar to those of dwellers in Sao Paulo, and therefore, are closely related to the need of demarcating the family's territory when they move-in, an later on, to the need of upgrading the dwelling along with the family's status.

From the decision-making perspective, although the laws governing remodeling activity in multi-family buildings are basically the same nationwide, in comparison to Sao Paulo, Santos' relationship with the seaside has lead to a different use and appropriation of balcony spaces. Some balconies have acquired a character of poolside place (i.e. only ocean view, without actual pool, except for penthouse units) for sunbathing, barbecuing, dining, or receiving guests. Hence, these balconies are larger, and often occupy more than 10% of the FAR, having their areas accountable.

As a result, balconies with a poolside character might be formally enclosed without implicating an increase in the property taxation. The problem is the general dweller in Santos, or in any other city in Brazil, does not have a clear idea on how much of the floor area ratio the balcony is occupying, and simply assumes that if the neighbor has glazed the balcony right beside, it is probably reasonable to do the same. So, again, in order to prevent issues caused by informal balcony enclosure, we suggest a review on the national building legislation, including the balcony as an accounted area, and the creation of condominium bylaws with clear design guidelines so that dwellers can individually choose to keep it open or enclosed.

The apartment stock in Santos is proportionally larger than in Sao Paulo, encompassing upper and lower middle strata of the population. Moreover, with less market pressure than Sao Paulo, the infill industry in Santos shows itself more open to informal agreements than in Sao Paulo. As a result, the income gap keeps the construction workforce affordable, creating opportunities for skilled or ordinary contractors to carry out made-to-order customizations for higher or lower income families.

Our investigation on customized apartments in Santos suggests that that the SI System concept should include not only flexible boundaries, with flexible facades, like we proposed for Sao Paulo, but should also include flexible service supply systems, admitting bathroom and kitchen arrangements different from those originally proposed, in a way dwellers can upgrade their home layouts to suit their family needs.

Table 3.43 Decision Making Levels in Santos

	Support	Infill		
4 parts	Base Building	Common Elements	Boundary Elements	Interior Elements
Examples	Columns, beams, foundations	Waterproofing, exterior walls, cladding, elev.	Window frames, entrance hall, doors, balconies	Partitions, int. cladding, fixtures, furnit. & equip.
Life Span	Long	Short		
Space Use	Common		Exclusive	
Concern	Collective		Individual	
Decision Making	Small works: syndic		Dwellers under common rules	Dwellers
	Large works: HOA			

CHAPTER 4

SI LEVELS AND CONTROL IN EMERGING SOCIETIES

CHAPTER 4

SI HOUSING LEVELS AND CONTROL IN EMERGING SOCIETIES

In this chapter we will put the background case studies information into perspective, by identifying which layers of the population do our users represent in the local and global context and clarifying the housing options are currently being offered to them. Then, we will analyze the adaptability demands in each case study, in terms of which architectural elements need to be changed, and who controls the decision of changing it. The purpose of this chapter is to clarify the decision-making levels for Open Building implementation in emerging societies.

4.1 PLACING OUR HOUSEHOLD SAMPLES

Clarifying which layers of the local population our samples actually represent while simultaneously developing a comparative standpoint, required statistic information from diverse local statistics bureaus, which often showed discrepancies in terms of methodology, and therefore were adjusted as possible. For instance, the average monthly disposable income of families is usually measured in the local currency, and may be easily converted into US dollars for an effective comparison, though the conversion does not represent the purchasing power it represents in that location.

Moreover, as explained in page 7, our qualitative study required volunteers who reside in customized apartment units. But, please notice that the group of people who lives in apartment units might not encompass a cluster that represents the whole population residing in a given location. Therefore, our samples could only be representative of the population that resides in apartment buildings at the selected locations (Figure 4.1).

Figure 4.1 Sampling Strategy Impact in Representativeness
(see Figure 1.3, p.07)

Notwithstanding, we tried to confirm the representativeness of our samples, based on the available data. We found information on the income classification of apartment dwellers in Sao Paulo and Santos, but we could not find similar information about the other cities, because the income either refers to the entire population, or is classified according to different job occupations. Our final option was to compare the volunteered households to the general populations of each city, using available data such population age, monthly disposable income and family size. Although the evidence is incomplete and presumably rhetorical to infer a general profile of the local dwellers, it shows that in spite of the social differences, the individual behaviors result in dwelling interactions that demand similar architectural response, and similar control strategies, allowing the development of general guidelines for a user-oriented housing model.

4.1.1 Households Profile

The five cities offer housing supply from public and private sectors, but the samples available at the time of our observation were publicly supplied in Jakarta, and privately supplied in the other cities. Household's tenure is primarily owned, regardless of the location. Although Dalian presents the largest index of homeownership, dwellings in China are sold by the government in purchasing contracts with a length of 70 years; after that, they might be repurchased (Figure 4.2).

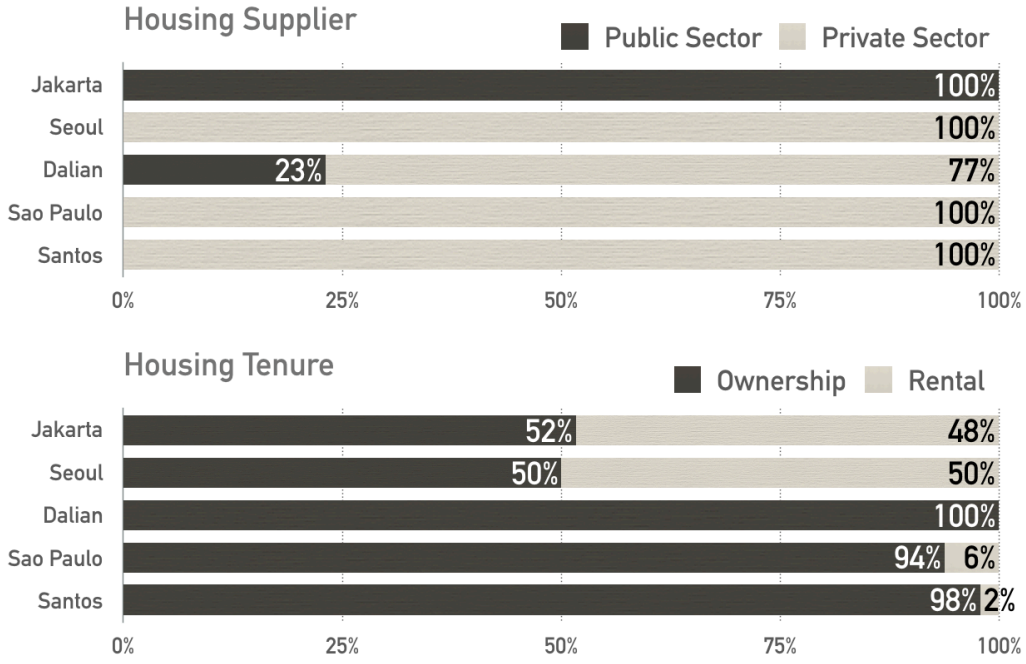


Figure 4.2 Households Profile

Samples showed household heads younger in Jakarta than in other cities. In general comparison, the heads of household age follow a skew pattern similar to the national age pyramid, in the Asian cities. The same doesn't happen in the Brazilian cities because of a particular condition. In Brazil, the stock of apartments is relatively small, both nationwide and in the metropolitan level. Moreover, the stock of apartments is usually concentrated in the city center in the hands of the upper middle class. The only city where the rate of apartments surpasses the rate of detached units is Santos (Figures 4.3 and 4.4).

Therefore, as shown in Figure 4.1, the households that occupy apartment units in Sao Paulo and Santos do not represent the totality of the national population. Instead, they represent the wealthier and well-educated families that can afford living in the city center, where are the population is decreasing.

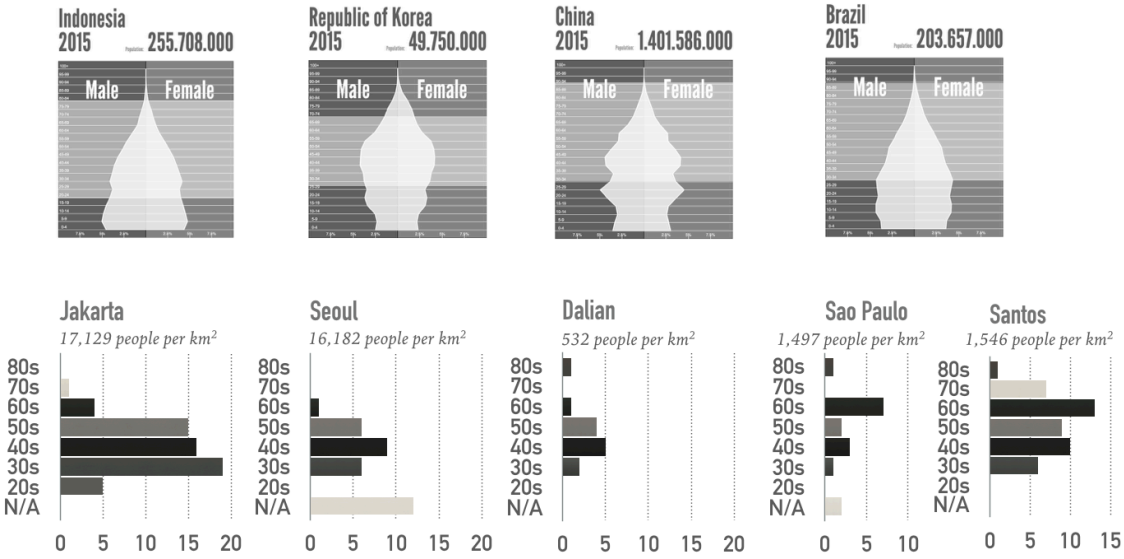


Figure 4.3 Age of the Household Head

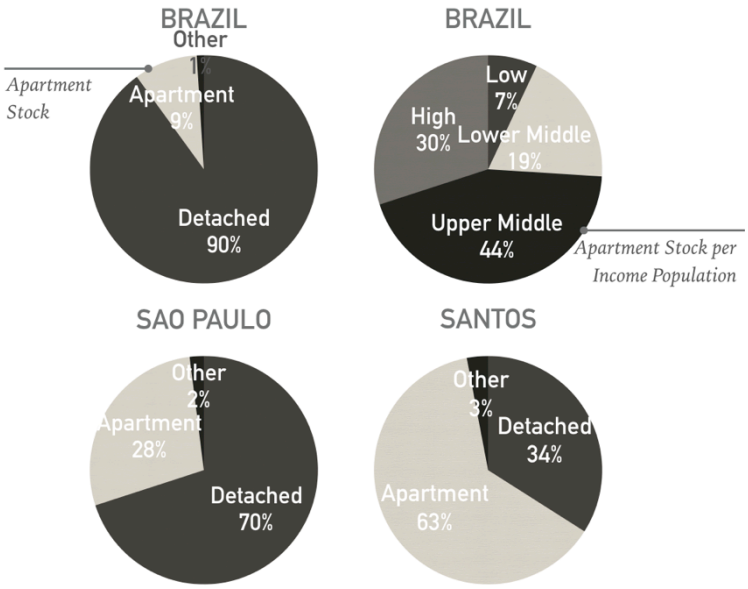


Figure 4.4 Profile of Apartment Occupiers of Sao Paulo and Santos

For all practical purposes, the households income here do not represent the local population of these cities, but the population that occupies the apartment dwellings we had the opportunity to visit. For instance, Jakarta has a larger number of low-income families, because the samples are constituted only of affordable dwellings (Figure 4.5).

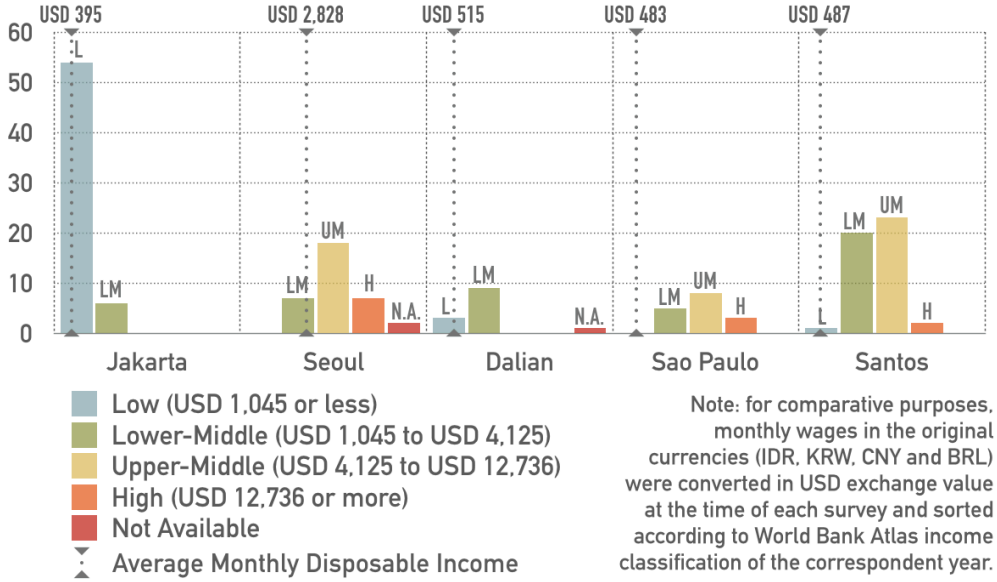


Figure 4.5 Household's Income (in monthly wages)

4.1.2 Correlation Between Family Size and Floor Plan Type

Family sizes in our Asian sample frame are slightly larger than the local averages. Instead, the Brazilian samples have family sizes marginally smaller than the mean. Correlating the family size and number of bedrooms in each sample, it was found that the number of bedrooms in Jakarta is underestimated both compared to the average family size and to the number of actual family members, which might produce some architectural elasticity for better accommodation (Figure 4.6).

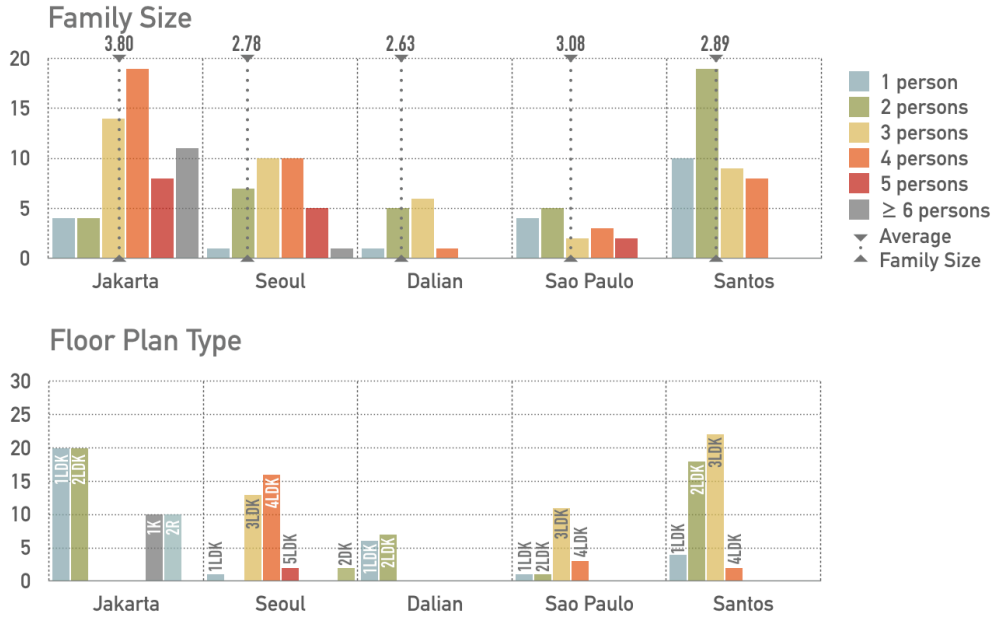


Figure 4.6 Correlation Between Family Size and Floor Plan Type

Relatively, there is a critical gap of dwelling area per capita, varying from 8.3 m^2 per person in Jakarta, and 67.5 m^2 per person in Santos. For instance, a 2LDK unit size can vary from 28 m^2 in Jakarta to 114 m^2 in Santos. This has a substantial impact on how people relate to the dwelling unit and the customized content we will see in the upcoming analysis, but does not exclude the needs of user choice in one place or another. In the following pages, we will see that although the users have different characteristics, many of their needs can be addressed by using the same solutions (Figures 4.7 and 4.8).

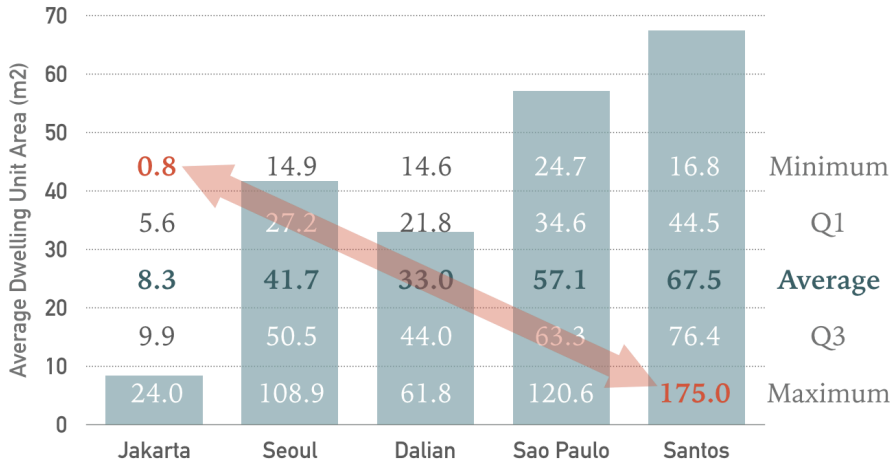


Figure 4.7 Average Dwelling Area per Capita

Figure 4.8 Average Dwelling Area per Number of Bedrooms

4.1.3 Households per Complex

Because our discussion involves not only individual, but collective user decisions, it is important to mention the amount of households in the locations we visited, because it will impact the way of controlling those decisions. In general, the urban land parcels in Sao Paulo and Santos are very small, leaving space for no more than one or two building blocks with an average of 4 units per story. Therefore, the HOA's size in Brazilian condo samples is really small compared of those of Jakarta and Seoul's samples. Unfortunately, that information about Dalian's samples is missing (Table 4.1).

Table 4.1 Households per Complex

City	Jakarta	Seoul	Dalian	Sao Paulo	Santos
Minimum	180	19	-	14	6
Q1	600	436	-	25	30
Average	1099	2625	-	81	66
Q3	960	1601	-	59	72
Maximum	2844	30002	-	480	390

4.2 MEASURING THE RANGE OF INDIVIDUAL DEMANDS

In order to assess the range of individual demands within the SI levels, we first classified the dwelling customization works into eight levels of complexity, according to their scope in terms of territoriality and ideal decision-making perception. Customizations close to the bottom of the chart should be ideally closer to individual decisions, while the ones on the top, should be ideally closer to collective decisions.

