

**Smart Housing- A Future Trend Of Living****Sustainability, Affordability & Smart Housing Techniques**Surya Dev Prakash¹, Akshay Kumar H.B.², Apoorva D.L.³, Ashwani Kumar⁴^{1,2,3,4}Department Of Civil Engineering, Nitte Meenakshi Institute Of Technology Bangalore,

Abstract — This paper deals about the several smart measures to be adopted in public and private housing all over the world and also the determining the affordability along with sustainable housing patterns. Many of these efforts are driven by theoretical concepts of urban planning and practice due to rapid urbanization. Most 'Smart Growth' planning reforms adopt as a core principle the goal of increasing housing affordability and diversity. As smart growth can increase housing prices under some circumstances. Low-density residential and commercial development, the argument goes, reduces the overall quality of urban life by increasing congestion, promoting social isolation and segregation, and inefficiently using land. Centralized land-use planning, the projects about energy efficiency in social housing buildings in European countries, which is supposed to be introduced in the aspects of subjective and objective energy saving potentials. It is proposed to be able to provide valuable and referential advices exchange our experience on a sustainable development in affordable housing. Providing affordable housing has become an urgent task for governments. Today have many governments around the world realized it and have been planning to take more actions on it. The U.S. government, Sweden's government and Singapore's government, for examples, have carried out many policies to solve the problem. in Canada and United States, local governments seem firmly committed to increasing the availability of affordable housing through a variety of innovative subsidy programs; In China, affordable housing involves the national construction program and organized by the real estate department of province government to provide a suitable housing environment for the low-income families. As per United Nation Economic Commission For Europe, by 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums. Development of 100 Smart Cities in India would provide ample opportunities to the real estate developers, who will not only have to focus on technology-driven homes but also affordability and lifestyle quotient. Developers who want to enter India's affordable housing market face many obstacles. But with an estimated market value of USD 245 billion, the sector is attracting growing interest. Tata Housing, one of India's fastest growing real-estate developers, is among a new generation of firms focusing on the low-income segment. Nonetheless, to achieve the sector's enormous potential, the Indian government will need to create a facilitating environment. We will discuss the elaborated smart housing techniques as well as affordability of housing in Bengaluru, India.

Keywords- Affordability; Sustainable; Urbanization; Congestion; Housing

I. INTRODUCTION

The potential for infrastructure is essentially because of the massive need for infrastructural development in the country, as India continues to march ahead on the road of fast-paced economic growth. When these high levels of economic activity are combined with other factors like rapid urbanization, rising disposable incomes, and an enormous population base eager to improve their lifestyle, the need for housing becomes obvious. Housing is generally deemed affordable if it constitutes 30 percent or less of household income (U.S. Environmental Protection Agency, 2010). Therefore any smart growth development funded in part by HUD, DOT, or the EPA should not burden low-income families when building smart growth developments in order to comply with environmental justice laws. Housing is generally deemed affordable if it constitutes 30 percent or less of household income (U.S. Environmental Protection Agency, 2010). Therefore any smart growth development funded in part by HUD, DOT, or the EPA should not burden low-income families when building smart growth developments in order to comply with environmental justice laws. The need for innovative affordable housing solutions is growing. Communities with a variety of housing choices that provide options for people of all ages and income levels offer an affordable housing solution worth exploring. A common perception is that high density and affordable housing will increase traffic, overcrowding and crime, strain public services and infrastructure, lower property values, and undermine community character. However there are several disadvantages to low density development. For example, in highly populated regions, low density can create an imbalance of housing, jobs and services, increasing vehicle mileage, traffic congestion and air pollution. There are many benefits to and higher density development and "smart growth". Smart growth refers to land use development practices that promote efficient use of land and existing urban infrastructure; an alternative to sprawl. Several states conducted housing studies and concluded that accessory dwelling units (ADUs) have the potential to provide a sufficient number of affordable rental units. An ADU is defined as "an attached or detached residential unit which provides complete independent living facilities for one or more persons, including provisions for living, sleeping, eating, cooking, and

sanitation on the same parcel as a single-family home” (Sunnyvale Planning Department, 2003, n.p.). ADUs include renovated garages, renovated basements, attached sheds, backyard cottages, and elderly cottage housing opportunities (ECHO) (MRSC, 1995). Other terms used for an ADU are accessory apartment, guest apartment, in-law apartment, granny flat, family apartment, and secondary unit (Commonwealth of Massachusetts, 2007). When it comes to implementing sustainability in each of these elements, communities tend to focus on economic development, environmental protection, and transportation diversity. Their initiatives often include using resources more efficiently, reducing automobile traffic, encouraging bicycling and pedestrian activity, and the protection of open spaces. Many communities also look at housing and other community needs. For instance, the North Central Texas Council of Governments lists — Planning efforts which seek to balance access, finance, mobility, affordability, community cohesion, and environmental quality as one of their three goals for sustainable development. Communities could encourage the development of affordable housing reserved for seniors or with small units because they do not want to increase the burden on their tax base by attracting low-income families with children. In order for development to be truly equitable and therefore fit the paradigm of sustainability it must include a range of housing types that are also affordable. In development practice, environmental justice has taken several forms. For instance, environmental justice laws may prevent an energy plant from being built if the pollution were going to disproportionately impact a group of people based on the aforementioned factors. In terms of housing policy, environmental justice laws have changed the U.S. Department of Housing and Urban Development’s approach to building low income housing. Rather than segregating large public housing projects from the rest of the community, where residents would have more equal access to municipal services and benefits, HUD now encourages mixed-income and dispersed affordable housing development. the tremendous opportunity available for housing development in India, one must take cognizance of the changed dynamics in the real estate sector post the crisis. At the time of the crisis, real estate developers in India, like everywhere else, faced liquidity problems. The weaknesses of their business model, where construction activities are financed primarily by collections from advance bookings came to the fore, as real estate sales volumes dipped. Forced by this challenging business environment, homebuilders in India turned towards a product of better mass appeal -affordable housing.

