



Affordable Design Techniques for Housing in India

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Abstract— Owning a house is a dream that every person has. The government doing efforts to ensure Indians have access to affordable houses. Affordable housing for all people is one of the important challenges. India is currently facing a big shortage of houses. The dream of owning a house, particularly for the low-income and middle-income groups has become a difficult reality. The provision of affordable Housing is a basic human need. The growing population coupled with the lack of adequate housing has necessitated the need for a strategy by the Government, architects, and designers with private developers to proffer solutions that will initiate cost-effective, innovative, and environment-friendly housing technologies for the construction of houses to enable the common people to own houses at affordable cost. This study aims to propose adaptable design strategies in the provision of affordable housing in India. To achieve that, the following objectives were pursued: to propose strategies for land-use efficiency, to recommend guidelines for flexibility in design, and to incorporate end users' opinions in the design of housing schemes. The study adopted the qualitative research method through the review of existing case studies. Among the recommendations made was proposing guidelines on the adaptable design that will aid architects and designers in the design of affordable mass housing schemes.

Keywords—Affordable, Shortage, Adaptable, Cost-effective, Innovative, Environment-friendly

I. INTRODUCTION

Affordable housing refers to housing units that are affordable by that section of society whose income is below the median household income. The Pradhan Mantri Awas Yojana (2015) envisages providing housing to all by 2022. The mission seeks to provide 20 million housing units and take up slum rehabilitation projects. According to the mission guidelines, an affordable housing project shall have a minimum of 35% of the houses for the Economically Weaker Section (EWS) category. EWS households are those having an annual income of up to Rs. 3,00,000 and a dwelling with a carpet area of up to 30 sqm. Low Income Group (LIG) is defined as having an annual income between Rs. 300,001 to Rs. 600,000 and a dwelling unit having a carpet area of up to 60 sqm. Slum is defined as a compact area of at least 300 population or about 60-70 households of poorly built, congested tenements in unhygienic environments, usually with inadequate infrastructure and lacking proper sanitary and drinking water facilities. This study endeavors to achieve what the topic "A HOME TO ALL" means in the Indian context. The success of this project depends upon the least cost and most effective materials and techniques for providing shelter to all.

II. LITERATURE STUDY

❖ Definition of Affordable Housing:

Before framing an affordable housing policy, it is important to delineate the contours of this problem by defining the term “affordable housing.” Defining AH is also important to create targeted policies aimed at making financing more accessible, providing interest rate subsidies, or favorable terms on par with infrastructure financing.

Internationally, housing affordability is defined in multiple ways. One of the most accepted definitions of affordability refers to housing affordability which is taken as a measure of expenditure on housing to income of the household. This is also accepted by the Indian Government, which states “Affordable housing refers to any housing that meets some form of affordability criterion, which could be income level of the family, size of the dwelling unit or affordability in terms of EMI size or ratio of house price to annual income” (High-Level Task Force on Affordable Housing for All, December 2008, p.7).

The Ministry of Housing and Urban Poverty Alleviation (MoHUPA) in its 2011 report takes note of both income and size criteria to define the concept (Table 1). Multiple studies in the Indian context have also suggested other metrics of affordability. Housing affordability is a multi-faceted measure, and while affordability is commonly defined using the expenditure method, there are other perspectives on affordability as well, as discussed in the next sections.

Table 1 Ministry of Housing and Urban Poverty Alleviation criteria for affordable housing.

	Size	EMI or rent
EWS monthly	Minimum of 300 sq ft super built-up area income of the buyer	Not exceeding 30-40% gross
LIG	Minimum of 269 sq ft (25 sq m) carpet area Maximum of 500 sq ft super built-up area Maximum of 517 sq ft (48 sq m) carpet area	
MIG	600-1200 sq ft super built-up area Maximum of 861 sq ft (80 sq m) carpet area	
EWS: economically weaker sections; LIG: low-income group; MIG: middle-income group. Source: MoHUPA, 2011		

❖ Factors for defining Affordability:

In this paper, there are three factors that are basically different processes of owning a house i.e.,

Financing, Designing, and Operating.