Moreover, the customizations could be grouped into three categories in terms of territoriality: home personalization, which includes any sort of dwelling improvement within its boundary walls; soft appropriation, which includes modification of exterior components, or placement of personal objects outside the dwelling unit; and dwelling expansion, which includes relocation of exterior boundaries, by addition of spaces that were not originally accountable to the property area.

Then, we tried to disentangle these customizations into the four SI sub-levels, but we could only fit two complexity levels into the interior level: I. Decoration and II. Finishing. The other complexity levels could not be classified, because even though some of the customized components would fit in one of the SI sub-levels, the impact caused by that customization would reach another sublevel (Figure 4.9).

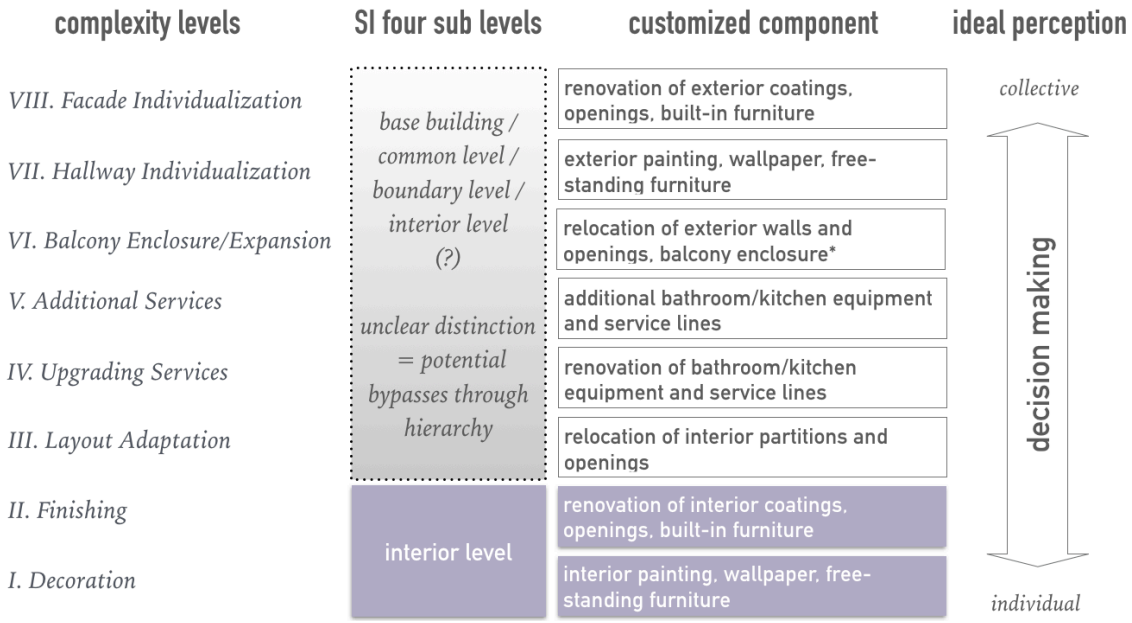


Figure 4.9 Individual Decisions Measurement Criteria

Roughly exemplifying, imagine placing a ceramic bath tube in a dwelling unit's bathroom. Filling it with water will add an unaccounted demand of water supply and sewage, and perhaps stop these services in other apartment units during construction work. Now, repeat this in other dwelling units of the same building and we might be seriously overloading the structure. Although this customization starts at the interior level, it might cause an impact on other building levels, which we call hierarchic bypasses (Figure 4.10).

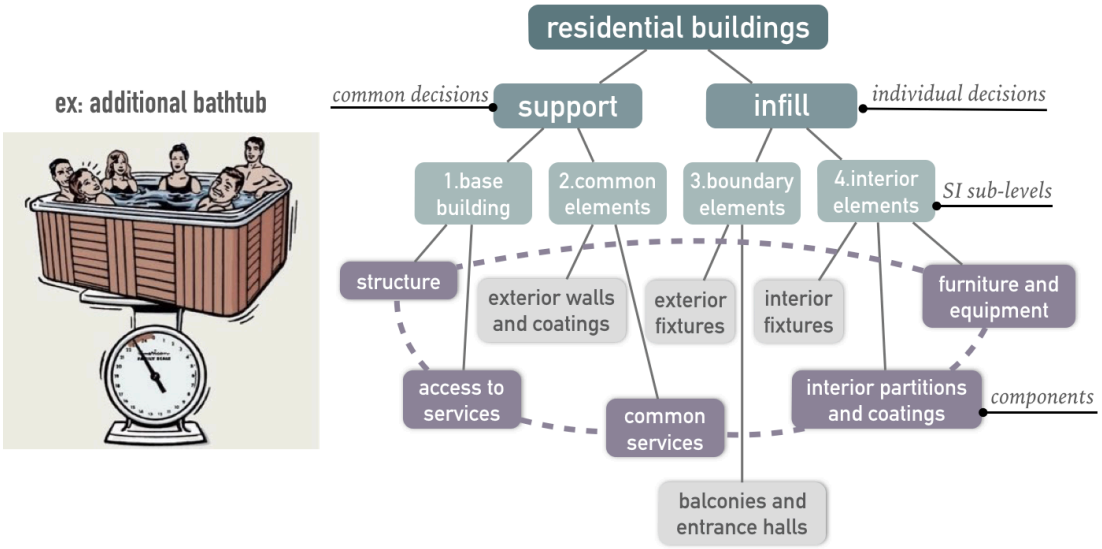


Figure 4.10 Example of a Hierarchic Bypass

We believe it is possible to enable safe dwelling customizations in any of the eight complexity levels we found, as long as there are rules for them to happen. The figure below shows the customizations classification into each of the eight categories mentioned before, plus balcony enclosure, which is not understood as dwelling expansion in all cases, but this will be explained later. In the following pages we will study the customizations within the dashed line, and we will clarify their potential bypasses between the SI levels and then, address solutions to reduce the problems they might problems they lead to (Figure 4.11).

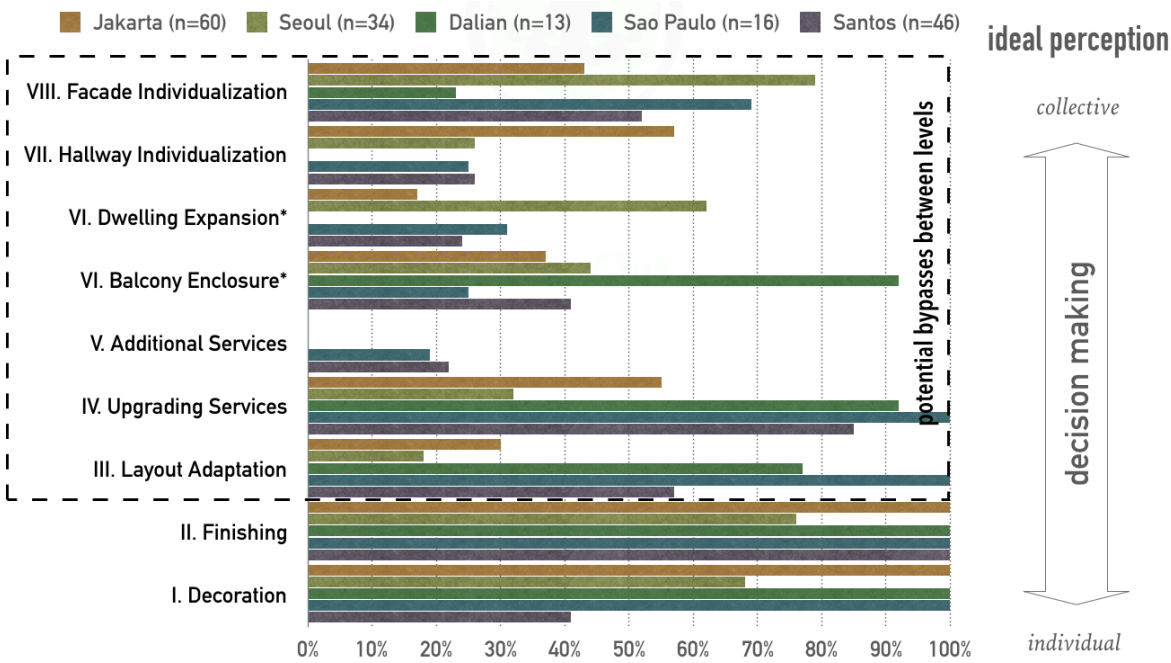


Figure 4.11 Actual Range of Individual Decisions

4.3 HIERARCHIC BYPASSES

4.3.1 Layout Adaptation

Typical buildings in Indonesia, China and Brazil have mechanical fixtures, wiring and ducts embedded into the load-bearing structure. This makes pipe relocation/renovation difficult, because the components are assembled with no regard to their different life cycles, and/or the functional purposes. Such as, bathroom pipes are built within cavities inside the bricks, covered with a layer of concrete, and then another layer of ceramic tiles. As a result, it is impossible to replace one component without disturbing its relation with the others".

Moreover, the load bearing wall system causes many limitations in terms spatial flexibility. In the case of the Brazil, structural masonry is regarded as cheaper than RC structure until 25 stories. It is considered suitable to attend the low-income demand, which correspond the larger portion of the population. But with the use of masonry partitions, the difference between the support and infill parts of the building is usually unclear, especially to dwellers that take charge of the remodeling process. As a result, the unawareness about how the remodeling process can compromise the integrity of a building, together with the informal chain of interior service suppliers has been leading to seriously dangerous apartment customizations.

Between January and February 2012, it has been registered four residential building collapses due to informal remodeling activities. Figure 4.12 shows two of them; the first, in Rio de Janeiro, by accidental removal of loadbearing components resulting in total collapse of the subject building, which impact imploded another contiguous building; and the second, in Sao Paulo, by accumulation of remodeling debris on the rooftop, opening a hole of 12 meter diameter across 15 stories.

Figure 4.12 Bypasses in Layout Adaptation Resulting in Building Collapse:
Rio de Janeiro, left (Freitas and Nunes, 2012), and Sao Paulo, right (Queiroz, 2012)

On interviews with two developers from Sao Paulo, which offer floor plan individualization options, we inquired them about the application of lightweight partition elements. One of the companies affirmed that 100% of their residential developments are built with load bearing masonry, and explained that this construction technique is a major factor on the design of floor plan options. The other company affirmed using both structural masonry and RC construction, and, on an attempt to employ divider panels as interior walls, got lawsuit by their clients for deliberate use of low-quality material. Since then, the use of divider panels by this company has been restricted to the construction of shafts.

4.3.2 Upgrading and Additional Services

Pipe relocation works were found within samples of Jakarta, Dalian, Sao Paulo and Santos, not only to rearrange the layout of bathrooms and kitchens, but also to relocate the entire room, sometimes reaching even the balcony space. Moreover, bathroom and kitchen additions were carried in samples of Sao Paulo and Santos.

These works might cause troubles and complications both in the neighborhood as well as the building scales. On the neighborhood scale, temporary water cut during the construction work sometimes blocks the supply for other units. Similarly, additional plumbing branches may reduce the water flow in peak hours. On the building scale, building new pipes might imply breaking new cavities within walls and slabs, in unpredictable pathways, and sometimes, creating leakages between units. In addition, bathroom floor and wall tiles, bath tubes, toilets, ceramic sinks and marble top cabinets are substantially heavy, and will almost certainly overload the building structure, especially, if added in many units. Figure illustrates a case of kitchen relocation to the balcony in Dalian, a case of bathroom expansion in Sao Paulo, and a case of bathroom duplication in Santos.

To address these issues, we suggest that the disentanglement of decision-making levels, by, for example, building pipe lines with independent branches and readings for each unit. In fact, it would be suitable plumbing should be detached from the walls and installed inside movable shafts to prevent unpredictable pathways and leakages. Finally, it should be incorporated as condominium bylaw or remodeling regulation for apartment buildings located in Sao Paulo and Santos the condition that additional bathrooms summed to pre-existent bathrooms should incorporate area and load of equipment equivalent to the original plan.

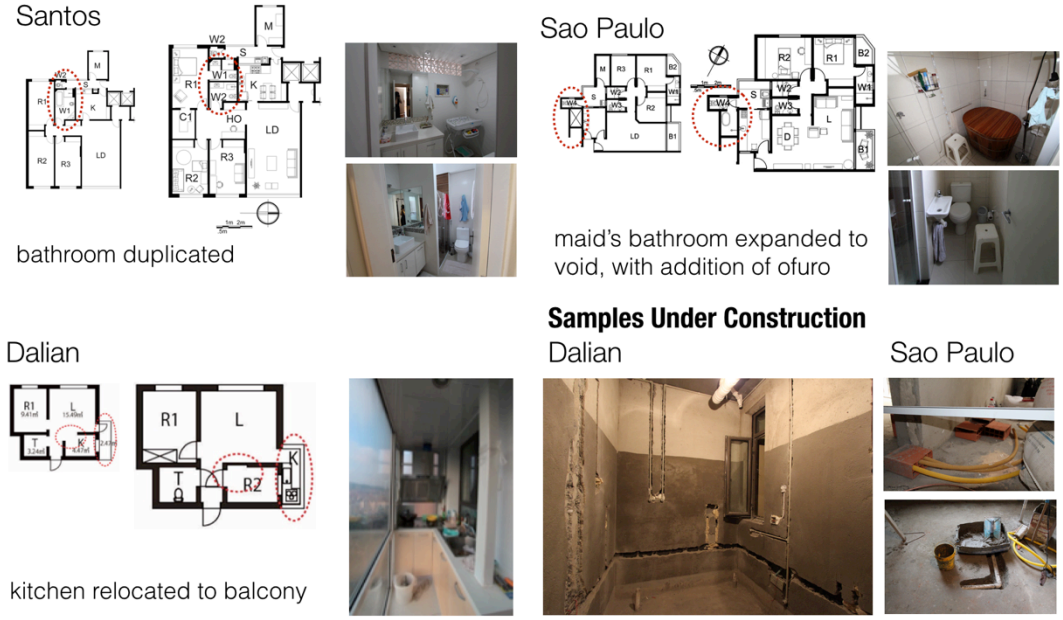


Figure 4.13 Bypasses in Upgrading and Additional Services

4.3.3 Soft Appropriation and Dwelling Expansion

From the observations, it was found that, in Jakarta, Santos and Sao Paulo, increases in the dwelling unit area are not only limited to balcony enclosure. It also happens towards the attic roof in penthouse units, common areas in ground level or common halls upper level apartments. Therefore, we suppose that dwelling expansion generally relies on space availability and lack of objection against its claim.

In the samples of Jakarta, the samples are narrower and the opportunities to grow were related to the height of the unit. In fact, the exterior of each unit seem to be treated individually. For instance, ground floor units incorporated surrounding yards; rooftop units developed an attic space under the roof; and the units in between claimed the common hallway. In turn, in the case of Sao Paulo and Santos, the dwellings are larger, and the incorporated areas typically had exclusive access, such as elevator halls, roof terraces of penthouse units, and so on.

In any case, the expansions might overload the building structure, especially, if numerous. By the building regulations of Brazil and Indonesia, expansions are forbidden and generally imply on tax increase proportional to the growth in property area, requiring a certificate of additional construction potential for property regularization. As a result, expansions are usually associated with ordinary and/or unregistered contractors, and lack of law enforcement, inhibiting the establishment of a quality streamline to protect the integrity of the buildings.

It is important to notice, however, the expansions do not always redefine dwelling area with hard boundaries. For instance, in the case of Jakarta, there were three cases of dwelling expansion through the common hallway by individual painting the exterior of the unit, replacement of openings, and placement of furniture. Similarly, in the case of Santos and Sao Paulo, some dwellers claimed elevator halls by individually replacing floor tiles and entrance doors, renovating wall coverage, and decorating it art frames and mirrors. Figure 10 illustrates dwelling expansions with hard and soft boundaries.

To address these issues, designers should clearly detach common and individual areas during planning stage, and give appropriate use to common areas of condominiums to prevent them of remaining idle and unnoticed. Also, it should be provided a buffer zone for dwelling expansion included in the construction potential and away from collective areas to coordinate all expansion activity in a pre-established sector of the building. Finally, condominium regulations and bylaws must provide specific conditions for remodeling and renovation, and enforce them, to promote formal and high quality construction, enhancing the lifespan of buildings.

Figure 4.14 Bypasses in Dwelling Expansion

4.3.4 Balcony Enclosure and Dwelling Expansion

Dwelling expansion is when the exterior walls of a unit are relocated, increasing the property area. As expected, due to their minimum size, Jakarta's samples were expanded as much as they could, depending on their location in the building. The sample below, on the left, is located in the ground floor, and thus, it incorporated ground space, doubling its area. Other samples in the top stories, incorporated the attic roof, but the most critical cases are in the mid stories, which incorporated hallways, and sometimes just hanged out of the facade, with wing walls. Expansion is also common in wealthier households of Brazil and China, and usually happens by incorporation of unclaimed areas.

Another way of expanding dwellings could be through balcony enclosure. From the observations, it was found that, in the five cities, balcony enclosures are very popular. Both customization approaches reflect territorial perceptions that allow individual priorities to permeate the dwelling boundaries in bias of common priorities. This is a very complex issue, but we prefer to study it with detail in the next chapter.

Figure 4.15 Bypasses in Soft Appropriation

4.4 REDUCING BYPASSES BETWEEN LEVELS

It is impossible to keep dwelling customizations safe, when they can reach any building level. But we can allow individual decisions reach the boundary level, as long as we build rules for them to happen.

In the first two levels it is ok to keep individual choice as it is, without regulations, because the content is totally personal and won't cause any harm to anyone. But going upwards, there should be clear distinction between load bearing walls and partitions, and any customization on these levels, should keep the original load to the structure, to avoid structural problems.

Another way to keep customizations in the interior level safe is to detach plumbing from walls, and if necessary, hide them in movable shafts. It is also important to make autonomous pipe branches and readings, so that one unit does not block the water of the other while in construction. These problems might be avoided at development stage, and be enforced by local building codes. But, if not, they will demand professional supervision during customization stage, or be controlled through apartment remodeling norms and standards.

territory	customizable contents	rule	decision (base)
limited common	VIII.renovation of exterior coatings, openings, built-in furniture	enforce pattern agreed in condominium assembly	HOA (condo convention)
	VII.exterior painting, wallpaper, free-standing furniture	follow pattern agreed between neighbors who share the space	Subcommittee (condo bylaws)
	VI.relocation of exterior walls and openings, balcony enclosure*	turn the balcony into a buffer zone for expansion	Developer / HOA (land use policy)
exclusive	V. additional bathroom/kitchen equipment and service lines	detach plumbing from walls	Designers (local building code) (remodeling norms)
	IV. renovation of bathroom/kitchen equipment and service lines	make autonomous pipe branches keep structural load as original	
	III.relocation of interior partitions and openings	distinguish partitions from boundary walls and load bearing walls keep original load to the structure	Interior planners at customization stage (remodeling standards)
	II. renovation of interior coatings, openings, built-in furniture	free choice	dweller
	I. interior painting, wallpaper, free-standing furniture		

Figure 4.16 Proposal: Coordinate Individual Decisions Within the Infill Level

Hallway and facade individualization should follow a pattern agreed in condominium assembly, and enforced through condominium bylaws. Depending on the dwellers territorial behavior, it might be controlled in smaller scale following a pattern agreed between dwellers that share that space. The pattern could be decided in subcommittees organized by story, block or orientation.