(a.) Sustainable Development of housing:

The key to building sustainable communities - those that get better and stronger over time - will be to recognize that economic opportunity, ecological integrity, and social equity are interlocking links in the chain of well-being - (President’s Council on Sustainable Development, 1993-1999). Although there have been variations in the definition of sustainable development in the past two decades, most are grounded in the premise put forth by the United Nations’ Brundtland. Commission that sustainable development —meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development (Brundtland Commission), 1987). In other words, it is finding and coming to an acceptable quality of life for all people that can be sustained indefinitely. Building off this idea, sustainable development has come to be understood in terms of three key spheres: the economic, the ecological, and the social elements. When it comes to implementing sustainability in each of these elements, communities tend to focus on economic development, environmental protection, and transportation diversity. Their initiatives often include using resources more efficiently, reducing automobile traffic, encouraging bicycling and pedestrian activity, and the protection of open spaces. Many communities also look at housing and other community needs.

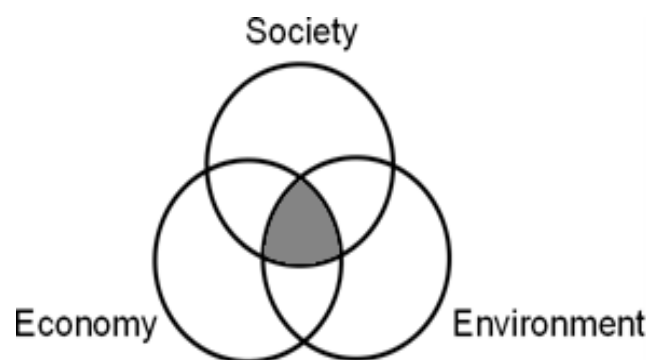


Figure 1. The three Key Elements of Sustainability

For instance, the North Central Texas Council of Governments lists —Planning efforts which seek to balance access, finance, mobility, affordability, community cohesion, and environmental qualityl as one of their three goals for sustainable development (North Central Texas Council of Governments). With improved scientific understanding and the subsequent environmental legislation enacted in the 1960s, environmental impacts became a mandatory factor in the

development process, at least for the federal government. By in large, states and local governments have adopted environmental protection laws as well (Kraft, 2006). While communities have been finding ways to protect habitats, reduce storm water runoff, remove hazardous materials from old buildings, and clean up contaminated sites (all forms of environmental protection and considered progress towards sustainability) for the past fifty years, the examination of the societal impacts of development, particularly distribution of its burdens and benefits, has only just begun. In development practice, environmental justice has taken several forms. For instance, environmental justice laws may prevent an energy plant from being built if the pollution were going to disproportionately impact a group of people based on the aforementioned factors. In terms of housing policy, environmental justice laws have changed the U.S. Department of Housing and Urban Development's approach to building low income housing. Rather than segregating large public housing projects from the rest of the community, where residents would have more equal access to municipal services and benefits, HUD now encourages mixed-income and dispersed affordable housing development. For the purposes of this paper, it is especially important to note that no income group should bear a disproportionate cost of governmental policies based on environmental justice law. It is less well understood that the U.S. housing bubble was not a monolithic event. It varied substantially by geography. Gross national house value increases and losses were overwhelmingly concentrated in metropolitan areas with more restrictive land use regulations — known by a variety of names, such as compact city policy, growth management or smart growth. Many metropolitan areas with these land use restrictions were not able to respond to the increased demand for homeownership caused by the greater availability of mortgage credit. The inevitable result was higher prices, which encouraged speculation and increased house prices even more. Thus, from 2000 to 2007, among the nation's 50 largest metropolitan markets:

- In the 10 markets with the greatest rise in prices compared to income, the cost of a house rose by an average of \$275,000, relative to incomes.
- Among the second 10 markets with the greatest price escalation, house prices rose \$135,000.
- By contrast, in the major markets with the least rise in prices, houses increased only \$5,000.

• **Urban Sustainability**

The terms smart growth and sustainability are sometimes used interchangeably, they are not the same thing. In the United States, smart growth is as a proxy for sustainable development. It appeals to sustainability principles by calling for development that —serves the economy, the community and the environment (U.S. Environmental Protection Agency, 2010).¹ However, smart growth emphasizes market-based approaches to sustainability. Historically and elsewhere, 'sustainable development' has used policy and governmental approaches to managing growth such as those put forth in the United Nations' Local Agenda 21 (Krueger & Gibbs, 'Third Wave' Sustainability? Smart Growth and Regional Development in the USA, 2008). Smart growth appeals to policy makers trying to balance economic prosperity and environmental regulations, environmentalists and others seeking to preserve land and combat sprawl, as well as developers who benefit from economic incentives for —smart development. This popular support of smart growth has led to awards celebrating developments that implement its principles. The EPA Office of Sustainable Communities even has a program for smart growth research, education and technical assistance and gives out the prestigious Smart Growth Achievement Award for excellence in smart growth development (U.S. Environmental Protection Agency, 2011). In 2009, the HUD, the EPA, and U.S. Department of Transportation (DOT), formed a partnership for sustainable communities to promote smart growth principles (U.S. Environmental Protection Agency, 2010). Clearly, its appeal is still growing. the availability of a range of affordable housing options for low-income families of various sizes and needs. It is certainly possible that communities and developers could create smart growth developments that provide a range of unaffordable housing. Furthermore, developers could create affordable housing that was not open to all low-income families. For instance, communities could encourage the development of affordable housing reserved for seniors or with small units because they do not want to increase the burden on their tax base by attracting low-income families with children. In order for development to be truly equitable and therefore fit the paradigm of sustainability it must include a range of housing types that are also affordable. EPA and HUD are working to promote affordable and equitable housing development it is unclear to what extent this has actually been achieved in recent sustainable and smart growth developments.