1) *Financing:*

-The Central Government initiatives are discussed in the following sections.

1. Pradhan Mantri Awas Yojana (Urban): PMAY (Urban) is the most significant urban housing scheme in India, which provides subsidies on house loan interests for purchasing or constructing a house. The income criteria, eligible loan amount for a subsidy, portion of interest subsidy, and maximum dwelling unit carpet area for different economic sections of the society are discussed below.

	Household Income	Eligible Loan Amount	Amount of Interest Subsidy	Maximum Dwelling Unit Carpet Area
Economically Weaker	Up to Rs. 3 lakh	Up to Rs. 6 lakh	6.50%	30 square meter

Section				
Lower-Income Group	Rs. 3 lakh – Rs. 6 lakh	Up to Rs. 6 lakh	6.50%	60 square meter
Middle-Income Group I	Rs. 6 lakh – Rs. 12 lakh	Up to Rs. 9 lakh	4%	160 square meter
Middle-Income Group II	Rs. 12 lakh – Rs. 18 lakh	Up to Rs. 12 lakh	3%	200 square meter

The maximum repayment period for all income groups is 20 years.

2. Pradhan Mantri Gramin (Rural) Awas Yojana: PMAY has also developed rural housing schemes in India. The PMGAY welfare scheme provides a 3% concession on interest rates of home loans not exceeding Rs. 2 lakhs. This benefit can be availed for upgrading an existing home or new construction in rural areas. The eligibility criteria are the same as PMAY (Urban) with a few additional details given below:

- A family availing of this scheme should not have a solid house
- The beneficiary of the family should only have a spouse and/or unmarried children
- Scheduled Cast (SC), Scheduled Tribe (ST), non-SC or ST who belong to the BPL category and free bonded labors can avail benefits of this scheme

3. Rajiv Gandhi Awas Yojana Housing Scheme: The Rajiv Gandhi Awas Yojana or Rajiv Awas Yojana (RAY) was launched by GOI in 2009 under the Ministry of Housing and Urban Property Alleviation (MoHUPA). It aims to make India slum-free and bring illegal constructions under formal regulations to improve the standard of living.

Benefits of RAY:

- The scheme follows 2 stage implementation strategies to make the city slum-free and prepare projects for selected slum development.
- States, Union Territories (UTs), Urban Local Bodies (ULBs), and Central Government agencies get benefits of financial assistance from this scheme.
- GOI provides Rs. 75,000 of financial assistance to the Economically Weaker Section for dwelling units of 21 to 40 square meters.

Eligibility Criteria for RAY:

- People dwelling in slum areas within a city (notified or not notified), Central Government and state government properties, autonomous bodies under the Act of Parliament, urban local bodies, and urbanized villages inside the city plan are eligible for the scheme.
- Cities and UTs with a predominance of STs, SCs, minorities, and slums get priority under the scheme.
- Cities of historic and heritage importance, tourism industry dominant cities, and district headquarters get significant consideration.

4. Following are some of the home loans in India 2023 by banks, along with the respective housing loan interest and processing fees-

S.No.	Bank Name	Interest Rate	Processing Fees
1.	SBI Home Loan	8.05%-8.55%	0.35% of the loan amount and a maximum of INR 10,000 +GST.
2.	HDFC Home Loan	8.60% - 9.50%	Up to 0.50% of the loan amount or INR 3,000, whichever is higher, plus applicable taxes.
3.	Axis Bank Home Loan	7.60% - 8.05%	Up to 1% of the Loan amount subject to a minimum of INR 10,000 Upfront processing fee of INR 2,500 + GST.
4.	ICICI Home Loan	8.40% - 9.45%	Up to 1.00% of the loan amount + GST.
5.	Bank of Baroda Home Loan	7.45% - 8.80%	Up to 0.50% of the loan amount or a maximum of INR 7,500 + GST.
6.	PNB Home Loan	8.25% - 11.20%	0.35% of the loan amount, subject to a minimum and maximum of INR 2,500 and INR 15,000, respectively.
7.	LIC Housing Finance Home Loan	8.00% - 9.25%	Up to 1.0% of the loan amount + applicable GST.
8.	Aditya Birla Home Loan	8.00% - 13.00%	Up to 1.0% of the loan amount + applicable GST.
9.	Citibank Home Loan	6.50% - 7.40%	Up to 0.40% of the loan amount + GST.
10.	Bajaj Housing Finance Home Loan	7.70% - 14.00%	Up to 1.0% of the loan amount + applicable GST.