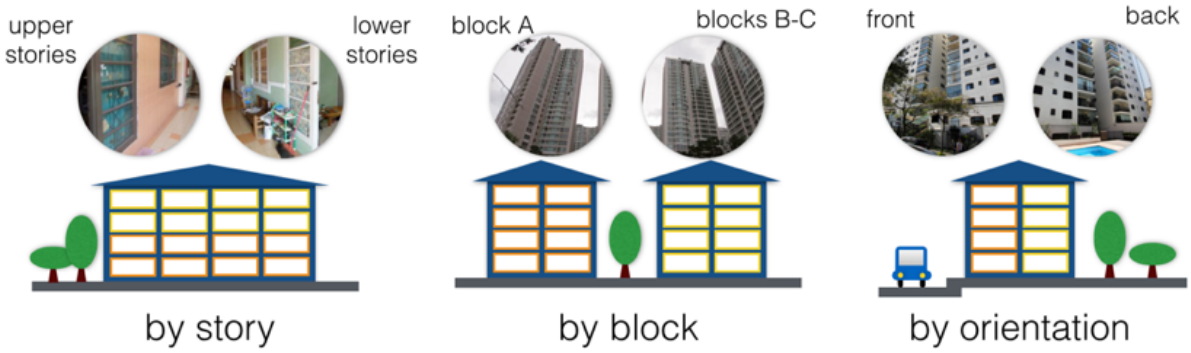


Figure 4.17 Limited Common: HOA Subcommittees per Shared Area

Finally, balconies should be recognized as accounted areas by local land use policies, and turned into buffer zone to coordinate dwelling expansion, rather than deny it. Perhaps this could prevent random expansions. This might be planned by developers during planning stage, and maintained by the HOA after the condominium is handled to the dwellers.

4.5 ABOUT SI LEVELS IN JAPAN AND THE EMERGING NATIONS

We understand, that in the case of Japan, policies need to be more restrictive for safety reasons. For instance, although balconies are parts of exclusive use, they are regarded as parts of collective concern, because they are used as fire escapes, and thus, cannot be adapted.

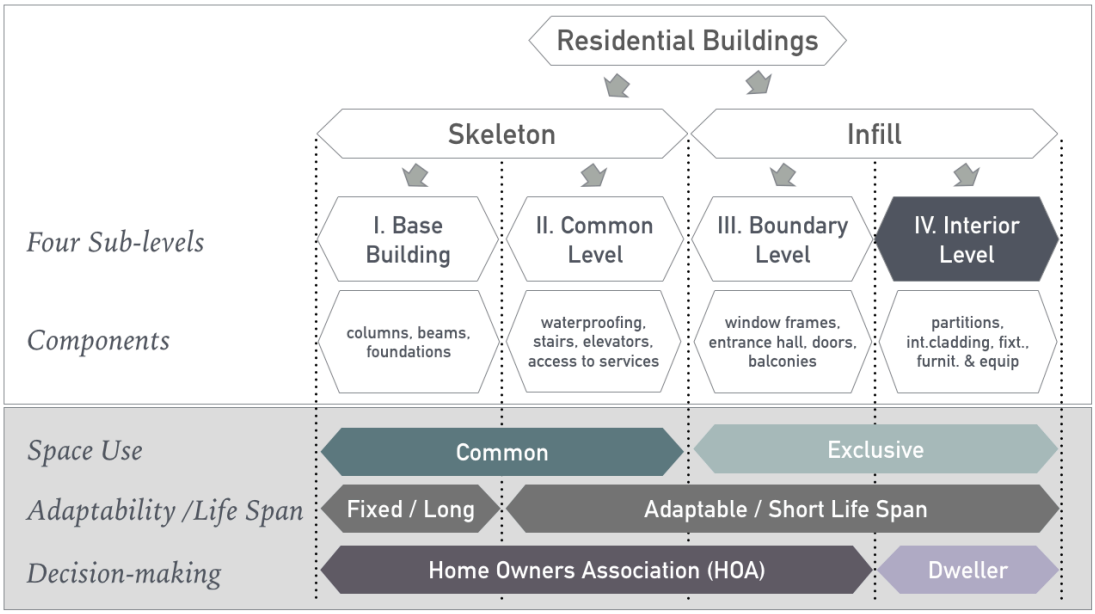


Figure 4.18 SI Levels in Japan

In turn, in the emerging world, the territorial perception allows individual priorities to permeate the dwelling boundaries, sometimes in bias of common priorities. I believe that by coordinating the hierarchic bypasses in a major frame, which involves policy makers, developers and designers, dwellers of multi-family buildings can enjoy their right of choice while keeping their homes safe.

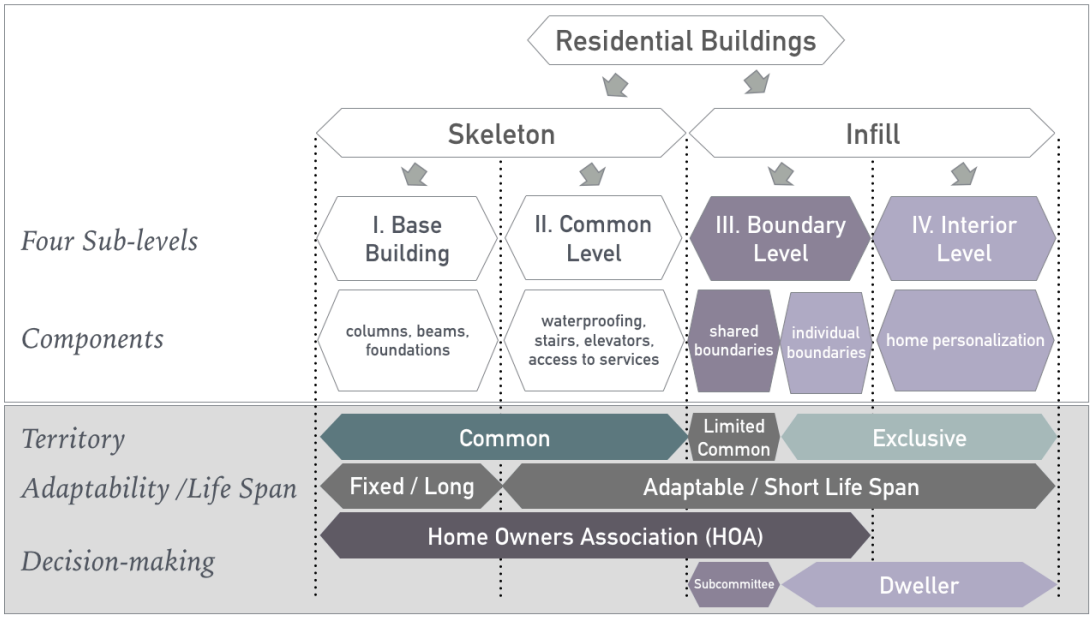


Figure 4.19 SI Levels in Emerging Markets

CHAPTER 5

FACADES AS MARGINS OF TERRITORIAL POWER

CHAPTER 5

FACADES AS MARGINGS BETWEEN TERRITORIAL POWERS

Based on the outcomes of the previous chapter, we propose an analysis of a very specific and controversial zone: the building facade. First, we clarify the building policies related to facade adaptation on each country, then, we compare them to the actual adaptation behavior. The goal of this chapter is to establish ways of controlling individual decisions that might trespass the margins of public interest or harm the facade performance.

5.1 INDIVIDUAL PERCEPTION AND POLICIES MANAGING FACADES

As previously organised by our native team members in early reports, in the following lines we summarise the background on the national policies regarding the management of the boundary level in the countries we visited.

5.1.1 Indonesia

In Indonesian public housing, it seems that the management of interior and exterior areas do not depend much on the national legislation; rather, it is basically organised in the neighbourhood level. Depending on the number of households per complex, the HOAs in Indonesian public housing can be stratified into three or four organisational levels:

1. The neighbourhood level (PPRS), which consists of the HOA, including all the homeowners in a complex;
2. The building block level (RT), which may consist of a group of 15 to 60 households;
3. The block sector level (Sub-RT), which consists of a relieving measure to reduce the branch of households under the same rule. Their decisions are then coordinated by a sector of the building, such as shared entrance hallways, or staircases;
4. The individual level, which consists of the householders' right of managing their dwelling units and surroundings.

But although the organisational structure seems well established, the regulations are vague in terms of clarifying which components can be modified. As a result, a substantial amount of balconies have been enclosed, without construction permission in owned units. Moreover, the enclosures were not limited to the placement of window sashes, but there were cases that created wing walls coming outside the facade. It is also commonplace to find dwelling units expanded to common areas, especially in lower rise buildings. Dwellers at mid-rise buildings also customise the common space near their unit by painting, replacing openings and placing furniture.

We have observed a total of 60 dwelling samples, but the amount of housing complexes is only 5, thus, it is hard to generalise our conclusions, but management policies might be more permissive or restrictive depending on the housing tenure.

For instance, interior customisation is allowed for two ownership complexes and not mentioned in the other two, but forbidden for the rental complex. In turn, exterior customisation involving modification of exterior walls is prohibited in one ownership complex, and allowed in another complex, under the condition of acquiring construction permission. The other two ownership complexes did not provide regulation for exterior customisation. In the rental complex, exterior customisation rules forbid alteration of dwelling shape, structure, and service lines.

5.1.2 Korea

In the national legislation on "*Property and Management of Multi-Storey Buildings*" there are no clear provisions whether the balconies correspond to individual or collective property. Also, according to Article 2, Section 14 of the national Building Code, the balcony consists of a buffer space between interior and exterior parts of a building, placed beyond its exterior walls to offer possibilities of outdoor contemplation, resting, etc. In the case of residential buildings, the Ministry of Land, Transport and Marine Affairs deliberates that it can be used for different purposes such as living room, bedroom, storage and so on.

In January 2006, balcony enclosure has been enabled by an amendment in the national Building Code, which aimed to regularise the condition of around 40% of Korean apartments that had their balconies informally enclosed. But, together with the regularisation of balcony enclosure, it came another amendment that deliberates the need to establish a third additional emergency escape route for apartment buildings above four stories, in case the direct access for the main two staircases is blocked.

From the above, balconies could be as individual property of exclusive use. Although, in order to keep a certain degree of exterior uniformity and prevent problems such as leakages between units, there are standards that should be followed to maintain the quality and performance of the building facade, each homeowner may make use and appropriation of the balcony according to his/her own needs and expenses.

Once balcony enclosure has become accepted by national building legislation, and since it has not been regarded as dwelling expansion, developers have started to add a column into home purchasing contracts, where the consumer can choose whether the balcony should be enclosed or not. It is important to notice that balconies with a depth up to 1.5m are unaccountable to the floor area of the unit, and, if there is no change in the property area, there will not be an increase on the real estate taxation.

Typical Korean apartments also have entrance hallways shared by few units, but they are not individually appropriated by the dwellers, because they are perceived as common property.

5.1.3 China

Like in Korea, the legislation in China also does not offer clear provisions whether balconies are classified as collective or individual property. However, in the Chinese Law, the ownership of things is generally understood as the right of use. There is also no mention on the balcony use as emergency escape route. Hence, balconies could be assumed as private properties of exclusive use. Moreover, from the land use management perspective, the balcony enclosure will not imply increase in the unit floor area; therefore, it will not imply increase on the real estate taxation either.

In China, boundary elements of buildings, and shared entrance hallways are generally perceived as part of the dwelling unit and are often incorporated/appropriated by individual users. Moreover, it seems the condominium management lacks organisational structure, because there is no well-established HOAs. Instead, the condominiums are handled to management companies that take charge of no more than the building maintenance, carrying out periodic inspections and repairs.

5.1.4 Brazil

In Brazil, when the balcony space occupies less than 10% of the floor area ratio, it is classified as common property (if the area is unaccountable) of exclusive use, and should be maintained at the expense of its respective owner, according to condominium convention and bylaws. It is also recognized as part of the urban space, and the landscape, and therefore, it can never be permanently enclosed.

Therefore, it is allowed the balcony enclosure with glass windows under the conditions that they cannot be fixed, and that the glass windows must not include sash frames, or that will imply in facade design alteration, requiring HOA approval and reissuance of municipal permission for upgrading the project. Similarly, it is also not allowed the use of curtains or blinds in balconies, neither the removal of walls and window sashes that separate the balcony from the dwelling unit. It is also forbidden the replacement of any exterior coating materials or making the exterior and interior ground levels even.

These actions would imply on illegal increase of property area, and rise of real estate taxation. For building regularization, it would require new project approval including the expanded area. In case there is no possibility of acquiring additional construction potential for onerous grant, the only way to regularize the building is by changing it back to its original conditions, subject to penalty fines and revocation of occupancy permit. Balconies larger than 10% of the floor area ratio are accounted in the unit area, only implying facade alteration, which needs HOA approval and municipal permission.

Finally, in typical Brazilian condominiums, there is a minimum of two elevators per block, regardless of the number of units: one for social use, with access to the living room and the other for service use, with access to the kitchen or laundry room. This is a reminisce on the 19th century bourgeois concept that aimed for separating dwellers and guests from maids, contractors, delivery persons and so on. The elevator hallways are, thus, separated, and shared by 2 or 3 households. Narrower hallways are sometimes be decorated by individuals, although they actually constitute common property, and should be maintained collectively.

5.2 BALCONY ENCLOSURE: FACADE ALTERATION OR EXPANSION?

Balconies are usually uncovered platforms that are located at high level and adjacent to a window or door. Often these structures form a platform and additional external space. This allows one to move out from the interior space to appraise the street, to enjoy the breeze and to provide small seating areas (Hyde, 2000). Depending on the location, balconies might suffer climate-related performance problems to overheating, frosting, or excessive rainfall. This makes the space difficult to use. Therefore, because of the lack of enclosure of these unprotected spaces, a clear understanding of the orientation and buffering of these spaces is required to make them more functional.

In the five cities we visited, dwellers discovered that if the balcony is enclosed with glass, they gain an extra room that is comfortable through most of the year. But it didn't take long for some developers to realize that all that extra floor space could be sold at a profit, so, sooner or later, the municipal authorities would have to respond to the need of controlling the outcomes of this innovation.

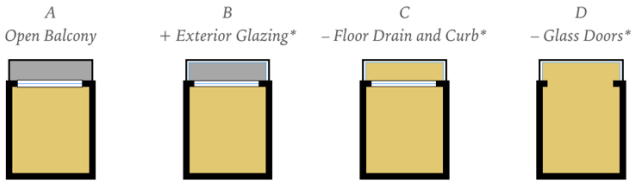
Due to its openness and transitional nature between common and exclusive usage, some land use policies account the balcony area as individual property, but others account it as shared property. In the first case, balcony enclosure is usually allowed, under the fulfillment of some criteria. In the second case, balcony enclosure would imply individual appropriation of shared property, and therefore, would be illegal. In the case of Jakarta, the balcony classification into individual or shared property is unspecified. Instead, in Seoul and Dalian, balconies are considered individual property. Lastly, in Sao Paulo and Santos, balcony deliberations are more intricate and require deeper enlightenment.

In Brazil, balconies generally correspond to individual property of limited common use, and are not included in the Gross Floor Area (GFA), as long as they are open and not exceed 10 percent of the Floor Area Ratio (FAR). Therefore, balcony enclosure generally implies in built area larger than the construction permit, requiring building regularization with submission and approval of the new project, subject to penalty fines and administrative closure of the building (revocation of certificate of building conclusion, or occupancy permit). If there is no possibility of acquiring additional construction potential for onerous grant, the only way to regularize the building is by reverting it to normal, as approved in the original project.

However, neither Brazilian dwellers have a clear idea of the occupation rate of their balconies, nor the local authorities have been enforcing the building regulations. As a result, glazing balconies with frameless glasses, specifically those allowing full opening, have become popularly accepted as a facade alteration work, that as such, should be approved by HOA's committee resolution in simple majority vote.

In Brazil, China and Korea, premature building regulations regarding balcony enclosure could require tiling or finishing in a material other than carpet, furnishing with a floor drain and a curb to keep rainwater out of the suite, and separation from the living space by glass doors, in a way it could be easily reversed into an open balcony, should a future dweller wish to. But, over the time, those regulations have been changing. In Seoul and Dalian, for instance, the tile, floor drain, curb, and glass doors are no longer required (Table 5.1).

Table 5.1 Summary of National Policies on Management of Balcony Space



	GFA Accountability	Facade Alteration or Expansion?	
Jakarta	unspecified	unspecified	
Seoul	accounted	facade alteration	
Dalian	accounted	facade alteration	
Sao Paulo	accounted if doesn't exceed 10% of FAR	facade alteration (condition: glazing without frames)	facade alteration, if accounted in the GFA expansion, if not accounted in the GFA
Santos			

** note that the alterations from B to D are cumulative*

5.2.1 Main Balcony Classification According to Building Components

We have noticed that while sometimes the balcony might be absent in some samples, it can be numerous in other samples, especially those located in Seoul, where a dwelling unit can have all its boundaries surrounded by balconies. To keep our study consistent to the number of dwelling units samples, instead of considering the entire sum of balconies within or samples, we preferred to focus in one main balcony of each sample, chosen by the larger area.

From the main balcony status classification into inexistent, open balcony and enclosed balcony, we observed that all existing main balconies (100%) in Seoul and Dalian were enclosed, in Santos about half of the main balconies (54.4%) were enclosed, and in Jakarta and Sao Paulo, most of the existing main balconies (63.3%~69.2%) remain open. Moreover, regarding the building components that changed, we observed that in Seoul and Dalian's samples, most dwellers have chosen to enclose their balconies by simply (B) glazing it or (D) by replacing the tiles, and removing the floor drain, curb, and glass doors. Also, although their accordance to the local policy might not be clear in Jakarta, Sao Paulo and Santos, all kinds of balcony enclosure (B), (C) and (D) were observed within our samples (Table 5.1 and Figure 5.1).