• **Comparison between affordability & sustainability:**

Housing is generally deemed affordable if it constitutes 30 percent or less of household income (U.S. Environmental Protection Agency, 2010). Therefore any smart growth development funded in part by HUD, DOT, or the EPA should not burden low-income families when building smart growth developments in order to comply with environmental justice laws. The EPA also recognizes that the issue of affordability is compounded by transportation options. They recognize that —for working families — those in greatest need of affordable housing — the combined cost of housing and transportation accounts for 57 percent of household income, on average (U.S. Environmental Protection Agency, 2010).¹ Many of the development projects we looked at that were funded or lauded by HUD or the EPA did include affordable housing. But some of them, like the Bethesda Row development in Maryland, did not. Furthermore, private development entities are not bound by environmental justice law. They have no legal responsibility to ensure that the burdens of development are equally distributed. However, if we are to achieve true sustainable development, development must also

be just. The relationship between the need for affordable housing and poverty is complicated. Since affordability is based on a general guideline and individual incomes, whether or not housing is affordable would vary from family to family. For instance, —affordable rents for people with very low incomes and those with moderate incomes would be different. Furthermore, the moderate income family, would could not be in poverty, but still have trouble finding affordable housing less than 30% of their total income. Poverty on the other hand has two specific definitions: one determined by the U.S. Census Bureau and the other determined by the Department of Health and Human Services (HHS). The U.S. Census Bureau uses thresholds to measure poverty while the HHS uses poverty guidelines. Poverty guidelines are adjusted for the cost of living for each state. They used for determining eligibility for federal programs (U.S. Department of Health and Human Services, 2010). For purposes of this research, we use the definition and provided by the U.S. Census Bureau, which are design for performing statistical analysis of poverty in the United States. Thresholds put forth by the U.S. Census Bureau do no vary geographically and are updated for inflation using the Consumer Price Index. —The official poverty definition uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps) (U.S. Census Bureau, 2010). Each person or family is assigned one out of 48 possible poverty thresholds, which vary according to the size of the family and the ages of the members as show in the table below (U.S. Census Bureau, 2010).

II. SUSTAINIBILITY AND GENTRIFICATION

At any given time, there is a balance at play in the forces that shape development all centered on the question, Development for whom? Is the development for the benefit of the existing residents? What about people who would like to live there? Don't their needs and desires matter as well? Who has the right to profit from the land? The developers? The government? The current and future residents? All of the above? Is land development simply a robbery by the capitalist class, the elites, of the poor and working class (Krueger & Gibbs, *The Sustainable Development Paradox*, 2007) and (Freeman, 2006, p. 60). The question of whom development is for can be summed up in one long, messy word: gentrification.

• **Gentrification: The Good, the Bad and the Ugly**

What is gentrification? According to some it means improved neighborhoods; neighborhoods that are safe, livable, and contribute to the local tax base (Lees, Slater, & Wyly, 2008). This too recalls the rhetoric of sustainability—making communities that care for the environment and society while improving the economy. But at what price? To many, gentrification means the displacement of low-income persons perhaps to worse places that are the only option they can afford. Bruce Dixon goes as far as to say that gentrification is —a theft of public and private resources from...poorer neighborhoods which deserve to be improved for the people who aready [sic] live there, (Dixon, 1998). —The diverse and historic communities that line the Turnpike together house more than a quarter of Boston's population and represent many of the city's most historic and vital neighborhoods. Perhaps more than any others, these neighborhoods have endured the costs and enjoyed the benefits of changes that have occurred over the past two decades. The costs are visible—congested streets; housing shortages (the 1999 residential vacancy rates were under 1%); and displacement of long-time residents in the face of surging housing costs. The benefits are just as striking—dramatic improvements in unemployment rate and income levels (instead of lagging, Boston now far exceeds national norms); and vibrant main streets (empty storefronts have largely disappeared) (Strategic Development Study Committee, 2000). In *There Goes the Hood*, Lance Freeman acknowledges that gentrification can have its benefits. In his interviews with low-income people in Harlem, NY, he found that they appreciated the increased safety of the neighborhood and greater access to amenities (Freeman, 2006, pp. 60-62). He also notes the duality in the response to the increase in property values. On the one hand owners with an eye towards moving welcomed the increased values because it meant they could sell and pocket the change (Freeman, 2006, p. 61). On the other hand, the increase in property values prevented residents who had grown up in the area from moving back to start their own families. He also notes that rapidly rising property taxes could pose a threat to owners who wish to stay. In one of the developments we discovered in the course of this research, the violence of gentrification was clear. A mobile home park with lots of elderly residents was cleared to make way for upscale housing that eventually fell through when the housing bubble burst, but not soon enough to keep the residents in their homes (Lindberg, Bay Pines Mobile Home Park Parcel for Sale Again, 2009). In this case the perpetrator of this economic brutality was not a sustainable or smart growth development, rather a typical developer hoping to make a profit on this waterfront property. However, the next developer to take interest in the site, Kittson, has a history of building —sustainable mixed-use communities similar to the development that have proposed for the now vacant Bay Pines area (Burney, Kitson Buys Rare Vacant Florida Land, 2010). We were able to capture the destruction of the Bay Pines Mobile Home Park community using Google Earth's —Historical Imagery feature. Some of the smart growth developments we found tried to remedy this by providing affordable housing in the new development. However, not all methods of preserving affordable housing are equal. Some provided affordable housing for people with moderate incomes and not low-incomes. Some promised the housing would be affordable for 10 years or so, but after that it would be converted to market rate housing. Still others limited who the housing was for in order to meet the needs of certain populations, while inadvertently making it seem like there is more affordable housing than there actually is for the general public.