The following are the key factors to take into account when applying for a Home Loan-

- Total EMI Amount, Duration, Rate of Interest, Initial Payment or Down Payment, Mortgage Insurance, Additional Fees.

5. Role of Public-Private Partnerships (PPP) for Affordable Housing: Private developers have an important role to play in the push for affordable housing policies. Private developers are essential to the affordable housing policy push, as they have the expertise to develop, manage and maintain housing. Governments around the world are increasingly turning to public-private partnerships (PPP) to promote the development of affordable housing. In many cases, the government provides the land and infrastructure, while private developers build the housing. Governments can facilitate affordable housing through public-private partnerships, tax incentives, and other policy levers.

The members of CREDAI (Confederation of Real Estate Developer's Association of India) have already announced the first major private investment into affordable housing. As per the data available, 375 affordable housing projects are to be launched across the country with an investment of Rs 70,000 crore. The cost of construction of affordable houses, as per CREDAI, will be in the range of Rs 15 lakh

to Rs 30 lakh, with an average cost of construction coming to Rs 18 lakh per house. These projects will involve the development of over 86 million sqft to build a total of 2.37 lakh housing units.

a. Objectives of Public-Private Partnerships (PPP) for Affordable Housing- the main objective is to combine the strengths of the private sector with those of the public sector in order to overcome challenges faced by affordable housing. However, the success of PPP as a strategy will depend critically on designing PPP structures that make an appropriate allocation of risks, responsibilities, rewards, and penances, and create incentives for value creation. This is at the heart of the policies and contractual structures to be created for different PPP strategies to address the challenge of affordable housing.

b. Generic PPP Models for Affordable Housing-

There are currently six PPP implementation models as described below:

Model 1. Government-land Based Subsidized Housing (GLSH):

Under this model,

- The public authority will provide land to the selected private developer. This would effectively constitute a state subsidy for the project.
- The private developer will be responsible and held accountable for designing, building, and financing affordable housing stock and associated services of predetermined standards, at a pre-determined cost and within a pre-determined time.
- The public authority will undertake to compensate the private developer for the housing stock on the satisfactory completion and handing over of the units, as per prescribed standards, cost, and time.
- The allottees would be required to make payment of a pre-determined amount or to pay predetermined equated monthly installments for a predetermined period of time for the cost of the housing unit at the time of handover.
- The establishment of the eligibility of beneficiaries will be the duty and the prerogative of the public authority.
- A Resident Welfare Association (RWA), inclusive of members from all economic classes of residents, may be constituted for the upkeep of common areas and public spaces within the Group Housing premises.
- Loans at an appropriate rate of interest and appropriate tenure could also be made available through housing finance institutions to the allottees for this purpose. An interest subsidy for the allottees could also be built into a financial subsidy regime through the central nodal agency (NHB/HUDCO).