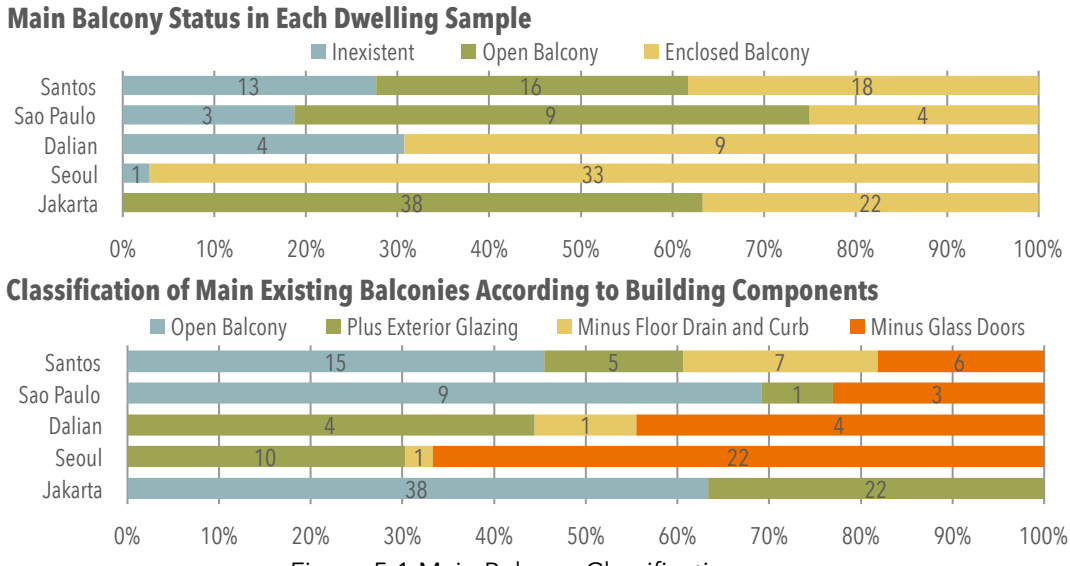


Figure 5.1 Main Balcony Classification

5.2.2 Balcony Design Response to Climate and Usage

From the results above, it is understood that balcony enclosure is a common need of dwellers in the five visited locations. Therefore, it broadens the scope of individual decisions to the facade level, which is however, not acknowledged by the Japanese SI System theory. As a matter of clarifying and emphasizing the diverse cultural and climatic backgrounds that converge into the demand of universal recognition of formal balcony enclosure, we propose an analysis on each local demand for balcony response to climate and usage.

First, we collected meteorological data on the macro aspects of climate of each city, focusing on the average dry-bulb temperature and rainfall monthly records for a typical year. Then, we organized the information into the following climate charts for each location (Figure 5.2). According to the Köppen Climate Classification, our selected cities encompass four distinct climates: Tropical Monsoon Climate (Am), Hot Summer Continental Climate (Dwa), Humid Subtropical Climate (Cfa), and Tropical Rainforest Climate (Af).

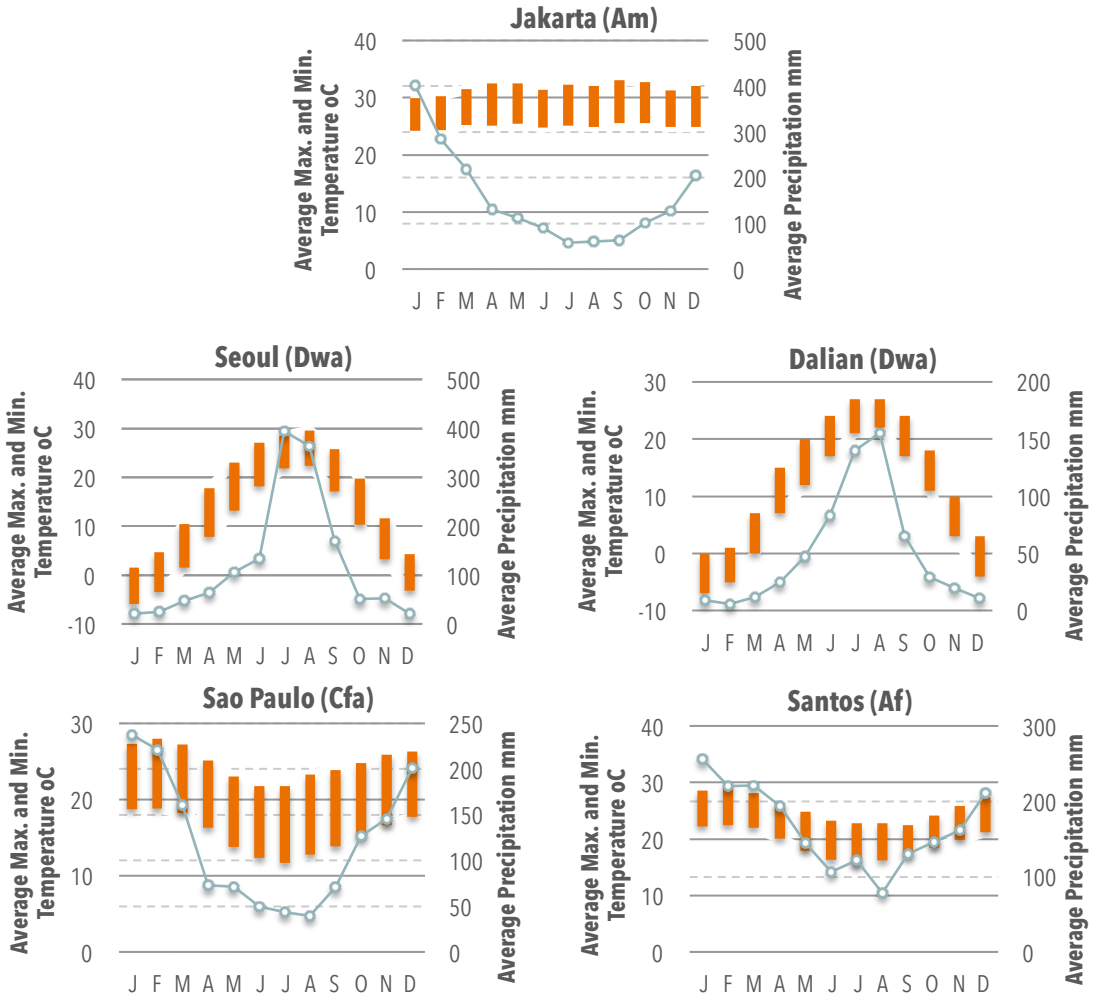


Figure 5.2 Climatic Charts of Jakarta, Seoul, Dalian, Sao Paulo and Santos
(Sources: World Meteorological Organization, Korea Meteorological Administration, China Meteorological Administration and Brazilian Institute of Meteorology)

5.2.2.1 Jakarta: Monsoons and Service Balconies

Jakarta has a tropical monsoon climate (Am). Despite being located relatively close to the equator, Jakarta has distinct wet and dry seasons. The wet season in Jakarta covers the majority of the year, running from October through May. The remaining four months (June through September) constitute the city's dry season (each of these 4 months has an average monthly rainfall of less than 100 mm). Jakarta's wet season rainfall peak is January with average monthly rainfall of 389 millimeters, and its dry season low point is September with a monthly average of 30 mm. The average temperature for the year in Jakarta is 28.38°C, with small variation along the year.

In Jakarta, the balconies are usually contiguous to the kitchen and are designed for service purposes such as laundry and storage, and if kept always open, could have this use compromised during the wet season. But, primarily, the dwelling units are overly narrow to keep an underutilized space for most of the year. As a result, and considering that enclosing balconies with glass might be unaffordable to many low income dwellers, they choose other materials, such as tarpaulin, wooden fences, fiber cement panels, wing walls, and so on. Within our samples, the balcony function is commonly maintained as an enclosed laundry/storage room, but occasionally is used to relocate the kitchen into the boundary corner and open space to accommodate other activities.

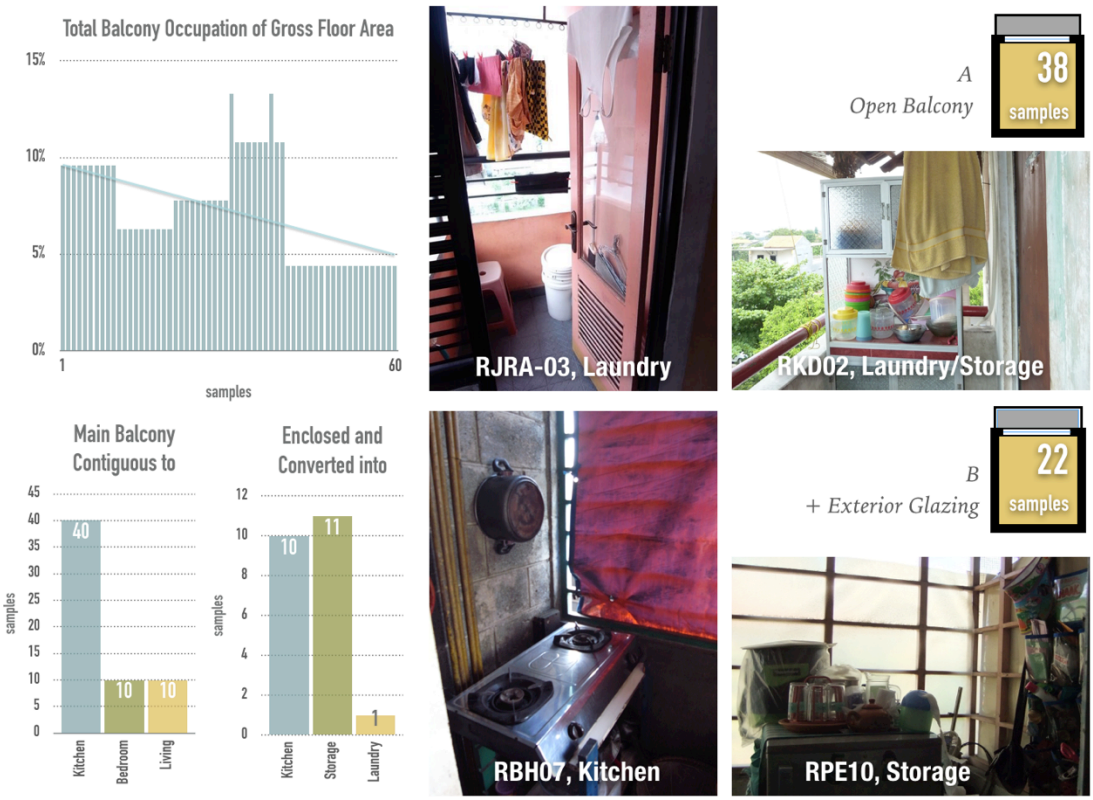


Figure 5.3 Jakarta's Balcony Samples

5.2.2.2 Seoul and Dalian: Snowfall and Winter Garden Balconies

Seoul and Dalian have humid continental climate (Dwa), characterized by humid summers, and cold, windy, dry winters. Summers are influenced by the East Asian monsoon that takes place from June until September. Winters are often cold to freezing with an average January temperature of −6.35 to 0.55 °C. Precipitation is relatively well distributed along the year, with a marked reduction in winter, when the volume of snowfalls exceeds rainfalls.

In Seoul and Dalian, the main balconies are commonly used as winter gardens, or totally demolished to extend a contiguous room, such as living rooms and bedrooms. Similarly to Jakarta's samples, but in this case regardless of the contiguous room, some balconies in Dalian, may be kept as enclosed laundries/storage rooms, but others might be used to relocate the kitchen out of the edge and open inner space to accommodate another bedroom for a newborn child. Instead, in Seoul, service balconies (secondary balconies) work as secondary kitchens for preparation and storage of *kimchi* (traditional fermented Korean dish). In addition, total balcony areas in Seoul might be really large compared to other cities, occupying an average of 23% of the gross floor area (GFA), which enclosed with glass, results in equal gain of extra room in cold periods.

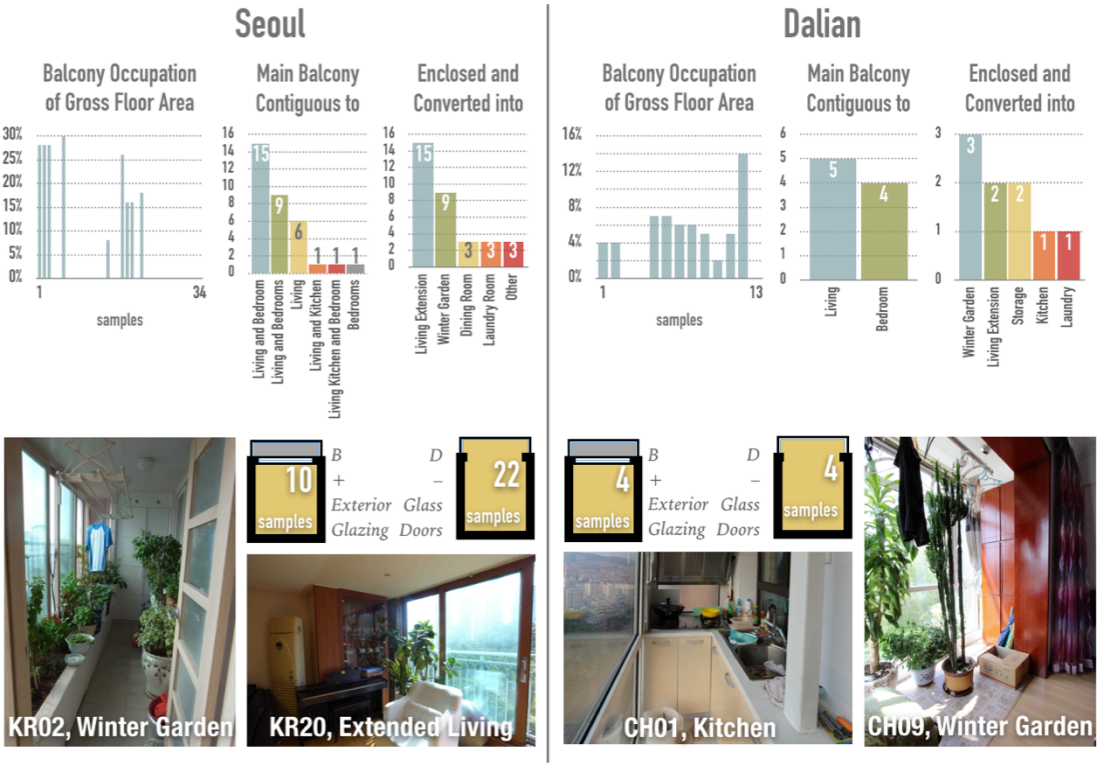


Figure 5.4 Seoul and Dalian's Balcony Samples

5.2.2.3 Sao Paulo: Environmental Problems and Green Balconies

Sao Paulo has a humid subtropical climate (Cfa). In summer, the mean temperatures vary between 17 °C and 28 °C. In winter, temperatures tend to range between 11 and 23 °C. The Tropic of Capricorn, at about 23°27' S, passes through north of Sao Paulo and roughly marks the boundary between the tropical and temperate areas of South America. But, because of its altitude, Sao Paulo enjoys a temperate climate. Rainfall is abundant, and it is especially common in the warmer months averaging 219 millimeters, decreasing in winter to 47 millimeters.

In Sao Paulo, the main balconies are usually contiguous to the living room or master bedroom, commonly used as verandas, with small seating space and greenery. Compared to the other cities, Sao Paulo's samples had the smallest proportion of enclosed balconies (only 30.8%). This decision expresses no relation with the needs of controlling temperature or rainfall. Perhaps, Sao Paulo's dwellers just want to keep the slight amount of green they still have. It is widely known that the city suffers of intense air and groundwater pollution, high levels of deforestation, and climate change.

Figure 5.5 Sao Paulo's Balcony Samples

5.2.2.4 Santos: Abundant Rainfalls and Waterproof Seaside Balconies

Santos has a tropical rainforest climate (Af), and is one of the few regions of Brazil outside of the tropical Amazon Basin that receive more than 2,000 mm of average precipitation yearly. Although very close to Sao Paulo, and located just outside the tropics, Santos has no real dry season. Tropical rainforest climates are typically found near the equator, so Santos featuring this type of climate is an exceptional situation. All months of the year averages more than 60 mm of rainfall during the course of the year. Santos features warm weather throughout the year, with mean temperatures varying from 23 °C, in June to 28 °C, in January.

In Santos the main balconies are also contiguous to the living room and master bedroom, but are larger compared to those of Sao Paulo, and are generally used as verandas for seaside contemplation. Since the balconies usually keep the original function, it could be assumed the need for enclosure is just to keep them dry, and preserve the furniture. But nowadays, Santos and other seaside cities in Brazil are facing a real estate phenomenon in new apartment releases, especially for the upper middle class, which is called gourmet balcony. It comes with a barbecue place and a whole outdoor set of living, dining and kitchen. That condition demands enclosure to shelter the furnishings, but also makes balconies larger, and therefore, accountable to the gross floor area.

Figure 5.6 Santos' Balcony Samples

5.3 INDIVIDUALIZATION OF OTHER FACADE ELEMENTS

There are other ways we can meet user demands in the facade level that will not involve balcony enclosures and illegal expansions. Here is a list of user demands over the facade found in samples of each city.

Table 5.2 Customized Facade Elements per Location

Jakarta	Seoul	Dalian	Sao Paulo	Santos
➤*air conditioner* ➤*window frames* ➤*wing walls* ➤*exterior painting* ➤*awnings* ➤*advertising boards* ➤*fences* ➤*antennas* ➤*laundry*	➤*air conditioner* ➤*window frames* ➤*glass color* ➤*awnings* ➤*advertising boards* ➤*antennas* ➤*laundry*	➤*air conditioner* ➤*antennas* ➤*laundry* ➤*fences* ➤*nets for babies/pets*	➤*air conditioner* ➤*window frames* ➤*glass color* ➤*greenery* ➤*curtain blinds* ➤*glass film* ➤*fences* ➤*net for babies/pets* ➤*flags*	➤*air conditioner* ➤*window frames* ➤*glass color* ➤*greenery* ➤*curtain blinds* ➤*glass film* ➤*fences* ➤*net for babies/pets* ➤*flags*

They could be classified into two categories:

- **Confined elements** - are those that might cause change of appearance of the facade, but are confined to the building facade. Examples: windows, glazing elements, glass films, blinds, protecting nets, built-in fences, exterior coating, greenery, furniture and equipment, such as air conditioner and parabolic antenna placed within the dwelling boundaries.

- **Voluminous elements** - are those that might cause structural overload, are strange to the original design of the building, or have projection outside the building facade. Examples: wing walls, awnings, advertising boards, furniture and equipment, such as air conditioner and parabolic antenna placed beyond the dwelling boundaries.

Figure 5.7 Examples of Confined and Voluminous Elements

5.4 CONSIDERING WAYS TO DELIVER USER CHOICE IN FACADES

Richard (2011) has identified five approaches for individualisation in contemporary housing facades. Depending on cultural and technological factors, they can vary from partial interventions, to fully demountable and movable facade panels. In the following lines, it is our purpose to discuss each of these approaches, and sort out how they could be suit the individualisation demands found in our case study locations.

- Individual appropriation – Even within a very strict modular grid, the presence of different occupants can be felt either through balcony enclosure, such as the apartment buildings in Korea. But sometimes, the results can be considered quite "noisy", showing wing walls in different colours, such as the public housing developments of Jakarta. Although this could be acceptable for some cultures, it leads to unpredictable changes that may harm the performance of buildings.

- Differentiation by the architect – Aware of the importance of avoiding the "chicken cage" image and of distinguishing units from one another in a residential building, many designers have deliberately opted for some form of differentiation at the construction stage. The most well known examples of differentiation by the architect show walls of each dwelling unit painted with a different colour from a chosen palette. In addition, various types and articulations of the awnings complete the individualisation sought by the architect. We believe this strategy creates random repetitions rather than individualisation, as it does not include individual decisions. But it could work if used by developers, or retrofitting companies when dealing with HOAs, for establishing patterns for facade individualisation, from which the dweller should be able to chose the most suitable, and change it again later, if needed.