III. METHODOLOGY

US forms of sustainability has been examined from the perspective of *where* the developments are located. After identifying the location using information given in their descriptions and determining an address for them on Google maps, we investigated the economic demographics of the affected community and the policies surrounding the development. Then mapped these developments and examined in order to draw conclusions about the potential effects of sustainable development today on existing communities.

• Selection Criteria

Since the definition of what constitutes smart growth is so broad, we limited the scope of the project to developments that were described as smart growth or sustainable developments by newspapers, smart growth groups, or their developers. If the developers included the terms smart growth or sustainability in the goals the developments were considered to be smart growth/sustainable developments. Although New Urbanism also appeals to the principles of sustainability, developments that only included the terms new urbanism or new urbanist were not included. As noted by a Google search, smart growth is more popular than new urbanism as evidenced by the 1,070,000 hits versus 397,000 hits, respectively (Google Search). Furthermore, we limited our selections to mixed used developments (the epitome of smart growth) that included a housing component, which allowed us to assess whether or not affordable housing was included. Affordable housing that discriminated on the basis of age or disability, e.g. senior housing and disability housing, while important, does not capture whether or not affordable housing is generally available in the area and therefore was recorded as affordable.

• Mapping

Data from the 2000 Summary Files 1 and 2 from the U.S. Census Bureau for the income levels in each tract. Shape files of the states and tracts were obtained from the U.S. Census Bureau as well as from ESRI. We used census tracts as the smallest mapping unit because each tract represents a roughly homogeneous population of 2,500 to 8,000 people and has relatively consistent boundaries from decade to decade. It is also the smallest census unit for which data is not tabulated based on estimates (U.S. Census Bureau, 2000). In the preliminary trial of this research, we examined the median income of these areas to see whether or not poor and moderate income families might feel economic pressure from this development. Depending on the distribution of incomes in a tract, it is possible poverty line could be higher than the median income.

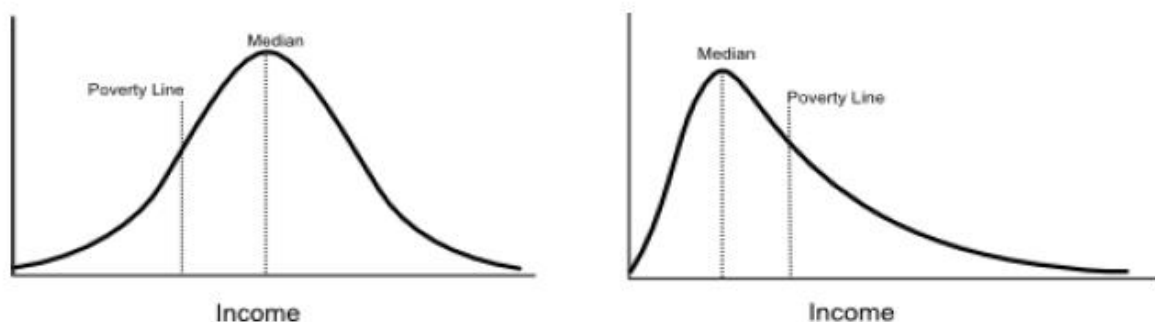


Figure 2. Income Distribution

In the Figure 2, the income distribution is relatively normal and the poverty line is below the median income. Even with this distribution shape, if everyone in the community were very poor it is possible that the poverty line would still be above the median income if the wealthiest households were, in reality, very poor. But perhaps more likely it is that a poor community's income distribution would look similar to the figure on the right, in which case an analysis looking at affordable housing would miss the needs of the population below the poverty line as well as above the median income.

• Search Methods

1. Searched the following websites for developments: Smart Growth America, Smart Growth Online, Urban Land Institute, Congress for new Urbanism, Environmental Protection Agency Smart Growth and Sustainability pages. Made sure to examine the EPA Smart Growth Achievement winners, CNU Charter Award winners, and the Phoenix Award winners.

2. Examined all cities in the United States with populations over 250,000 (U.S. Census 2000) to determine whether or not the city had a sustainability or smart growth plan using the following Google search function: name of city AND (smart growth or sustainable or sustainability). Searched hits following links (and searched more terms if necessary) related to master plan development plan, revitalization, infill, smart growth, redevelopment, improvement district, brownfields etc.
3. Cities that had a plan using the terms —smart growth, sustainability or sustainable were further examined by identifying development and master plans mentioned on the websites.
4. If the plans or development descriptions fit the Decision Tree for Development Inclusion, they were included in the database and analyzed.
5. The smart growth or sustainability term inclusion for a member of a development's project team (i.e. owner, developer, architect, general contractor) was determined by finding that member's website and using the following Google search function: site: web- address (smart growth or sustainable or sustainability). This search function returns all instances of those words used on any page within the website.
6. Affordability was similarly determined. Websites that included developments or plans were often searched using this Google search function: site: web-address (affordable or affordability or workforce). The results were then examined to determine whether or not the plan or development met the Affordability Determination Criteria.
7. Searched lists of Award Winning developments and selected developments that included the rhetoric of smart growth and fit the selection criteria.
8. Developments created by small (i.e. those that build several houses in a neighborhood over the course of decades) community development corporations were not searched for and were generally not included.