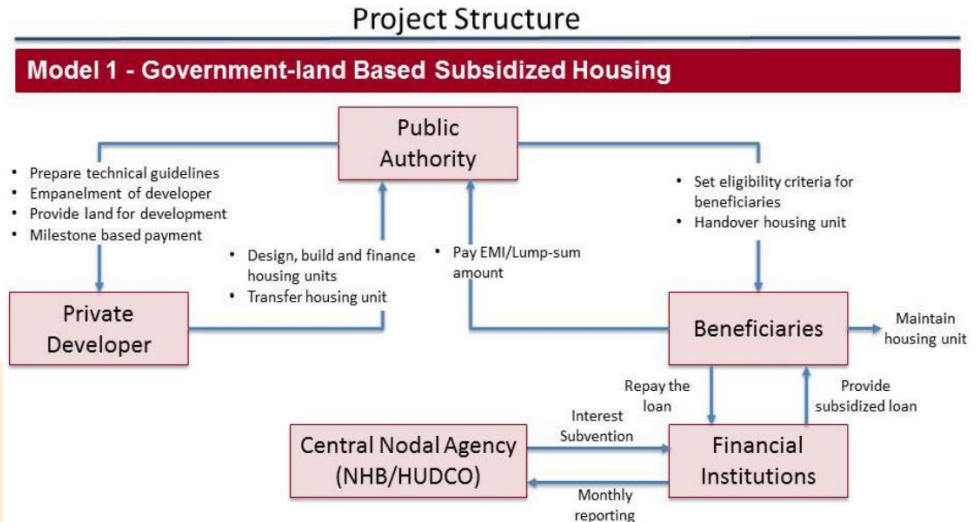


Figure 1: The roles and responsibilities of the various stakeholders in Model 1. Source: MoHUPA

Model 2. Mixed Development Cross-subsidized Housing (MDCH):

- The essential difference in this model from model 1 will be that the developer does not receive any payment from the public authority for providing the affordable housing stock.
- In exchange, for providing affordable housing at another location, on land to be arranged by the private developer, provided that the characteristics of the other land are similar to that provided by the State.

• The value creation for the private developer can be further enhanced by providing higher FAR, TDR as well as fast track clearances for undertaking the development of high-end housing. In exchange for all this value creation, the private developer will be required to provide affordable housing free of cost, this constitutes a cross-subsidy between high-end housing and affordable housing in addition to the subsidy in the form of land provided by the government.

• In order to encourage the private developer, a bonus payment by the Public Authority may be included for the developer for every housing unit accepted and paid for by an eligible allottee. All other aspects of this model would remain the same as in Model 1.

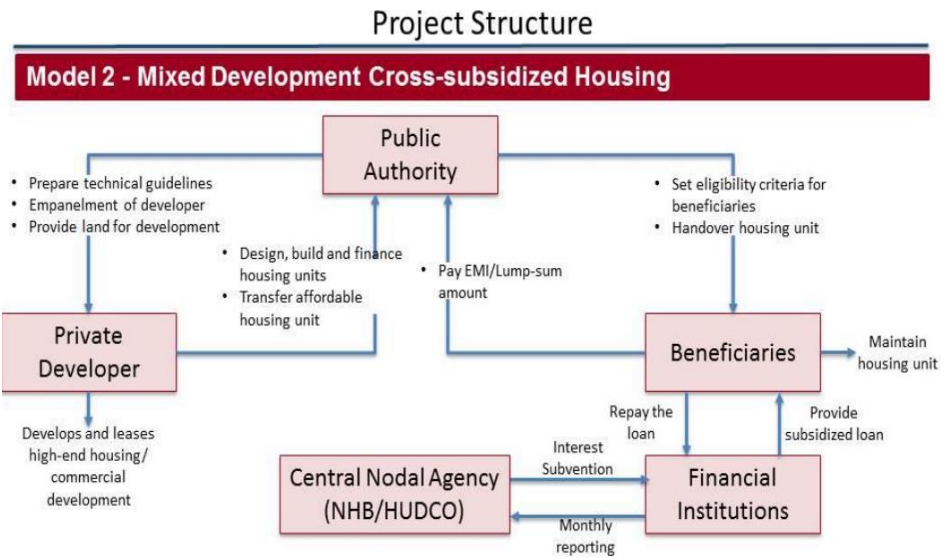


Figure 2: The roles and responsibilities of the various stakeholders in Model 2. Source: MoHUPA

Model 3. Annuity-Based Subsidized Housing (ABSH):

• As in Model 1, the government will provide land under this model as well.

• In this model, the developer receives revenue from the government in the form of regular annuity payments for a period of time (up to 10 years) instead of a lump sum amount at the time of handover.