- Selection from a menu – When the user has an opportunity to participate of the design process, a "menu" can be offered within a certain technology, and without increasing the cost compared to merely repeating the same or a limited set of variations. Then, the options can be closer to the interior planning, to the taste of the occupants and to the degree of visual intimacy desired. This approach could work in countries as Brazil, China and Korea, which already offer a menu with interior options during construction stage, by including exterior options such as window/panel/door colours to be chosen by the users. But its worth would be doubtful when considering its adaptability in a long term, because it demands technological compatibility between components.

- Movable facade panels – The most explicit and complete way to achieve full adaptability of the facade through space and time is to introduce a subsystem of fully movable panels. These panels should be easily dismantled and relocated or replaced according to the need of the occupant. These components could be further personalised with painting or some other input. More than adaptability, the average consumer in the emerging world enjoys the idea of personalisation, and if possible, at inexpensive prices. But, assuming that any change would require the destruction of a previous arrangement, this approach tends to be costly, unsustainable, and therefore, inappropriate for our targeting housing markets. The uniform aspect of this solution, however, could be a useful tool to dimmer the social identity level demanded by various groups. That means the repeating element could be used as a neutraliser to bring balance to the noise caused by other changeable elements.

- Interchangeable components – To introduce the 4th dimension, time, in the individualisation of residential building facades, an appropriate technology has to be implemented, in order to preserve basic structures while enabling other arrangements. The most well succeeded example of this approach so far, is the facade of NEXT21, which adopts a demountable technology, using vertical metal profiles to support the glazing modules and to attach exterior multicolour stainless steel laths in front of an insulated wall composition. The exposed structural concrete beam acts as a neutral horizontal boundary between various options selected. This is definitely the best solution in terms of functional performance, individualisation possibilities, and long-term adaptability. But, it may be not possible to be fully implemented in emerging markets depending on the development level of the house building industry. Notwithstanding, through research, we can show the industry what components need interchange ability.

5.5 USING OPEN BUILDING TO DELIVER USER CHOICE IN FACADES

We assume that selection from a menu; movable facade panels; and interchangeable components are the most suitable strategies to deliver facade individualization demands of our target user. Table 5.3 below summarizes the advantages and disadvantages of the application of those three approaches.

Table 5.3 Approaches to Deliver User Choice in Facades



Approach	1. Selection from a menu	2. Movable facade panels	3. Interchangeable components
Features	Customization without adaptability	Adaptability without customization	Adaptability plus customization
Advantages	User participation at planning stage	Uniform exterior appearance/social identity	User choice in a long-term perspective
Disadvantages	Short-term/limited choice of components	No choice of components, expensive maintenance	Lack of technological requirements

This study revealed that individual decisions coming out of multifamily building facades is commonplace in emerging nations, and the most usual solution employed is balcony enclosure. Regardless of the cultural background or environmental condition of overheating, frosting, or excessive rainfall, balconies tend to be enclosed as a means of floor space optimization. But neither the balcony glazing, nor the awnings, nor the new air conditioning equipment, nor the wall colors are definitive. Therefore, residential buildings should have their facades prepared for change. Obviously, that depends much on the cultural values and the technologies available in each place, but mostly, on the decision-making process.

Our suggestion is based on the idea that facades could be individualized before and after key delivery stages. Before key delivery stage, individualization strategies might be simply proposed by developers, by the use of movable panels that would be operated by the dweller after move-in; or proposed and discussed with home purchasers, through option menus. Both strategies could be used to coordinate user choices that might have projection outside the building facade. After move in, we suggest the permission of self-individualization of components confined to the facade (Figure 5.8).

Finally, the list of elements composing the menu, the movable panels and the interchangeable components should be proposed by local designers, familiar with the local resources, environment, culture, and mainly the consumer. Because the final decision belongs to the consumer, and whatever choice the designer does, if unsuitable to the consumer, it will be replaced by an ideal solution as soon as possible. Similarly, the local authorities should control exclusively the building alterations that may harm the building performance. Only the homeowners association, be it totally strict or chaotic, should be able to deliberate the aesthetical diversity of individual solutions.

In terms of organization, the facade would be separated into two layers, an exterior layer which coordinates the individualization, giving a uniform identity aspect, as proposed by the designers and maintained by the HOA, corresponding the skeleton part, and an interior layer, which is composed by the facade parts subject to individualization, as determined by the HOA and its subcommittees, corresponding the infill part. The Koujak Jaber building, in Beirut, by Victor Bisharat, 1964, exemplifies a practical use of this idea: the circular openings in the facade coordinate individual decisions, and what happens inside those openings might be chosen by the dwellers, according to the HOA's deliberations (Figure 5.9).

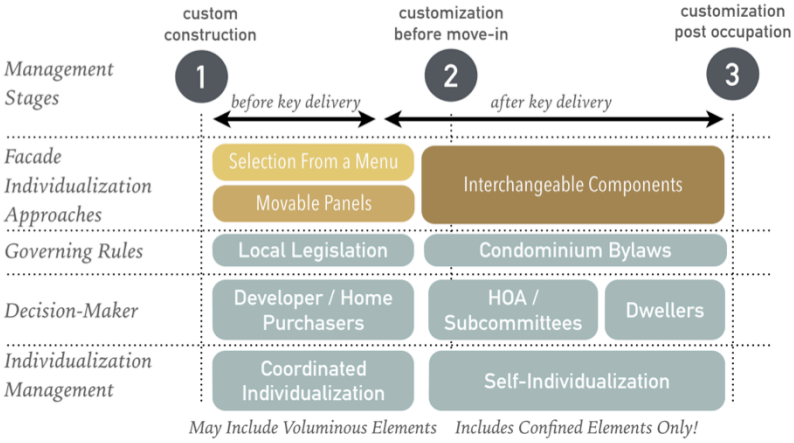


Figure 5.8 Proposal: Managing User Decisions in Facade Individualization (left)
Figure 5.9 Coordinating Decisions: Example of Koujak-Jaber Building
(Sam Ashley, 2012)

CHAPTER 6

DELIVERING USER-CHOICE THROUGH INFILL MASS CUSTOMIZATION

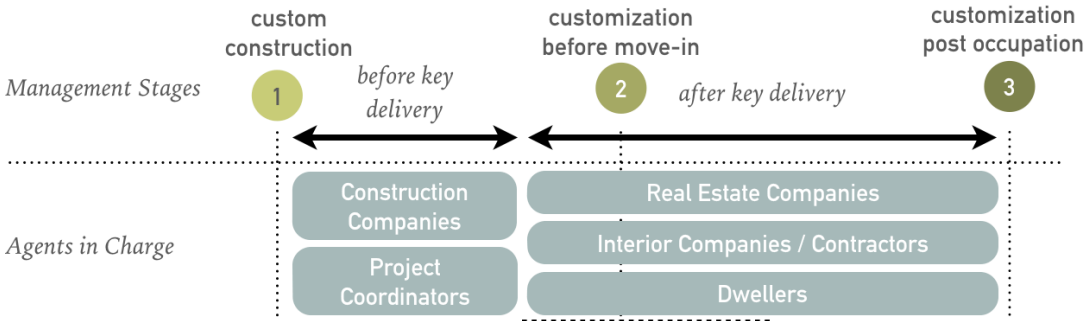
CHAPTER 6

DELIVERING USER-CHOICE THROUGH INFILL MASS CUSTOMIZATION

This chapter is focused on clarifying the infill delivery approaches employed in each country. First we clarify when user choice must be delivered and the infill mass customization approaches that are being employed in each country. Then we analyze the complexity of each infill production process considering the amount of user choice and professional involvement. The purpose of this chapter is to organize these infill delivery approaches according to their complexity into a progressive model that can serve communities of different social and technological backgrounds.

6.1 INFILL DELIVERY STAGES

Infill delivery, or user participation in the choice of infill components can happen in three different stages from construction to post occupation. In order to understand the process of infill mass customization, the first thing we considered is in which of these stages it should be delivered. When asked at which stage they had their apartments customized, and hence, had made infill alterations, it was found that most of them had it before move in (Figure 6.1).



	Custom	Before Move-in	Post Occupation	N/A
Jakarta	0	29	21	10
Seoul	6	7	16	15
Dalian	0	10	3	0
Sao Paulo	0	11	4	1
Santos	13	22	11	0
Total	19	79	55	26

Figure 6.1 Choice Delivery Stages

6.2 INFILL DELIVERY PRACTICES

Currently, infill choices have been delivered in five different ways before move-in. In the next page, Table 6.1 summarizes their advantages and disadvantages.

1. Unfinished Plans

Unfinished plans, present in Jakarta and Dalian's samples, are those in which are delivered without any infill components, leaving it to the dweller, which makes the purchasing price much affordable. The disadvantage is that it must be finished before the dweller can move-in, and there is no warranty in case of any damage to the skeleton part.

2. Reversible Rooms

Reversible rooms are common in Brazilian's samples. They are third rooms, strategically placed in the layout, which can be partly or totally demolished to accommodate the needs of the dweller. But those are an option only for dwellings with 3 or more bedrooms.

3. Lay Out Options

Layout options were available in Seoul, Sao Paulo and Santos' samples. They enable user choice from a menu of layout options predefined by the developer. But those options might be very restrict depending on the structural components. On interview, a representative person of one of the largest development companies in Sao Paulo, affirmed that 100% of their developments are built with structural masonry and masonry walls, and explained that the load bearing walls are a major factor in the design of floor plan options.

4. Option Menu

Option menu was found in Seoul's samples, but is also being offered in Sao Paulo. It is based on a set of options previously established by the company, from which the dweller can chose the floor plan layout and a few finishing options, such as floor coating materials, ceramic sanitary ware, etc. Room arrangement can be freely chosen without extra cost, but the finishing choice will affect the final price. Moreover, choosing components outside the menu is often rejected. Another development company of Sao Paulo was interviewed on this matter, and the representative person revealed that the company has been experimenting on infill mass customization for seven years, and one of their biggest challenges is project management. They claimed that is important to establish a deadline for dwellers decisions, and offer a reduced number of customization possibilities in order to keep the construction schedule and provide appropriate services.

5. Negotiable Options

Negotiable options are common in samples of all locations. It is an unofficial agreement between the home purchaser and the developer during the construction period to modify, include or exclude certain infill components. But because it is an informal bond, it leaves a lot of uncertainty about the service cost, quality or warranties on the side of the consumer. A development company of Santos was interviewed on this subject, and the person in charge has mentioned that in this kind of agreements there is no cost reduction for excluded components, instead there is an additional charge for unconventional components.

Table 6.1 Summary on Infill Delivery Practices

Approaches	Unfinished Plan	Reversible Rooms	Layout Options	Option Menu	Negotiable Options
Advantages	Interior choice left to the dweller; Reduced price for purchasing.	A third room, placed in center of the layout that can be partly or totally demolished	Enables choice from a menu of layout options pre-defined by the developer	Enables choice from a menu of interior options pre-defined by the developer	Enable choice of elements outside the menu
Disadvantages	Must be finished before move-in; No warranties	It is an option only for dwellings with 3 or more bedrooms	Options might suffer restrictions depending on the structural component	Users cannot choose interior components outside the menu	Uncertainty about service cost, quality or warranties

6.3 INFILL MASS CUSTOMIZATION ANALYSIS

6.3.1 Complexity Level of Actual Infill Delivery Practices

Placing these choice delivery models into Thuesen's diagram, mentioned in Chapter 1 (p.16), we have layout options and reversible rooms as a match-to-order (MTO) strategy where the user select a small group of variants in standard buildings, the option menu as a configure-to-order (CTO) strategy, where the user can choose a number of parts and modules pre-established by the developer, and the negotiable options, as an integrate-to-order (ITO) strategy, where the dweller can integrate other parts out of the menu. Unfinished dwellings would be classified into tailored dwellings, because they received individualized finishing, and those without any infill choice are categorized as ordinary standard dwellings. Figure 6.2 illustrates the above-described classification, with the corresponding amount of dwelling samples in each range.

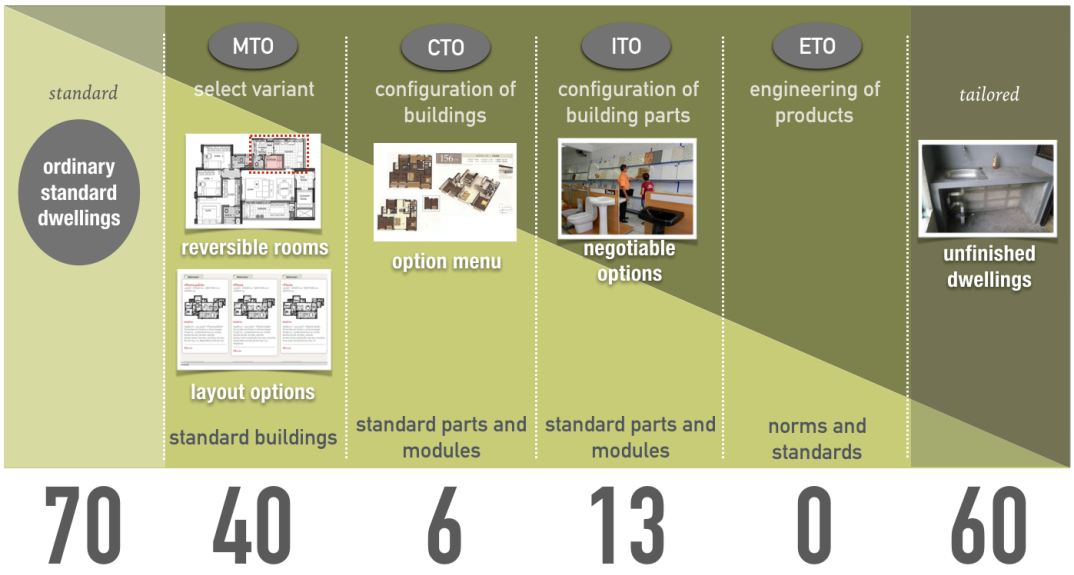


Figure 6.2 Classification of Infill Delivery Practices According to Complexity Level
(see Figure 1.13, p.16)

6.3.2 Long-Tail Measurement of Local Infill Industry Development

Looking each location separately, it could be said that Jakarta and Dalian's samples still follow the mass production model. While Seoul's production is developing a pathway towards mass customization. However, Sao Paulo and Santos' samples are shifting mass production into MTO, and skipping CTO. Therefore, they are just aggregating tailored decisions regardless of the production process, which creates a condition of choice that might only be delivered to wealthy families (Figure 6.3).

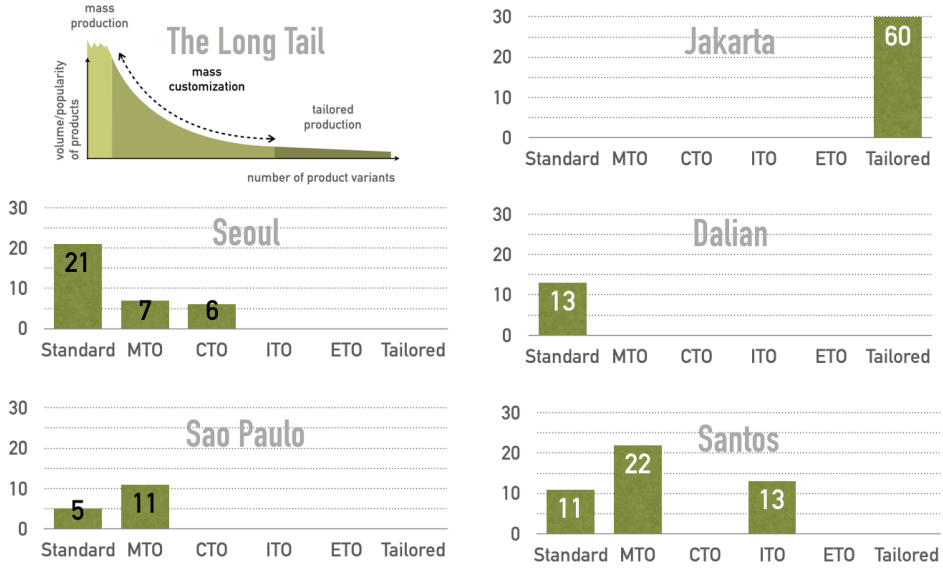


Figure 6.3

Figure 6.3 Long-Tail Measurement of Local Infill Industry Development

6.3.3 Self and Professional Involvement

It is also important to notice that CTO, ITO and ETO strategies are related to custom construction processes, and therefore, are more linked to professional involvement. Instead, MTO strategies are just one step ahead of standard production, and therefore, the options offered are so limited, that it creates demand for tailored customizations before move-in or post-occupation. Tailored customizations are those carried individually after key delivery, and might be professionally or self-managed.

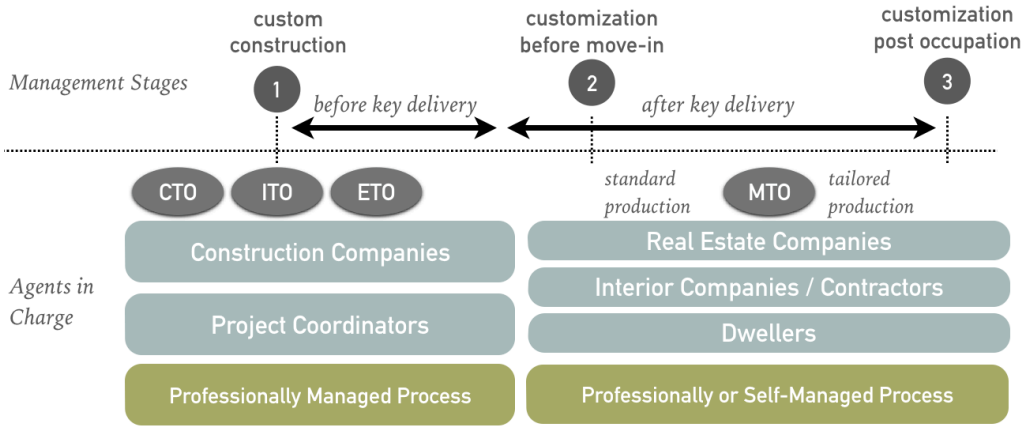
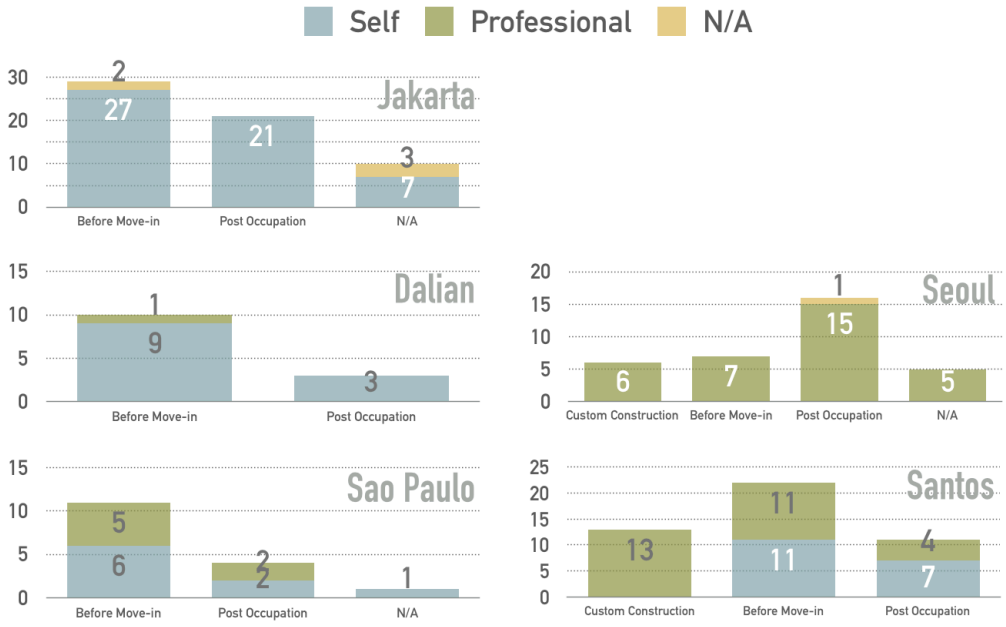


Figure 6.4 Professional Involvement in Different Stages of Customization

Considering self and professional involvement to the customization stages, we found that in the locations with a larger amount of samples that underwent custom construction, which is by rule professionally managed, there is also a larger rate of samples that underwent customization before move-in managed by professionals. That means that custom construction might not only help reducing the number of customizations before move-in, but it might also improve the dweller's awareness of the role of professionals in making their homes the way they wish it to be.