• **Decision Tree for Development Inclusion**

1. Was the development built or planned to be built in the timer period between 1990 and 2010?
 - a. Yes—Next
 - b. No—DON'T INCLUDE
2. Is the development solely an infrastructural change? (e.g. road improvements, new transportation)
 - a. Yes—DON'T INCLUDE
 - b. No—Next
3. Is it mixed use development with a housing component?
 - a. Yes—Next
 - b. NO—DON'T INCLUDE
4. Is the housing component restricted by age, disability or previous housing status, e.g. senior/disability/formerly homeless housing?
 - a. Yes—Next
 - b. No—DON'T INCLUDE
5. Is the site adjacent to or in a neighborhood, or is the plan for a specific neighborhood area?
 - a. Yes—Next
 - b. No—DON'T INCLUDE

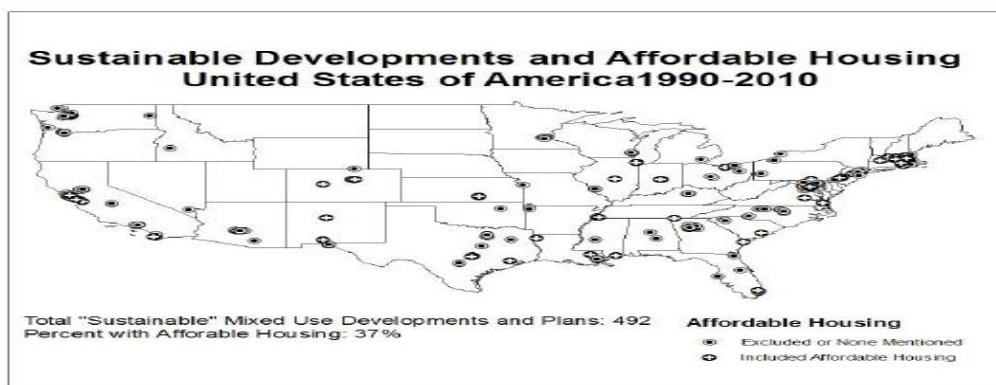


Figure3: Sustainable Developments and Affordable Housing U.S.A.

6. Does the plan explicitly use the term —smart growth or —sustainability?
 - a. Yes—Include
 - b. No—Next
7. Do any of the developers, architects, or general contractors of the project use the terms —smart growth or sustainability to describe their company's mission or work?
 - a. Yes—Include
 - b. No—Next

8. Has the development received an award for sustainability or smart growth (or an award mentioning sustainability as a goal such as the Phoenix Awards for Brownfield redevelopment)?

a. Yes–Include

b. No–DON'T INCLUDE

The map depicts the four hundred and ninety two developments that met the search criteria. They are spread throughout the United States. Thirty seven percent of them included affordable housing.

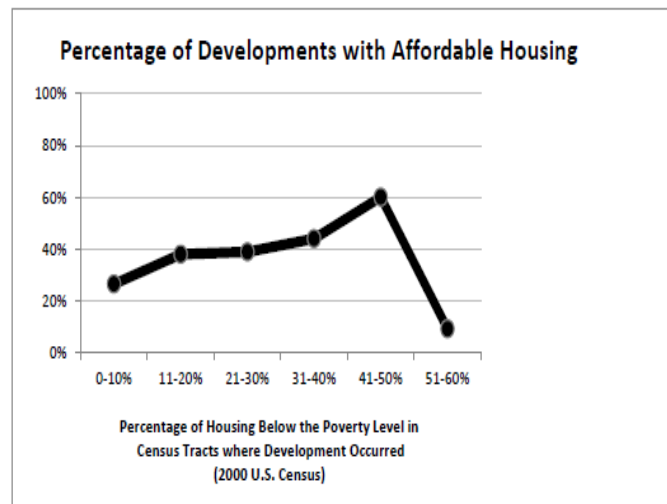


Figure 4. Percentage of Developments with Affordable Housing

Most importantly, this graph provides insight on the social equity of sustainable development as it is practiced today. If developments fit the paradigm of sustainability that is they included affordable housing we would expect the lines to overlap completely. The gap between the solid line and the dashed line represents what sustainable development has yet to achieve: equitable housing development. The graph above depicts the percentage of developments with affordable housing with respect to the percentage of housing below the poverty level in tracts where developments occurred. It shows that nearly thirty percent of developments that went into tracts with relatively little housing in poverty included affordable housing. While it is not one hundred percent, perhaps thirty percent is not too bad when it comes to protecting the people in the housing units that make up less than ten percent of the total occupied housing stock. The general trend upward to a higher percentage of affordable housing is encouraging. However, the sharp drop in the percentage of developments with affordable housing in the when fifty to sixty percent of the housing units have families in poverty is puzzling. There are several explanations for the drop. It could be due to the small sample size within this range (11 developments). In the worst case scenario, it could be due to the development of the urban frontier (the areas on the fringe of the worst areas in a city) with —sustainable, luxury housing. In terms of whether or not the market-based of smart growth is working for affordable housing development, we found that in general it was not. Many of the developments that included affordable housing did so because a growth policy, not because of a market incentive. Most of the developments in San Francisco, CA and Massachusetts included affordable housing because a certain percentage of affordable housing was required for any new city or state funded development. A sizeable portion of the rest of the developments were funded in part by HUD or the EPA who usually included affordable housing.

• The Housing Bubble

The U.S. housing bubble that developed from 1999 to 2006 was the result of actions by both potential homeowners and lenders. Potential buyers perceived homeownership as an investment that had little risk. Economic incentives offered to lending institutions resulted in the issuing of subprime loans with variable interest rates to households with poor (or no) credit histories. Increased demand for homes raised prices and, as a result, the supply increased: more new homes were built and more existing homes were put on the market.