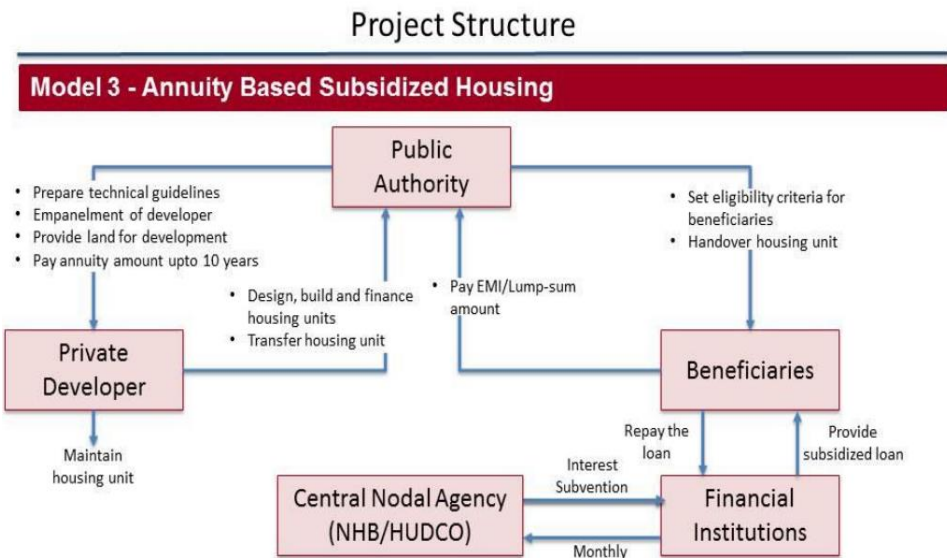


Figure 3: The roles and responsibilities of the various stakeholders in Model 3. Source: MoHUPA

- The public authorities will monitor the quality of the maintenance and there will be rewards and penalties linked to the long-term quality of service received by the occupants
- Also, it is expected that this will improve the construction quality itself since the developer will now be responsible for the long-term performance of the asset.
- A bonus payment by the Public Authority may be included for the developer for every housing unit accepted and paid for by an eligible allottee, to incentivize good quality construction, good design, time-bound delivery of housing units, and any other conditions of the agreement.

Model 4. DBFMT – Annuity cum Capital Grant based Subsidized Housing (AGSH):

- This model is similar to the Model 3
- Under this model a significant proportion of project cost (say 40-50%) is paid to the private developer during the construction phase itself.
- The remaining amount is paid to the developer as an annuity for up to 10 years after the successful completion of the project.
- The annuity amount will of course be lower under this model than under Model 3.
- Developers will continue to bear the responsibilities of construction as well as maintenance and their rewards will continue to be substantially linked to the long-term performance of the asset, as in model 3.

The annuity payments are subject to encourage the private developer for good performance of the asset and provision of maintenance services.

- However, to the extent that government will

finance a part of the construction cost, the financing cost and risk to the private sector will be reduced. This is also expected to bring down the total project cost.

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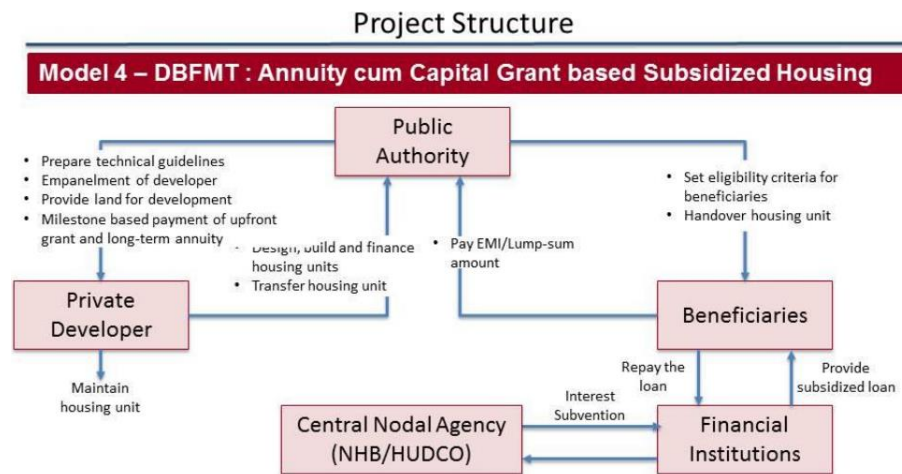


Figure 4: The roles and responsibilities of the various stakeholders in Model 4. Source: MoHUPA

Model 5. Direct Relationship Ownership Housing (DROH):

- The difference between this Model and Model 1 is that in this model there will be a direct financial relationship between the Developer and the Allottee.