6.5

Figure 6.5 Professional Involvement in Different Stages per Sample Location

6.4 A PROGRESSIVE MODEL FOR INFILL MASS CUSTOMIZATION

Unlike in Japan, mass customization of infill components the emerging world is more focused on standard processes, rather than industrialized tailored processes. Therefore, rather than manufactured infill components, handcrafted infill components are more likely to suit the dwelling customization needs of the user from the emerging world. In fact, while the wage of contractors is still affordable to the average population, it does not make sense trying to increase the diversity of industrialized infill components, because the variety of handcraft production will always be unbeatable.

Instead, the emerging industries should invest on the development of standard infill components that can be customized by the user. An industrialized infill production for dwelling customization that leaves to the user the decision of hiring professional assistance or not, might streamline the exact level of quality and safety standards needed for infill customization in the emerging world. That means, rather than infill systems industrially produced for perfect assemble, uniformity and reliability, the consumer of the emerging world demands infill components that can be either randomly assembled with other industrialized products, or combined with self-built infill parts.

It became clear that as the emerging house building industries develop, standard dwellings will be replaced by dwellings with layout options or reversible rooms, those will be replaced by dwellings with construction options, and when the industry assumes full control of assembling individual decisions in multifamily dwellings, possibly there will be even construction agreements allowing the user to choose from outside the option package.

But until this scenario is met in each country, we should focus on multifamily dwellings that incorporate the skeleton concept to enable individual decisions, such as it is being experienced in the case of the unfinished plans of Jakarta and Dalian. Moreover, we should streamline tailored customizations by developing building norms and standards for infill customization. Figure 6.6 summarizes our proposal for a progressive model for delivering user choice through infill mass customization.

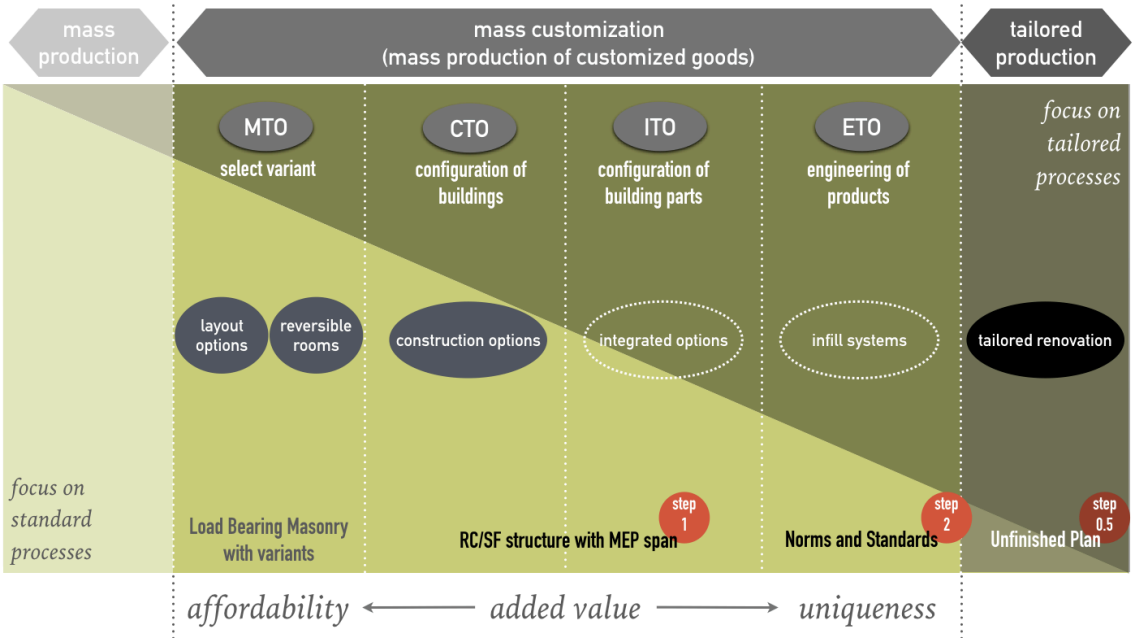


Figure 6.6 Delivering Choice through Infill Mass Customization

CHAPTER 7

DISCUSSION

7.1 Conclusions
7.2 Recommendations

CHAPTER 7

DISCUSSION

This chapter reviews the purposes, methods, and results from the analyses presented in chapters 3, 4 and 5, presenting a discussion about the outcomes of this research and recommendations for future studies and proposals on Open Building in emerging markets.

7.1 CONCLUSIONS

7.1.1 On the Methods Employed

Literature review has provided a broaden knowledge about the interaction demands between people and dwellings, the impacts of individual and collective decision-making in the multifamily residential environment, and the means of achieving a desirable design response to those demands. Furthermore, studying the development of the Open Building theory in Japan has improved the notion of the personal, spatial and contemporary interdependence of its applications, required for spreading it to the emerging nations.

The background case studies in Jakarta, Seoul and Dalian provided information about other kinds of interactions between people and dwellings, house building legislations, and decision-making management in condominiums, which were unprecedented to the author, and contributed to the development of an unbiased response to the conflicts perceived during fieldwork stage. In turn, the confirmation of a similar response in Sao Paulo and Santos, not only has improved the depth and consistency of the study, but it also offered a full reading of the information that was necessary to organize all the case studies together and develop the comparative analysis.

It is important to mention that in spite of our efforts of combining all the information; much of it turns out to be lost in translation, so to speak. Although the research team had a very systematic organization, the interview sheets had to be prepared in different languages, the questions had to be addressed in accordance to the local etiquette, some important questions were not asked in every location, and finally, the data collected were processed and saved differently. Notwithstanding, given the purpose and the time span of our research, we assume that we could achieve some very interesting outcomes, and the loss would be much bigger if we stuck into the same questions and protocols every place we went.

7.1.2 On SI Levels and Control in Emerging Societies

Based on the notion that control in human organizations is usually designed to work as a hierarchic structure, but in reality it works as a complex network of decisions, as proposed by Bar-Yam (1997), we carried out a study on apartment customization practices, and tried to sort the individual decisions into the hierarchic structure of four decision-making levels proposed by the Japanese SI Housing System: base building, common level, boundary level, and individual level. As a result, we found that the individual decision in all the five city locations we visited, bypass the hierarchic structure, reaching the four decision-making levels.

Bypasses are the result of a customization that started at the individual level, but has some sort of impact in another level. After classifying and analyzing all the customization types, and their potential bypasses, we assumed that if we develop some customization rules, we might eliminate some of the bypasses and keep most of the dwellers' decisions within the individual level. However, it seems to be also important to the dweller of the emerging world to interfere at the boundary level. Similarly, we suggested some rules, which were treated with more detail in the following chapter, and proposed the inclusion of an intermediate scale of decision making, to be ruled by subcommittees of dwellers that share that boundary. The organization of these subcommittees could be by story allocation, facade orientation, or building block, depending on the users perception of that space as a shared territory.

7.1.3 On Facade Individualization

Facades are like membranes separate public and private decisions. Some researchers believe that private decisions should stay inside, and public decisions should stay outside of the membrane. Other researchers believe private decisions can come out of the membrane. This study revealed that even though the local building policies deliberate that individual decisions should stay inside, they tend to come outside anyway, and the most usual solution employed is balcony enclosure.

This study also revealed that regardless of the cultural background or environmental condition of overheating, frosting, or excessive rainfall, balconies tend to be enclosed as a means of floor space optimization. Moreover, it is commonplace in the locations we visit facade alterations by the placement of unconventional window frames, glass films, built-in fences, air conditioning equipment, antennas, etc. But none of these alterations are supposed to last forever. Therefore, residential buildings should have their facades prepared for change. Obviously, that depends much on the cultural values and the technologies available in each place, but mostly, on the decision-making process.

Our suggestion is based on the idea that facades could be individualized before and after key delivery stages. Before key delivery stage, individualization strategies might be simply proposed by developers, by the use of movable panels that would be operated by the dweller after move-in; or proposed and discussed with home purchasers, through option menus. Both strategies could be used to coordinate user choices that might have projection outside the building facade. After move in, we suggest the permission of self-individualization of components confined to the facade, by the employment of interchangeable materials as designated by the homeowners association.

7.1.4 On User Choice through Infill Mass Customization

Based on the long tail theory (Anderson, 2006), the mass customization concept (Pine, 1993), and the generic model that translates these ideas to the construction sector by combining order decoupling points, proposed by Thuesen (2013), we developed an analysis of the infill delivery practices in the five cities we visited.

It became clear that as the emerging house building industries develop, standard dwellings will be replaced by dwellings with layout options or reversible rooms, those will be replaced by dwellings with construction options, and when the industry assumes full control of assembling individual decisions in multifamily dwellings, possibly there will be even construction agreements allowing the user to choose from outside the option package.

But until we build this scenario, we should introduce multifamily dwellings that incorporate the skeleton concept to enable individual decisions, such as it is being experienced in the case of the unfinished plans of Jakarta and Dalian. Moreover, we should streamline tailored customizations by developing building norms and standards for infill customization.

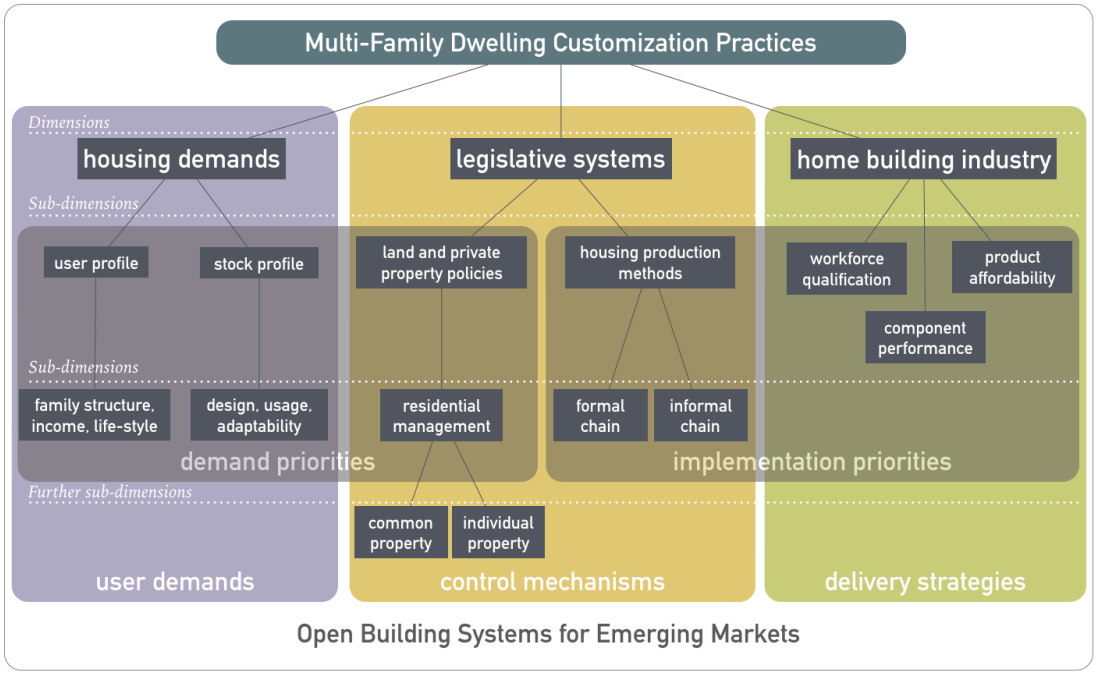


Figure 7.1 Research Framework

7.2 RECOMMENDATIONS

This research has brought contributions to the field of housing studies, making progresses on the application of the concept of open building as an international approach for multifamily housing production. The outcomes and information provided by this research are expected to aid designers, developers and policy makers to create more dynamic architectures, more personal home spaces, and more sustainable cities, anywhere, but especially in the emerging world. In order to continue this research and widen the scope of its outcomes, future studies should consider:

- Expanding this study to other emerging markets in order to confirm if our results apply to multifamily dwellers of countries with more contrasting backgrounds or simply unfulfilled by this research such as India, South Africa, Russia, Pakistan and Philippines;
- Increasing the samples and deepening the results within the countries we have already visited in order to develop consistent national policies for open building implementation, as realized by the Building Research Institute, in Japan;
- Reviewing the local building legislation requirements to make the registration of unfinished dwellings feasible to Brazil and Korea, by taking as a reference the examples of the Unfinished Plan (Indonesia and China), and the Two-Step Housing Supply (Japan);
- Reviewing the local building legislation requirements to make balcony enclosures feasible to Brazil and Indonesia, by taking as a reference the examples of Seoul and Dalian;
- Proposing from scratch or reviewing existing local apartment remodeling standards, and condominium regulations pre and post occupation, to respond to the actual individual and collective decision-making demands;
- Studying local materials and techniques, and verifying the feasibility of creating interchangeable modules for self-managed facade individualization;
- Analyzing how much is the cost of custom construction for the developer, for the interior supplier and for the consumer, comparing the budgets before and after completion, and indicating the feasibility of user participation during design stage; and
- Developing methodologies for management of user-choice, distinguishing the role of infill suppliers, developers and project coordinators for the establishment of custom construction ventures.

References

1) Anderson, C. (2006). The Long Tail: Why the future of business is selling less of more, New York: Hyperion.

2) Badan Pusat Statistik (2004). Housing and Settlement Survey.

3) Bar-Yam, Y. (1997). Complexity rising: From human beings to human civilization, a complexity profile, in Encyclopedia of Life Support Systems, (United Nations, Oxford, UK, 2002); also NECSI Report.

4) Barlow, J., and Ozaki, R. (2005). Building mass customized housing through innovation in the production system: lessons from Japan. Environment and Planning A. Vol.37. London: Sage Publications (pp.9-20).

5) Barth, J. R. et.al. (October, 2012) China's Housing Market: Is a bubble about to burst? Research Report. Milken Institute.

6) Costa, M. A Study on Open Building Systems through Multistory Dwelling Customization in Brazil (Master's Thesis). Chiba University.

7) Costa, M. et.al. (2015). A Study on Open Building Implementation through Apartment Adaptation in Sao Paulo, Brazil. In: Journal of Architecture and Planning. Architectural Institute of Japan. Vol.80, No.713, pp. 1503-1511.

8) Cuperus, Y. (2001). An Introduction to Open Building. In Proceedings of the 9th Annual Conference of the International Group for Lean Construction. Singapore.

9) Douglas, J. (2006). Building adaptation. Oxford: Butterworth-Heinemann.

10) Habraken, N. J. (1972). Supports: an alternative to mass housing. New York: Praeger Publishers.

11) Habraken, N. J. (1998). The structure of the ordinary: form and control in the built environment. Cambridge, Mass: MIT Press.

12) Habraken, N. J. (2005). The NEXT21 Project in the Open Building Context. In Osaka Gas (2005). NEXT 21: The design spirits and the whole picture of 10 years of experimental living. Tokyo: X-Knowledge.

13) Iso, K. (2015). Stock Renovation through Rental Customization Based on Landlord's Investment. Master Thesis. Chiba University (in Japanese).

14) Japan Statistics Bureau, Ministry of Internal Affairs and Communications (2013). Housing and Land Survey. Retrieved January 29, 2016 <http://www.e-stat.go.jp/SG1/estat/ListE.do?bid=000001051892&cycode=0>

15) Jia, B. (2011). Transformable Building Facade: An Interface Between Community and User's Control. , in Proceedings of the Joint Conference of CIB W104 and W110 - Architecture in the Fourth Dimension, Boston, 15-17 Nov 2011, USA, pp. 321-327.

16) Jung, J. Y. et.al. (2015). A Study on Actual Condition of Customization of Dwelling on the Apartments in South Korea. In: Journal of Architecture and Planning. Architectural Institute of Japan. Vol.80, No.708, pp. 239-247.

17) Kendall, S. (1995). Developments Toward Open Building in Japan. Privately published and distributed 75 page report by the author.

18) Kendall, S. and Teicher, J. (2002). Residential open building. London: E & FN Spon.

19) Kobayashi, H. and Fujimoto H. (2003). What is Skeleton Housing? Considerations about the development of long-lasting housing. Japan: Ministry of Land, Infrastructure and Tourism (in Japanese).

20) Kobayashi, H. et.al, (2014). A Study on SI Housing as an International Theory including Developing Countries and its Implementation Methods, Grant-in-Aid for Scientific Research of Ministry of Education, Culture, Sports, Science and Technology, Japan, (in Japanese).

21) Leupen B. (2006). Frame and Generic Space. Rotterdam: 010 Publishers.

22) Linner, T. and Bock, T. (2013). Automation, robotics, services: evolution of large-scale mass customization in the Japanese building industry. In Piroozfar, P. A. E., and Piller, F. T. (2013). Mass customization and personalization in architecture and construction. New York: Routledge.

23) Malard, M. L. (1992). Brazilian low cost housing: interactions and conflicts between residents and dwellings. Doctoral Thesis. University of Sheffield.

24) Mori Art Museum (2011). Metabolism, The City of The Future: dreams and visions of reconstruction in postwar and present-day in Japan. English Edition. Tokyo: Mori Art Museum.

25) Nikolic, J. (2011). Multifamily Open Building: application of "open building" approach in design and construction process of multifamily housing. Master Thesis. Polytechnic University of Catalonia.

26) Noguchi, M. (2013). Commercialization principles for low-carbon mass customized housing delivery in Japan. In Piroozfar, P. A. E., and Piller, F. T. (2013). Mass customization and personalization in architecture and construction. New York: Routledge.