The American Dream of Homeownership

Following World War II, Americans began to realize the dream of home ownership with the development of low-priced suburbs on the fringe of urban areas, such as Levittown, New York. As average (median) family incomes rose in the post-war era, homeownership grew significantly. Consider:

- Homeownership rose from 44 percent of households in 1940 to 62 percent by 1960.
- Sixty-five percent of households were homeowners in 1995.

■ Homeownership peaked in 2006 at 69 percent.

House sizes also increased: 1

■ In 1973, the average single-family home was 1,525 square feet.

■ By 2006, the average home size rose to 2,248 square feet, an increase of 47 percent.

The quality of housing also increased, with amenities like air conditioning becoming standard features in new homes.

IV. Housing Regeneration in the Context Of Bengaluru:

This is a citizens' initiative to understand the housing regeneration process in Bangalore. It is a commentary on existing housing market in terms of stock – availability, quality, quantity & service levels and affordability.

Today most of the independent houses in layouts don't have space within the plot (negligible setbacks available after akrama-sakrama setback dispensation). Civic Amenity to support a neighbourhood cannot be established due to lack in availability of vacant plots even at market price. The resultant change in neighbourhood scale and lack of new well defined

boundaries seems to discourage residents from active participation in civic activities. When these layouts were designed, they considered carriageway requirements of only distribution/ conveyance lines of few utilities. Therefore there is no space for community level WTP/STP/Solid waste management.

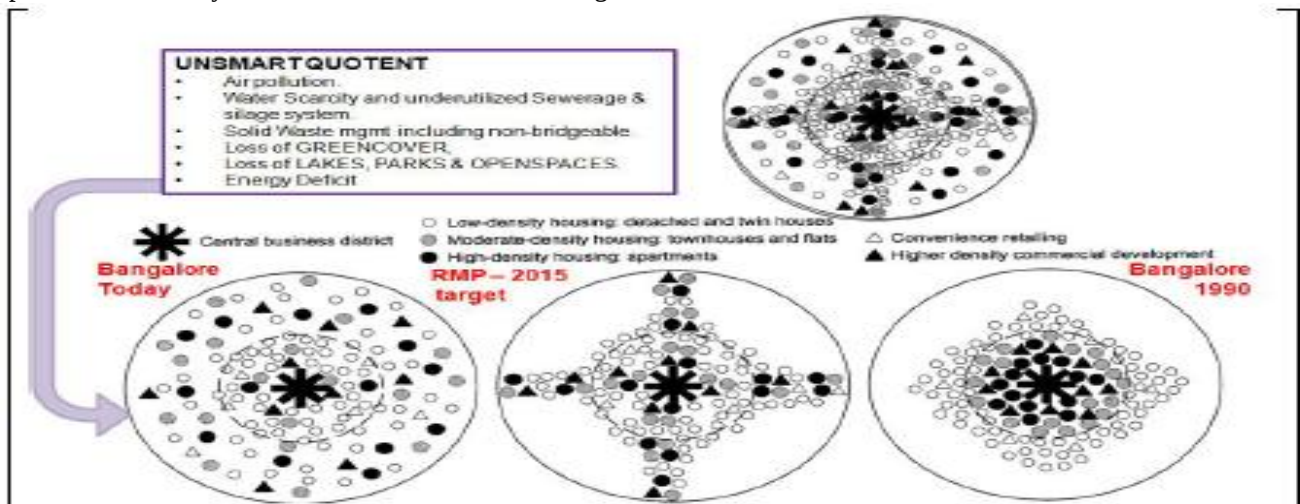


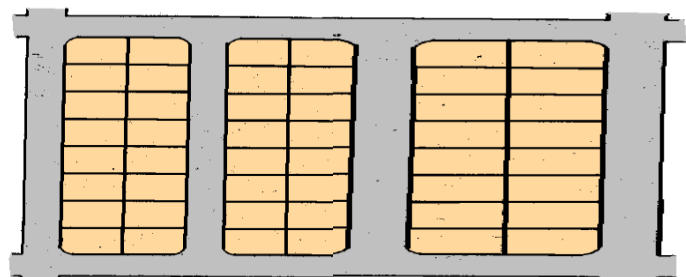
Figure 5: Unsmart Quotient

The city is slowly losing its urban scale. The neighbourhood boundary cannot be defined in the absence of supporting civic amenity and other natural boundaries. Developers of Group Housing Projects greater than 10 Acre had to surrender through a gift deed around 10 % of Gross land for civic amenities. The FAR allowed was computed on available net land, reducing the revenue generation from large group housing projects. Therefore majority of the group housing complex developed before the year 2005- 06, often had gross area less than 10 Acre. Secondly even after surrendering the land for development of Civic amenity, the project developer lost control over future land use and ownership of the civic amenity site. Thus it's a disincentive for a developer to go for community scale group housing projects with needed Civic amenity. For a decaying housing stock, when the discounted cost of maintenance (that includes capital infusion for reconstruction & repairs, discounted for inflation) surpass the selling price of a better housing stock of same size, residents would realise that it makes sense to re-build to renew while staying in places they can connect to, that also has adequate city level amenities. Today residents of Bangalore are mostly in the service sector (predominantly export driven IT-ITES sector) that has the highest wage. Rental or cost of house ownership is more than 30% of the house hold income, i.e. resident in the 80 % median per capita income range would take him at least 40 to 45 years to repay housing loan even after reduction in interest rates. Based on past experience from service sector driven economies, as the population ages, there is also an associated decrease in average real wage. To make housing affordable, BDA/ BBMP needs to introduce policy initiatives like

- Increase the availability of usable land by allowing land pooling for urban / housing renewal.
- Introduce use of TDR for urban renewal projects, i.e. to directly aid densification
- Green TDR to broad base TDR availability & lower carbon footprint. Amendment in existing bylaws and introduction of guidance policies that would aid in formation of SMART COMMUNITIES out of present day Layouts & group housings would be driving the Urban / Housing regeneration efforts in the future.