The land will be allotted by the government and will constitute a significant subsidy.

- Allottees would be required to make payments towards the cost of the housing unit directly to the Developer.

The type of construction allowed under this model would only be of EWS and LIG units.

- This recovery may take the form of a lump-sum payment at the time of transfer of the housing unit to the allottee or in the form of equated monthly installment (EMI) for a fixed period of time leading to the transfer of the unit to the allottee.

The Developer's interests are thus aligned with providing a well-constructed and well-maintained house to a customer. If properly implemented, this should result in good outcomes.

- As in Model 1, the eligibility of the beneficiaries can continue to be established and announced by the government before the implementation of the project.

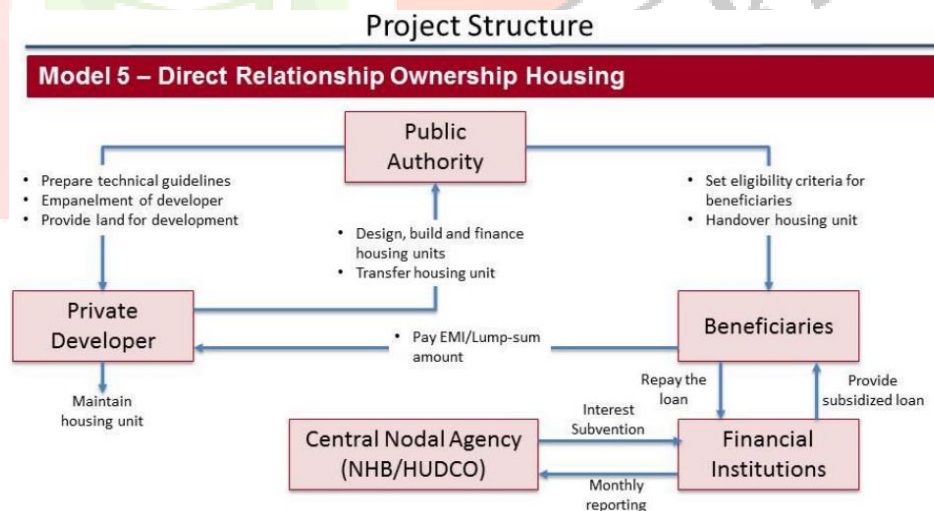


Figure 5: The roles and responsibilities of the various stakeholders in Model 5. Source: MoHUPA

Model 6. Direct Relationship Rental Housing (DRRH):

- The essential difference between this Model and Model 5 is that in this model the Allottees would be required to make rental payments towards the usage of the housing unit directly to the developer, whereas these units continue to be owned by the developers.
- The type of units allowed under this model would comprise only EWS and LIG units.
- The developer will be responsible for the maintenance of the dwelling units for a pre-determined period.
- As in Model 5, the eligibility of the beneficiaries can continue to be established and announced by the public authority before the implementation of the project.
- The developer can impose reasonable penalties, for the delay in rental payments or rental non-payment

• The risk of nonpayment of rent by EWS is considerably overstated, the experience of banks and other financiers is that small borrowers are low. The rental model for affordable housing is the preferred model in many countries.