27) Osaka Gas (2005). NEXT 21: The design spirits and the whole picture of 10 years of experimental living. Tokyo: X-Knowledge (in Japanese).

28) Osamu, S. (1994). A History of Tatami, Chanoyu Quarterly, 77.

29) Patchell, J. (2002). Linking Production and Consumption: the co-evolution of interaction systems in the Japanese house industry. Annals of the Association of American Geographers 92 (pp.284-301)

30) Patton, M. (1990). Qualitative Evaluation and Research Methods. Beverly Hills, CA. Sage (pp.169-186).

31) Pine II, B. J. (1993). Mass Customization: The new frontier in business competition, Boston: Harvard Business School Press.

32) Renaud, B. (1999). The Financing of Social Housing in Integrating Financial Markets: a view from developing countries. Urban Studies 36(4): 755–73.

33) Richard, R-B. (November 15-17, 2011). Cultural and Technological Factors in the Individualization of Multi-Dwelling-Unit Building Façades. In Proceedings of the Joint Conference of CIB W104 and W110 - Architecture in the Fourth Dimension, Boston, 15-17 Nov 2011, USA, pp.328-333.

34) Sakai, K. (2013). A Study on Open Building Systems through Multistory Dwelling Customization in South Korea (Master's Thesis). Chiba University.UN-Habitat (2008). Housing Finance Mechanisms in Indonesia. Report. Nairobi. Kenya

35) Thuesen, C. et.al. (2013). Enabling mass customization in construction: making the long tail work. In Piroozfar, P. A. E., & In Piller, F. T. (2013). Mass customization and personalization in architecture and construction.

36) Tseng, M. and Jiao J. (2001). Mass Customization, in G. Salvendy (ed.) Handbook of Industrial Engineering: Technology and Operation Management, 3rd edition. New York: John Wiley & Sons.

37) Tsukamoto, Y. and Almazan, J. (2006). Scrap and Build. In Monu Magazine on Urbanism. 4th Issue. Kassel: University of Kassel. Retrieved February 2, 2016 <http://www.mudot.org/monu4/Scrap.pdf>

38) UN-Habitat (2009). Housing Finance Mechanisms in Republic of Korea. Report. Nairobi. Kenya.

39) United Nations, Department of Economic and Social Affairs, Population Division (2005). World Urbanization Prospects: The 2005 Revision (p.126).

40) United Nations, Department of Economic and Social Affairs, Population Division (2015). World Urbanization Prospects: The 2014 Revision (p.93).

41) Urban Renascence Agency (1998-now). KSI Experimental Housing Project. Retrieved in February 3, 2016, from <http://www.ur-net.go.jp/rd/ksi/>

42) Warouw, F. (2011). A Study on Open Building System for Multistory Dwelling in Indonesia: Contemporary customization practices and future opportunities (Doctoral Dissertation). Chiba University.

43) World Bank (2009). Housing Finance Policy in Emerging Markets. Washington, DC.

44) Yin, L. Y. (2015). A Study on Open Building Systems through Multistory Dwelling Customization in China: Case study of Dalian (Master's Thesis). Chiba University.

List of Tables

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List of Acronyms

ABDI	Brazilian Association for Industrial Development
ABNT	Brazilian Association of Technical Regulations
BPS	Badan Pusat Statistik /Statistics Indonesia
BRI	Building Research Institute (Japan)
BRICS	Brazil, Russia, India, China and South Africa
CTO	Configured To Order
CHS	Century Housing System
DINKs	Double Income, No Kids
DIY	Do-It-Yourself
ETO	Engineer-to-Order
FAR	Floor Area Ratio
GDP	Gross Domestic Product
GFA	Gross Floor Area
HOA	Home Owners Association
HOFINET	Housing Finance Information Network
HVAC	Heating, Ventilation and Air Conditioning
IBGE	Brazilian Institute of Geography and Statistics
IMF	International Monetary Fund
ITO	Integrate-to-Order
ILO	International Labor Organization
KOSTAT	Statistics Korea
LDK	Living, Dining, Kitchen
MDIC	Ministry of Development, Industry and Commerce (Brazil)
MEP	Mechanical, Electrical and Plumbing / Piping
MEXT	Ministry of Education, Culture, Sports, Science and Technology (Japan)
MLIT	Ministry of Land, Infrastructure, Transport and Tourism (Japan)
MOC	Ministry of Construction (Japan)
MTO	Match-to-Order
N-11	Next Eleven Countries
NBSC	National Bureau of Statistics of China
NHB	National Housing Bank
OB	Open Building
RC	Reinforced Concrete
R&D	Research and Development
SBJ	Statistics Bureau of Japan
SI	Support Infill
SMG	Seoul Metropolitan Government
UR	Urban Renaissance agency (Japan)
WDI	World Development Indicators

APPENDICES

Appendix A: Fieldwork Material
Appendix B: Thesis Presentation Slides

APPENDIX A

FIELDWORK MATERIAL

The following documents were used during the fieldwork surveys in Sao Paulo and Santos.

Material Checklist and Duties

Brazilian Home Remodeling Survey

Material Checklist

Description	Amount
Video Recorder	1
Digital Camera	1
IC Recorder	1
Electric Measuring Tool	1
Measuring Tape	1
Four-color ballpoint pen	3
White Paper A3	No. of units
Grid Paper A3	No. of units
Tracing Paper A3	No. of units
Apartment Floor Plans A3	(No. of units) x 3
Clipboard A3	3
Batteries AA and AAA	1 extra pack
Apartment Samples List and Schedule	3
Assignment Sheets	3
Management Companies Interview Sheets	No. of companies
Dwellers Interview Sheets	No. of units
Survey Sample (color version)	2
Apartment Samples Data Base (computer version + printed version)	2
External Hard Disk	1
Universal Plug Adapter	1
Clear File	1
Laptop PC	1
Thanking Gifts	No. of units + No. of companies

Duties

Me

Before Interview:
- Give the equipment to the students
- Introduce yourself and your research (give an ID card)
- Remember to turn on the IC Recorder;

During interview:
- Take all the notes carefully;
- Photograph any available plans or documents;

After interview:
- Show the interview sheet to the dwellers to get their agreement, and then take it back;
- Give the thanking gift to the dweller.
- Confirm all the registries with Student 1
- Gather the materials back
- Transfer all the data to the hard disk
- Recharge the batteries of all the equipment

Assistant A

Before Interview:
- Make sure you understand all the plan before entering the apartment;
- Wait for the dweller's permission before taking any interior photos;

During Interview:
- Proceed to each room according to the dweller's explanation, or dweller's authorization;
- Check if the room arrangement matches to the original plan;
- Register on the plan sheet all the remodeled, renovated parts, making quick drafts when necessary (make sure the registries are as clear as possible);
- Register any particular detail or special use of the rooms;

After Interview:
- Gather all the sheets back in the file.
- Confirm all the registries with Marianne

Assistant B

Before Interview:
- Wait for the dweller's permission before taking any interior photos;

During Interview:
- Proceed to each room according to the dweller's explanation, or dweller's authorization;
- Take photos from each corner in every room;
- Take a video from all the apartment

After Interview:
- Remember to gather all the equipment back in the bag;
- Take exterior photos from the condominium and its facilities;

Interview Sheet: Dwellers

Levantamento Reforma de Apartamentos no Brasil

Ficha de Entrevista aos Moradores

* Se houver escritura do imóvel, pedir para deixar disponível durante a entrevista para consulta de dados.
* Se houver projeto ou qualquer imagem do apartamento, pedir para copiar ou fotografar.
* Se houver qualquer contrato de obra, ou serviço relacionado ao imóvel, pedir para copiar ou fotografar

Entrevista

Dia:	Grupo Participante:	Observação No.
Nome do morador:		

Localização

[1] Endereço: _____

Perfil dos Usuários

[3] Usuários [4] Qual a renda mensal da sua família? R$_____

	exemplo	U1	U2	U3	U4	U5	U6
a. Relação Familiar	Filho						
b. Idade	17						
c. Sexo	M						
d. Ocupação	Estudante						
e. Necessidades	Cad. de rodas						

[5] Além das pessoas que vivem na casa, tem alguém que não mora, mas usa a casa com frequência? □Não |□Sim

[6] Quem?_____ [7] Com que frequência?_____

[8] Você tem algum filho que deixou de morar com você? □Não |□Sim [9] Por que ele(a) se mudou? _____ [10] Com que idade? _____

[11] Você alguma vez precisou adaptar a casa pela necessidade de alguém da família? □Não |□Sim [12] O que? _____

Ficha Condomínio + Apartamento

[13] Nome do Condomínio: _____ [14] Construtora: _____ [15] Ano de Construção: _____

[16] Blocos: _____ [17] Andares:_____ [18] Unid. por andar: _____ [19] Tipo de estrutura: _____ [20]Tipo de parede: _____

[21] Dormitórios: _____ [22] Suítes: _____ [23] Área Interna: _____(m²) [24]Área de Sacada: _____(m²)

[25] Áreas de lazer: _____

[26] Administradora: _____ [27] Taxa de condomínio (R$): _____

[28] O apartamento é : □Próprio; □Financiado; □Alugado; □Emprestado [29] Ano de mudança: _____ [30] Preço (R$): _____

[31] Onde você morava antes? □Num apto; □Numa casa | □Próprio; □Financiado; □Alugado; □Emprestado; □Casa dos pais | Em _____

[32] Por que motivo você se mudou para este apartamento?_____

Reforma do Apartamento

[33] Quantas reformas você já fez neste apartamento? Em que ambientes? Você poderia explicar um pouco de cada reforma?

Ambiente	Ano	Antes/depois de mudar-se?	Projeto	Execução	Conteúdo	Off-site	Custo	# Reformas anteriores	Motivo
1)									
2)									
3)									
4)									
5)									
6)									
7)									
8)									
9)									
10)									

Levantamento Reforma de Apartamentos no Brasil

Ficha de Entrevista aos Moradores

* Se houver escritura do imóvel, pedir para deixar disponível durante a entrevista para consulta de dados.
* Se houver projeto ou qualquer imagem do apartamento, pedir para copiar ou fotografar.
* Se houver qualquer contrato de obra, ou serviço relacionado ao imóvel, pedir para copiar ou fotografar

Problemas e Complicações na Reforma

[34] Você teve que recorrer a algum procedimento legal para viabilizar a reforma? □Não |□Sim, Qual? _____

[35] Você enfrentou algum problema ou complicação durante a reforma? □Não |□Sim, Qual? _____

[36] Quem foi o responsável por esse problema? _____

Manutenção Domestica (pintura, dedetização, instalação/reparo de aparelhos, manutenção de instalações elétricas, internet, etc.)

[37] Em geral, como a sua família reage diante de um problema que requer manutenção? □Tentam resolver por si mesmos |□Contratam alguém

[38] Algum tipo de manutenção domestica é executada por membros da família? □Não |□Sim, Qual? _____

[39] O apartamento requer algum tipo de manutenção regular? □Não |□Sim, Qual? _____

[40] Com que frequência?_____ [41]Quem executa? _____ [42] Quanto custa? (R$)_____

[43] Quem é a pessoa encarregada da limpeza da casa? _____

[44] Você muda a posição da mobília com frequência? □Não |□Sim [45] Por que? _____

[46] Em quais ambientes? _____

[47] Tem algum ambiente que você gostaria de mudar, mas não pode? □Não |□Sim, Qual e por que? _____

Atividades Cotidianas e de Lazer

[48] Você poderia explicar como são utilizados os ambientes da casa? (Usar planta como referencia)

[49] Sua família faz uso das áreas de lazer do condomínio? □Não |□Sim

[50] Se não, por quê? Se sim, quais áreas e com que frequência? _____

[51] Em que momentos todas as pessoas da casa costumam se reunir? _____

[52] Para qual atividade? _____

[53] Com que frequência? _____

[54] Em que ambiente? _____

[55] Sua família costuma receber convidados em casa? _____

[56] Quem costuma receber convidados? _____

[57] Para qual atividade? _____

[58] Em que ambiente da casa ou do condomínio? _____

[59] Com que frequência? _____

[60] A sua família costuma organizar eventos sociais em casa (Festas de aniversario, Natal e outras celebrações)? □Não |□Sim, Quais? _____

[61] Em que ambiente da casa ou do condomínio? _____

[62] Geralmente quantas pessoas estão em casa? Durante a semana: ___ | Nos fins de semana e feriados: ___ | Em eventos sociais: ___

Satisfação

[63] Qual o grau de satisfação da sua família com relação ao espaço da casa? ☐1 | ☐ 2 | ☐3 | ☐4| ☐5

[64] Comparada a sua moradia anterior, este apartamento é: ☐ Melhor | ☐ Similar | ☐ Pior | ☐ Não sei

[65] Vocês tem intenção de se mudar? □Não |□Sim, Por que? _____

[66] Vocês tem intenção de fazer outras reformas no apartamento? □Não |□Sim, Por que? _____

[67]Que tipo de reforma?_____

[68] Se você pudesse aumentar o espaço da sua casa, que ambiente você escolheria aumentar? _____

[69] Se você pudesse acrescentar outro ambiente na sua casa, qual seria? _____

Interview Sheet: Developers / Construction Companies

Levantamento Reforma de Apartamentos no Brasil

Ficha de Entrevista as Construtoras

Entrevista

Data:	Nome da Empresa:
Nome do Entrevistado:	Cargo:

Personalização de Apartamentos

[1] Que tipo de serviços a sua empresa oferece?

_____

[2] Que tipo de personalização vocês oferecem?

☐ Opções de personalização durante o período de construção do edifício | ☐ Coordenam trabalhos de reforma individuais antes do período de mudança |

☐ Coordenam trabalhos de reforma individuais antes do período de mudança | ☐ Outros _____

[3] Você poderia descrever as opções de customização que vocês oferecem? Quanto custam?

Conteúdo	Preço (R$)
1)	
2)	
3)	
4)	
5)	

[4] Vocês fornecem alguma visita de inspeção guiada por um especialista, após a obra? ☐Não | ☐Sim

[5] Se não, quem se responsabiliza no caso do morador encontrar algum problema no apartamento? ☐ a construtora| ☐ a empresa que fez a obra de interiores | ☐ Outro_____

[6] No caso de apartamentos que não foram vendidos, vocês oferecem algum apelo de venda, como alternativa? Tipo reforma?

_____

Áreas Molhadas

[7] Vocês oferecem alguma opção de personalização para áreas molhadas? ☐Não | ☐Sim,

[8]Se não, por que? _____ Se sim, Qual? _____

[9] Como vocês lidam com problemas de impermeabilização, canos furados, e vazamentos?

_____

[10] O que você acha da Unidade de Banho Japonesa? (mostrar figura e explicar)

_____

Perfil da Empresa

[11] A sua empresa subcontrata outras companhias? (Por exemplo, empresas que fazem obra de interiores, fabricantes de elevadores)

_____

[12] Em que fase da obra eles executam seus respectivos trabalhos e qual a sua ligação com o canteiro de obras durante esse período da obra?

_____

[13] Como você define o escopo das responsabilidades da sua empresa e qual a margem de tempo que eles duram sobre esses serviços?

_____

[14] Como você descreveria a relação entre os setores incorporação, projeto e construção? Por favor, explique os respectivos papeis.

_____

_____

_____

Interview Sheet: Furniture Makers / Interior Companies

Levantamento Reforma de Apartamentos no Brasil

* Se houver qualquer catalogo, eu gostaria de obter uma copia ou tirar fotos.

Ficha de Entrevista aos Fabricantes de Moveis

Personalização de Apartamentos

[1] Você poderia nos explicar um pouco dos seus serviços, qual o nível de industrialização deles e quanto eles custam?

Serviço	Parte Executada em Loco	Preço(R$)
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		

[2] Quantas opções de cozinhas vocês oferecem?

_____

[3] Você poderia nos explicar as especificações básicas de um set de cozinha, as opções e o processo de montagem?

_____

_____

_____

[4] Que tipo de interface vocês oferecem aos seus clientes? □Escolha a partir de catálogos | □Consulta profissional | □Outros _____

Áreas Molhadas

[5] Vocês tem alguma experiência de substituição de banheiras, bancadas de cozinha, etc., antes do período de entrega da chave ao morador? ☐N | ☐S

[6] Como vocês lidam com problemas de impermeabilização, canos furados, e vazamentos? Quem se responsabiliza: vocês ou a construtora?

_____

[7]O que você acha da unidade de banho japonesa como produto? (mostrar foto e explicar)

_____

Perfil de Empresa

[8] Você aceita pedidos personalizados? Por quê?

_____

[9] A sua empresa trabalha em parceria com alguma outra companhia (construtoras, empreiteiras, designers de interiores...)?

_____

[10] Em qual fase da obra e como a sua empresa se relaciona com o canteiro de obras durante o período de atuação?

_____

[11] Como você definiria o escopo de responsabilidades da sua empresa e a margem de duração dos seus serviços?

_____

[12] Quantas pessoas você tem na área de design? Quais as qualificações do seu pessoal?

_____

[13] Você poderia descrever quais os deveres dos seus operários e quanto eles recebem para um contrato de reforma genérico?

_____

[14] Por que motivos os clientes escolhem a sua empresa?

_____

[15] Você poderia nos contar um pouco das suas expectativas acerca das tendências no mercado de moveis?

_____

Interview Sheet: Condominium Managers / Management Companies

Levantamento Reforma de Apartamentos no Brasil

Ficha de Entrevista aos Administradores / Síndicos

* Se houver planta ou foto do empreendimento, pedir para copiar ou fotografar.

* Se houver contrato padrão para compra ou aluguel de imóveis, pedir pra copiar ou fotografar

Entrevista

Data:	Nome do Condomínio:

Perfil do Administrador

[1] Nome: _____ [2] Empresa: _____

[3] Qualificaçao:_____

[4] Você poderia nos contar um pouco da sua experiência como administrador(a) ?

_____

[5] Por que razão você se tornou administrador(a) de imóveis?

_____

[6]Ha quantos anos você atua?

_____

[7] Você pode nos contar um pouco do seu trabalho?

_____

Perfil do Condomínio

[8] Área total: _____ [9] Blocos: _____ [10] Pavimentos: _____ [11] Unidades por pavimento: _____

[12] Plantas tipo: _____ [13] Área por unidade: _____ [14] Total de unidades: _____

[15]Tipo de estrutura: _____ [16] Ano de construção: _____ [17] Construtora: _____

[18] Orçamento Administrativo	R$ Total	R$ por Bloco
Taxa de Condomínio		
Fundo de Reserva		
Manutenção de Elevadores		
Taxas de Estacionamento		
Seguro do Imóvel		
Outros Serviços		

[19] Que tipo de comodidades o condomínio possui?

_____

[20] Alguma dessas comodidades (áreas de lazer) é gerenciada por terceiros?

_____

[21] Você poderia nos explicar (ou fornecer uma copia) a respeito da convenção e o regimento interno do condomínio?

_____

[22] Você poderia nos explicar sobre a estrutura de gestão do condomínio (corpo de funcionários e respectivos afazeres?)

_____

[23] Que parte você tem nas tomadas de decisão nas questões condominiais?