Changing Built form- Cause for deterioration of quality of life

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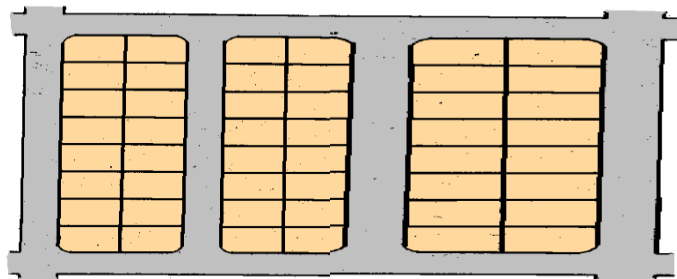
Today community or town of Bangalore are having FRAGMENTED PARALLEL STREETS as the objective was to generate BACK TO BACK GRID IRON PLOTS with maximum, EAST, WEST & NORTH FRONTAGE PLOTS (Vastu Compliant plots with marketable attributes). The hierarchy of Civic Amenities are also overlapping and due to change in traffic pattern, the the HIGHEST THOROUGH TRAFFIC. Today there is a new development control bylaw AAKRAMA SAKRAMA that allows BUILTFORM deviation provided the final AS BUILT STRUCTURE'S increased value add is less than equal to 20%.



Figure 6: AAKRAMA SAKRAMA

Speculations related to application of AAKRAMA SAKRAMA started a decade back, supported by cities caretakers. We have seen a mad rush for encroachment of building setbacks and construction of additional floors.

The neighbourhood boundary is today blurred as they have lost scale due to illegal change in land use residential to service / facility centres in IT/ITES. Streets with lowest RIGHT OF WAY have ulations changed its character, resulting in worsening of supply supplies.



Thus LOWRISE LOW DENSITY NEIGHBOURHOODS of the are slowly/ illegally getting converted to LOWRISE HIGH DENSITY NEIGHBOURHOODS. PRE & POST AKRAMA SAKRAMA, the community population has spiked up and the land use has changing adequate potable water supply as well as quality. Secondly there is no space left in the built form to create water storage systems. This has given rise to illegal water tanker based unreliable

– Technology, Form and Function Context of Bangalore India

Fine Grain Diversity

Measurement of diversity in a balanced community or in the social, cultural and economic utility or infrastructure is done in terms of Simpson's or Shannon's diversity index is termed to be Fine Grain Diversity. In a resilient cities, where the whole is built from self - sustainable components leaves room for evolution. Modifying the urban whole from a technical blueprint involves destroying a great many components on very different scales. Fine grain diversity refers to mixed use. At the neighbourhood scale, it refers to a 'smart' mix of residential buildings, offices, shops, and urban amenities. At the block and building scale, mixed use consists of developing small-scale business spaces for offices, workshops, and studios on the ground floor of residential blocks and home-working premises.

STAGE	IMPORTANT SETTING	rites of PASSAGE
INFANT-Trust	Home; Crib; Nursery; Garden	Birth Place, setting up the cribout of the crib, making a place
YOUNG CHILD - Autonomy	Owns place, couples realm, children's realm, commons, connected play	Walking, making a place, special birthday
CHILD - Initiative	Play space, Own place, common land, neighborhood, animals.	First ventures in Town..... joining
YOUNGSTER - Industry	Children's home, school, own place, adventure play, club, community.	Puberty rite, private entrances, paying your way.
YOUTH-Identity	Cottage, teenage society, hostels, apprentice, town & region.	Commencement, marriage, work, building.
YOUNG ADULT - Intimacy	Household, couple's realm, small work group, the family, network of learning.	Birth of child, creating social wealth building.
ADULT - Generatively	Work community, the family, town hall, a room of one's own.	Special birthday, gathering, change in work.
OLD PERSON - Integrity	Settled work, cottage, and the family, independent regions.	Death, funeral, grave sites within estate..... common sacred grooves.... meditation.

A person's life traverses several stages of growth – infancy to old age and a balanced community sustains the give and take of growth. People need support and confirmation from people who have reached a different stage in the life cycle and at the same time would need support from people who are at the same stage as they are. To balance the community, the community pattern include a balance of people at every stage of the life cycle- i.e. from infants to the very old and support & contain a full slate of settings which best marks the ritual crossing of life from one stage to the next. The Resilient City Master Plan also needs to allow Functional Flexibility, i.e. cities, urban forms can easily adapt (with limited investment needs) to a redistribution of urban functions. A resilient urban form must have flexibility to get a third dimension without disturbing the availability and hierarchy of facilities, amenities and quality of life. For example Community re-densification initiatives not limited to policy like Transferable Development Rights (TDR), issued in addition to normal Floor Area Ratio, increases the Community Global FAR, protects cultural or historical heritage, increasing the number of inhabitants, reducing per capita cost of utility distribution and increased access to utility.