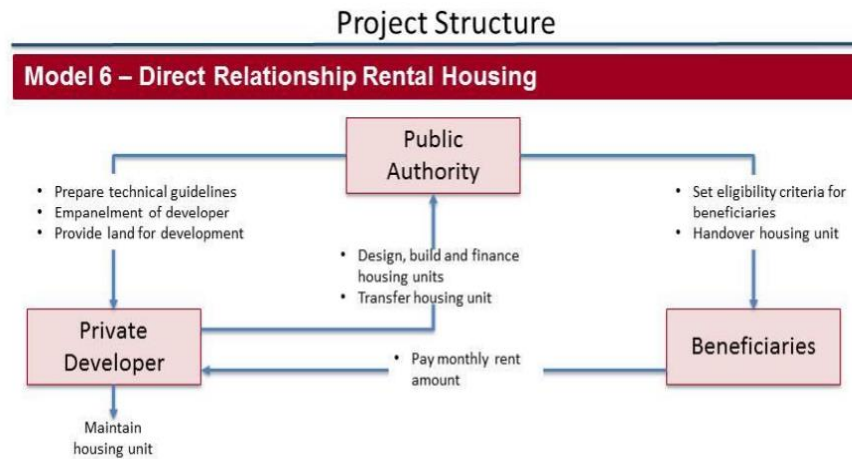


Figure 6: The roles and responsibilities of the various stakeholders in Model 6.

Source: MoHUPA

2) Designing:

Following are the various concept and strategies when effectively employed in building design will give the building the capacity to accommodate effectively the evolving demands of its context, thus maximizing its value throughout the building life cycle-

➤ Land use efficiency

The land still represents the most important development resource for municipal and national governments. The land is a key factor in housing design and cost. The availability, size, and location of land to a large extent determine its use and cost implications. Often, this cost is transferred to the end users/inhabitants/tenants. With the rate of price appreciation of the land, the cost of housing also skyrockets at an alarming rate, with the low and middle-income earners bearing the brunt of the costs in the form of rents and lease costs, being the ones who can hardly afford to build houses of their own. It is the quest for affordable urban housing that has given rise to urban sprawls and slums, unplanned urban areas, and illegal occupation of existing accommodations.

There have been different suggestions as to how to go about reducing this cost implication on the housing inhabitants. These are generally referred to as Smart Growth. Smart growth, in a nutshell, refers to a set of goals and policies set in place in order to curb sprawl. Some proponents of smart growth are of the opinion that the housing needs of low-income earners can be addressed by planning neighborhoods of higher densities, a greater variety of housing types, and mixed land use than by low-density, single-family homes.

Land use efficiency takes into cognizance not only the designated use of the land but also the location of the land and the size of the land. Sustainable land use for low-income earners would imply residential zones sited close to commercial and institutional zones in order to reduce the cost of transportation. For planners, land use efficiency involves maximizing the spatial provision of the structure erected on the site.

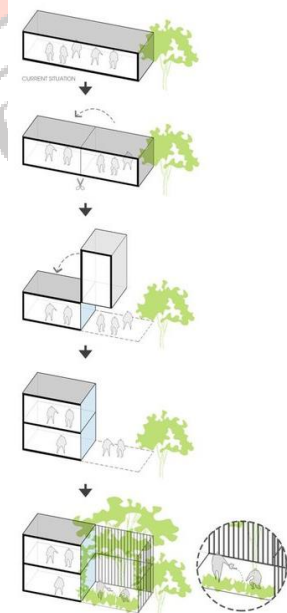


Figure 7: showing how a small space can be designed differently. Source: archdaily

➤ Flexibility in design

The term “flexibility” as distinct from “adaptability” connotes the capability of different physical arrangements, whereas, adaptability is concerned with the capability of fitting different social uses. This implies that “flexibility” is used for physical changes and “adaptability” is used to depict non-physical changes, although, both usually occur at the same time thereby removing any rigid boundary between them.

Flexibility can be achieved by modifying the physical form of the building by linking, splitting, extending, and integrating spaces. Thus, flexibility in design would allow for new modifications based on new lifestyles, family size, or economic growth. The drive for flexibility in designs is greatly influenced by economic constraints as well as functional use, although, the major factors influencing flexibility in the architectural circumstance are the users of buildings, their needs, and their requirements which change rapidly over time thereby necessitating the cause for buildings towards a flexible physical, spatial, and cultural structure to respond to the changes.

Tracing the history of flexibility in design, a major contributor Le Corbusier, proposed the Domino system, this system has formed a pillar in discussions on flexibility in design. The Domino system entailed industrialized designs for housing using concrete framed structures (columns and slabs). This informed the design of the free floor plan where the interior is different from the building frame which bore the building structural loads. Thus, encouraging flexibility in the arrangement of non-load-bearing partition walls to meet user needs and requirements even as they change. Although Le Corbusier’s Domino system achieves flexibility, it can be argued that this flexibility is confined to the delineation of the framed structure.