_____

[24]O condomínio tem suporte administrativo de alguma empresa? Qual o nome?

_____

[25]Que tipos de problemas são confiados ao serviço dessa empresa?

_____

[26]Qual a relação entre o conselho administrativo e a administradora (empresa)?

_____

Reforma / Regimento

[27] Ha registro de quantas unidades foram reformadas? Quantas?

_____

[28] Existe algum procedimento requerido no caso da reforma de unidades (permissão, declaração, outro documento)?

_____

[29] Existe alguma restrição de reforma de acordo com o regimento do condomínio?

_____

[30] Em caso de reforma ilegítima, o condômino será sujeito a alguma penalidade? Qual?

_____

[31] Qual o procedimento adotado em caso de reforma de áreas comuns? Existe regimento interno para isso?

_____

[32] Houve alguma reforma de ou construção de áreas comuns do condomínio durante a sua gestão?

_____

[33] Se a resposta anterior for "sim", você poderia nos explicar sobre cada uma dessas reformas?

Comodidade	Ano	Quórum	Execução	Conteúdo	On-site?	Custo	Procedim. Legais	# Reformas Anteriores	Motivo da Reforma

[34]Houve alguma emenda no regimento interno do condomínio a fim de viabilizar ou proibir algum tipo reforma? Qual? Como foi?

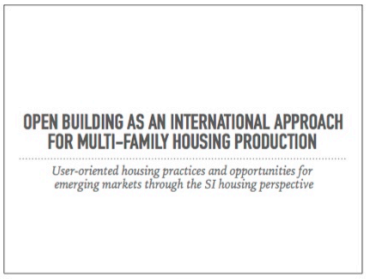
_____

_____

_____

APPENDIX B

THESIS PRESENTATION SLIDES



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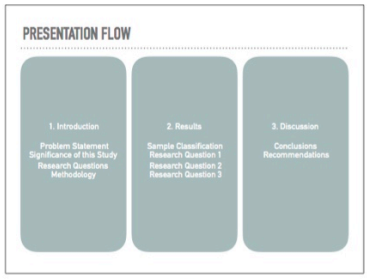

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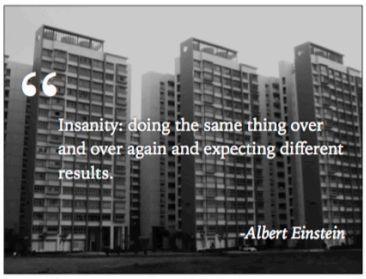

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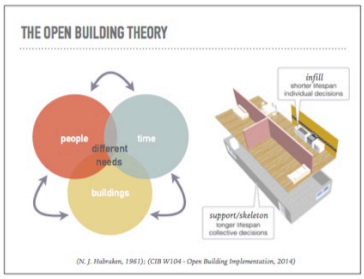

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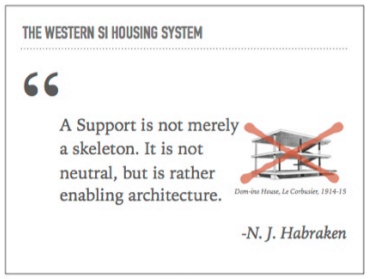

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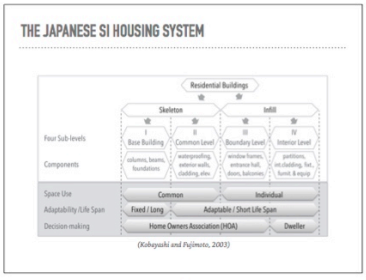

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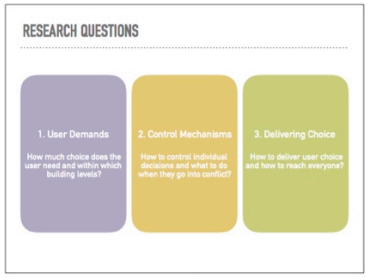

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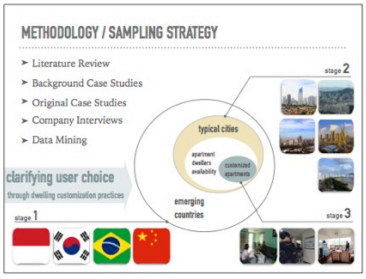

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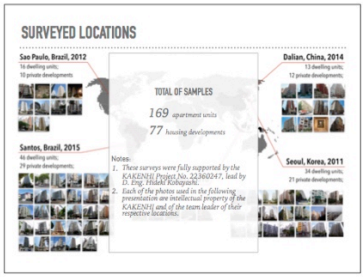

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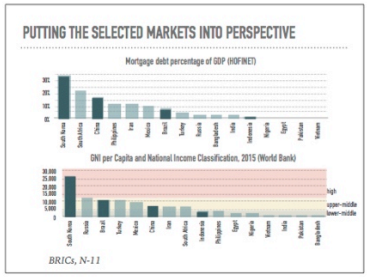

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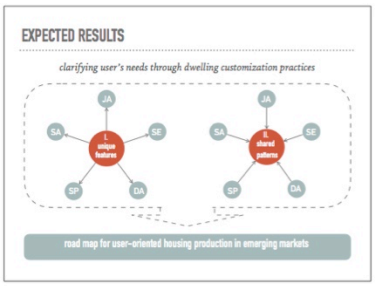

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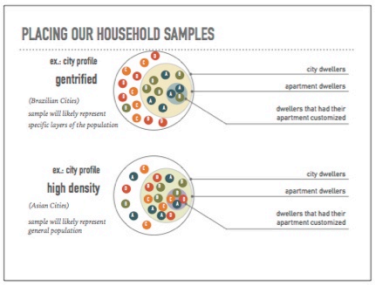

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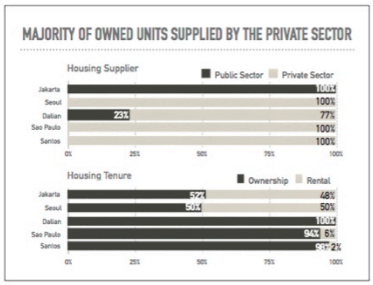

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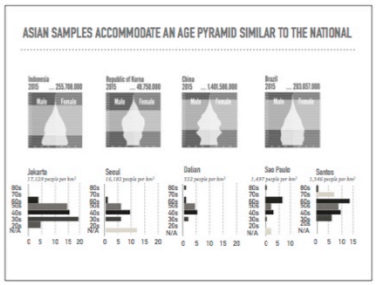

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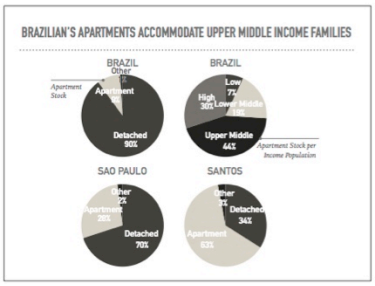

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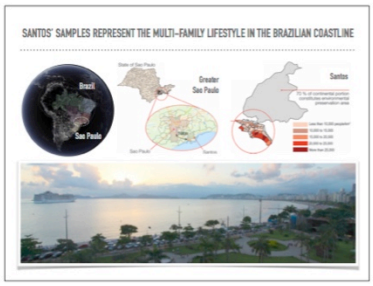

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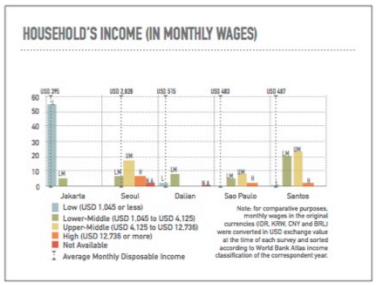

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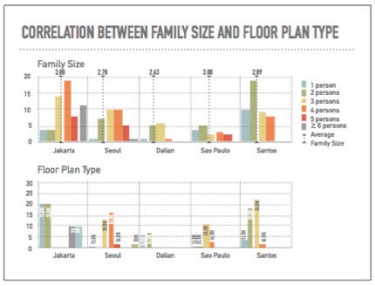

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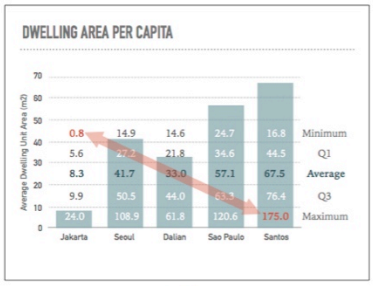

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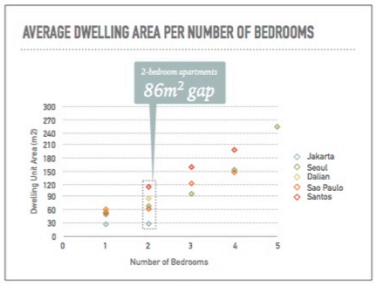

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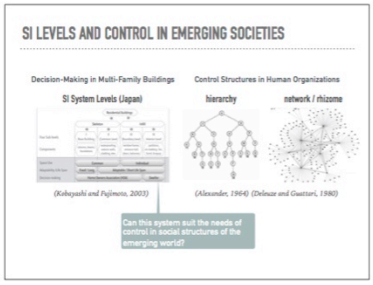

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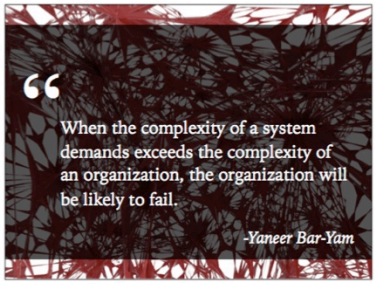

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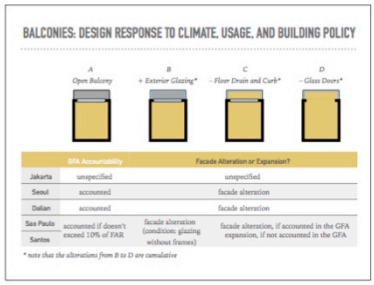

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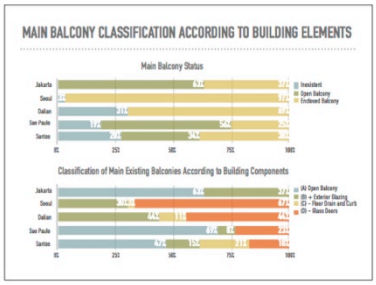

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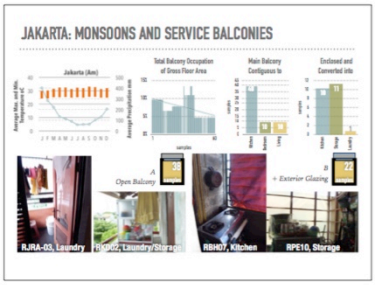

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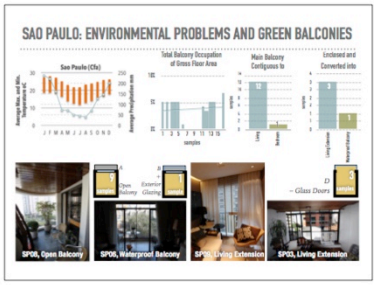

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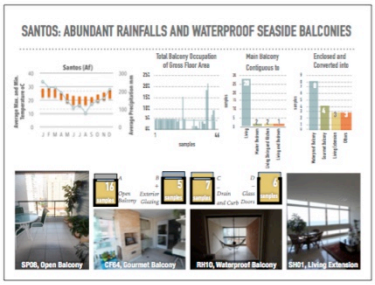

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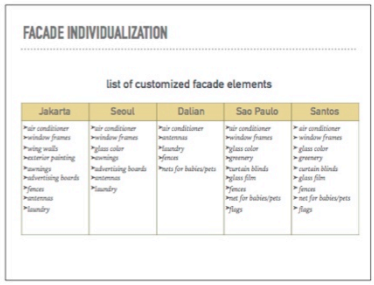

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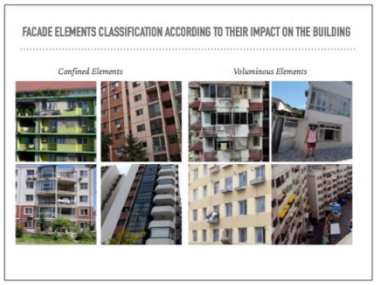

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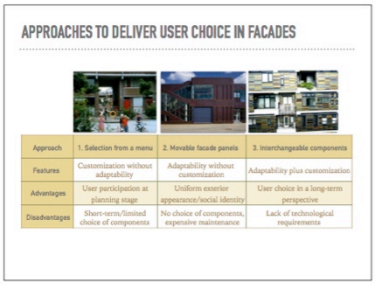

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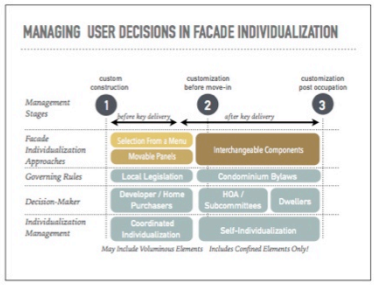

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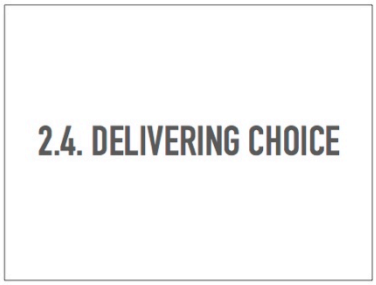

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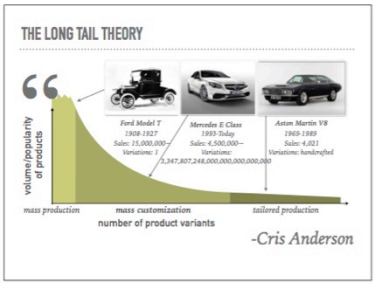

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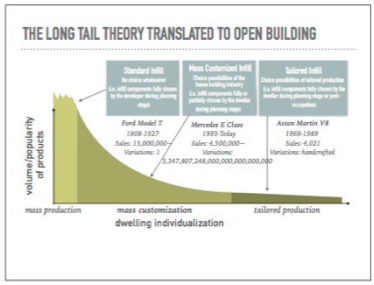

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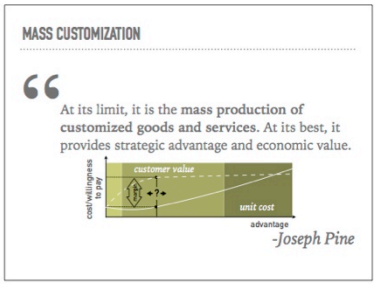

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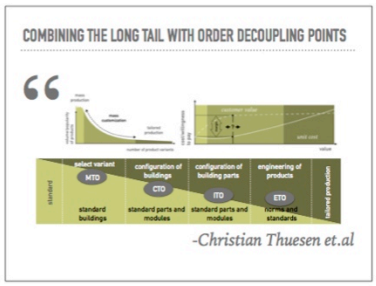

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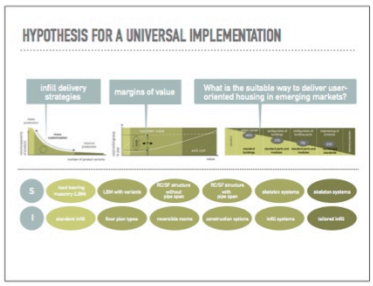

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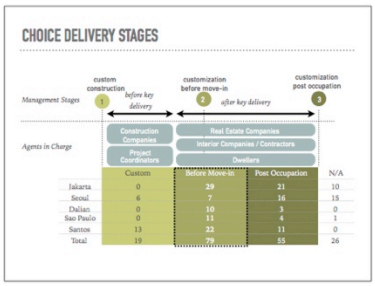

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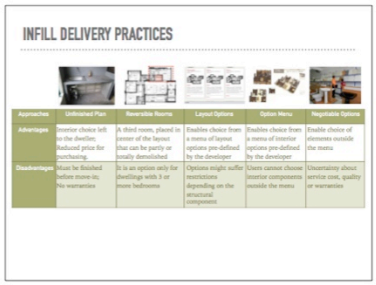

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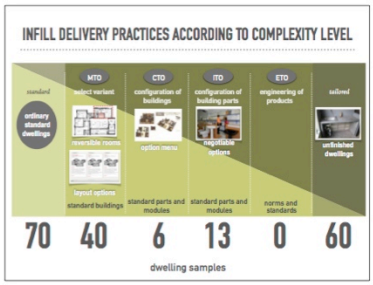

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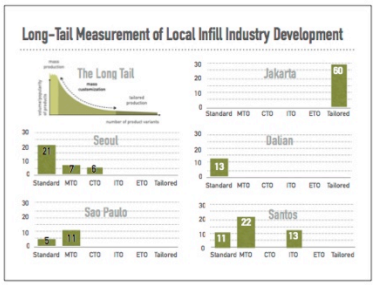

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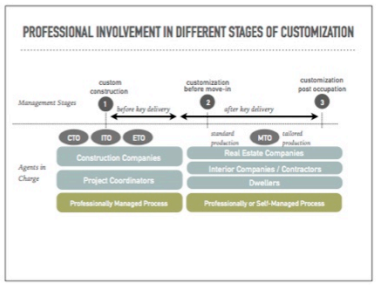

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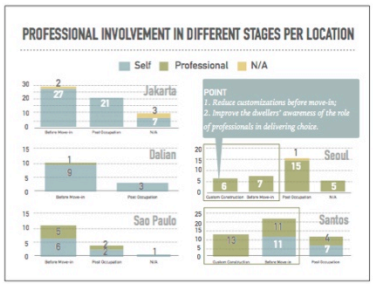

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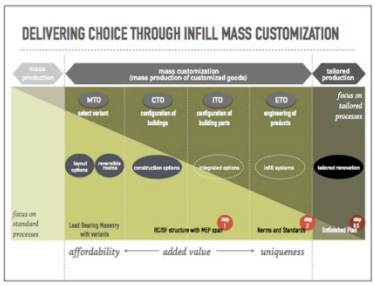

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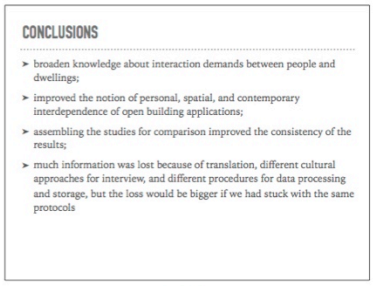

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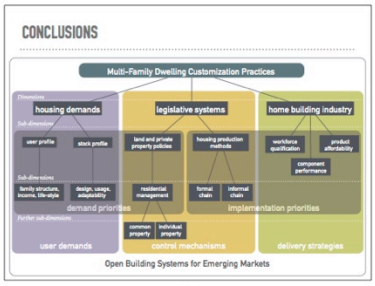

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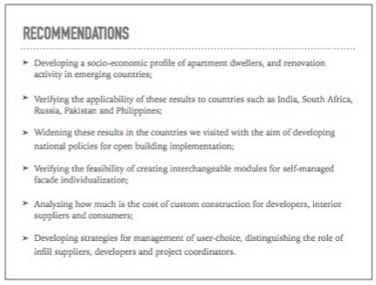

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