Table 1: Indicators of Flexible/ Adaptable Architecture and Definition:

Type of Flexibility/ Adaptability	Definition
Convertibility	allowing for changes in use within the building
Expandability	facilitating additions to the quantity space in a building “Allowing for increases in volume or capacity (the latter can be achieved by inserting an additional floor in a building, which does not increase its volume)”
Durability	“Selecting materials, assemblies and systems that require less maintenance, repair and replacement”
Design for Disassembly	“Making it easier to take products and assemblies apart so that their constituent elements can more easily be reused or recycled.”
Upgradability	“Choose systems and components that anticipate and can accommodate potential increased performance requirements”
Lifetime Compatibility	Do not encapsulate, or strongly interconnect short lifetime components with those having longer life times.

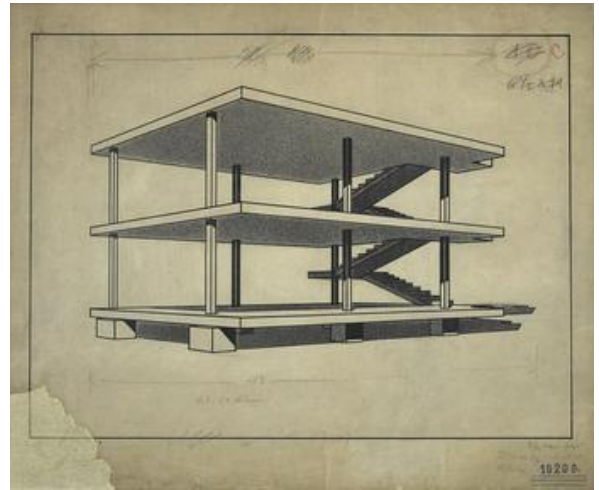


Figure 8: Drawing of the Maison Dom-Ino. Source: Le Corbusier

➤ Case Study

Quinta Monroy housing project:

Architects: Alejandro Aravena,

Area: 5000 m²

Year: 2003,

City: Iquique, Chile

The participatory design process proved innovative for affordable housing. The building was designed as a “half-building” in the first phase, where the government funds were used, and another “half-building” in the second phase, where the families take over and adapt the building to their specific needs.

The design process channeled the occupant’s building capacity into the development process, thereby keeping it within affordable means for the homeowners.

Affordability: The design strategy was geared towards a social housing scheme that keeps increasing in value, as opposed to one that keeps depreciating. For maximum land efficiency, the buildings were designed in clusters of 20, with a common public space and restricted entrance, to encourage social life. The design strategy allowed the most important sections of the site and building to be provided and also provide growth within a frame provided.

Low-income families that started off living in 1 or 2-bedroom units in a very short time were able to complete the building into a middle-income household of 3-4 bedrooms units.

Adaptability: At the center of the design philosophy, is the notion that the building should expand as the economic fortune of its occupant increase. The design of the “half-building” gave an opportunity for the occupants to make additions within an already provided frame. The buildings designed as low-income social housing, in a couple of years, grew into middle-income homes.

The effect/end result of the development: The design adaptability and affordability proved to be effective only through a participatory design process. The homeowners themselves were able to maintain their social life and also live in the area that they want to live in.

3) *Operating:*

Today 330 million people suffer from housing poverty and given the current trends in supply that will increase to 440 million households by 2025 which means in less than 10 years 1.6 billion people or one-third of the world's urban population will suffer from some kind of housing poverty. Housing was not simply a product but also a process in which end-users could play an important role. Providing them with a proper operation



Figure 9: Image of the “Half-Building” Source: Retrieved from www.archdaily.com



Figure 10: Image of the Site Planning showing Land efficiency. Source: Retrieved from www.archdaily.com



Figure 11: The effect/result of the development. Source: Retrieved from www.archdaily.com

<https://www.99acres.com/articles/government-policies-to-boost-private-participation-in-affordable-housing.html>

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