- **Urban Morphology studies to arrive at scale of Housing Regeneration Master Plan**

There is a need to understand Bangalore's residents not in terms of just demographic numbers. The city of Bangalore is slowly losing its scale, character and ability to maintain a sense of continuity of fundamental values and security to exist in a good living environment. The city has failed to maintain settlement character due to reduced harmony between the built environment and the people, necessary for a balanced community of the various socio-economic groups. Cooperation within, lack of fraternity & tolerance has reduced self-help process within community. The city is in need of a framework within which there will be an opportunity for incremental physical development, within existing legal, economical and organizational framework. Even before preparation of Strategy Plans of Resilient City Master Plan, we need to undertake Urban Morphology Studies through extended participation of citizens, using IoT / IoE apps, analytics including game theory. Outcome of this study will be Value and Lifestyle based segmentation (VALS) of the population. VALS and quantified inadequacy of the social -economic - cultural infrastructure of the neighbourhood would help to quantify quality of life. Neighbourhood strategies to improve quality of life (includes effect of population growth within a particular VALS and migration from one VALS to another due to change in aspiration) needs to be prepared. The proposed amenities also needs to comply with facility norms & hierarchy defined in National Building Code 2005 for social - economic - cultural infrastructure.

- **Collaborative Mechanisms & Civic Engagement: Scale & Type**

- i) At the neighbourhood level (500 Persons), the civic engagement can start with**

- Sharing info or asking info related to day to day activities using existing internet/ intranet groups, whatsapp / Google groups.
- Sharing information about upcoming events within the cluster/ community / neighborhood, including conventional posters put up in cluster notice boards.

Engagement in sharing of civic amenity and running of the cluster facility management - for example segregation of garbage at source, checks to keep an eye on work of facility mgmt/ housekeeping staff as well as compliance of agreed upon garbage segregation at source modalities.

- ii) At the community level (5 to 6 Neighbourhoods, 2500 to 3000 persons) engagement can start with weekly meetings for**

- Exchange of working notes;
- Engagement with civic body & utility officials for collective bargaining and Create a virtual vote bank while interacting
- with political functionary @ ward level.
- A minute of meeting signed and maintained with details of
- engagement will keep the officials at the toes.

- iii) At the Town / Ward level (population of 40000), the citizens need to hire urban planner and volunteer professionals with city roots to**

- Document the assets & utility of communities, preferably in a map of scale 1:500.

- Check the quality of service levels of utility/ services/ infrastructure/ amenities and create a quality of life shortfall matrix;
- Prepare a remedial action plan in synergy with city development plan. Thereafter the neighborhood communities' leadership works as a common stakeholder and starts interaction with political/ civic leadership.

• Green transfer of Development Rights (GTDR): Community Redensification Tools

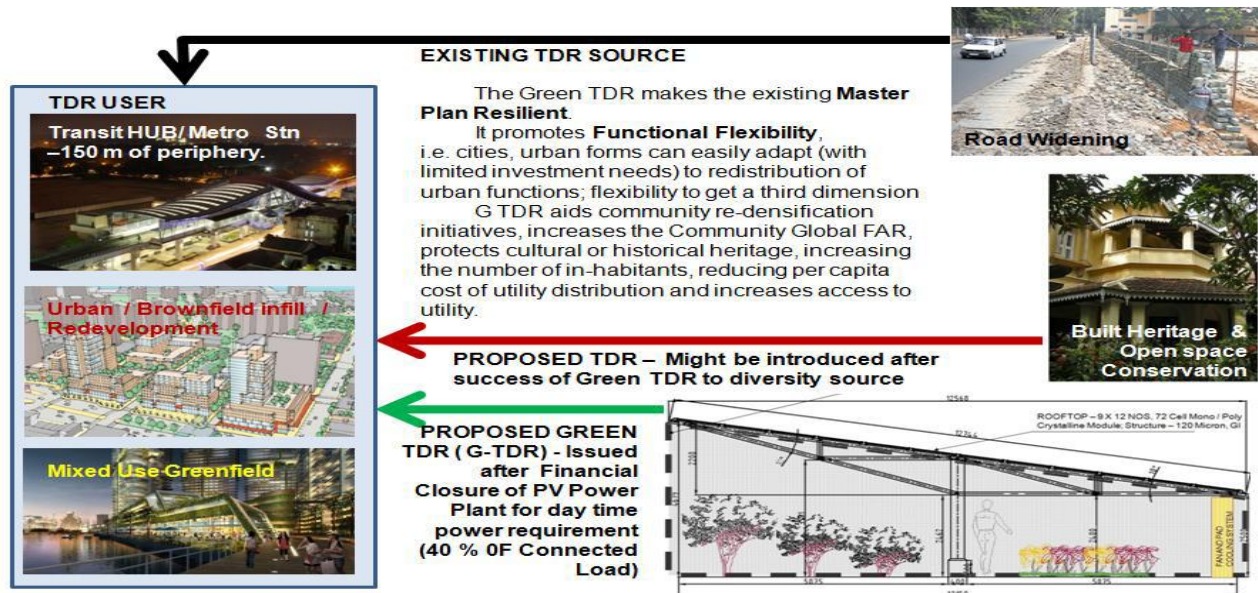
a) What is TDR?

A Transfer of Development Rights (TDR) is a certificate from the Municipal Corporation that the owner of a property gets where his/her property (either part or whole) is reserved for the purpose of public utilities such as road, garden, school etc.

Transfer of Development Rights (TDR) means making available certain amount of additional built up area in lieu of the area relinquished or surrendered by the owner of the land. The owner of land either use extra built up area for himself or transfer it to another in need of the extra built up area for an agreed sum of money. TDR is generated on plots reserved for public amenities like roads, playgrounds, gardens, schools, markets etc. TDR is an effective tool to simultaneously limit development in valuable open space areas while stimulating additional development in areas well suited to higher densities.

TDR for prospective development is granted, though it can be generated from preservation of privately owned past developments of heritage value. Use of TDR as an urban planning instrument started more than a decade back in MUMBAI, followed by Cyberabad Development authority and Bangalore through CDP-2005. TDR in Bangalore, Karnataka was introduced in the year 2005. If a property obstructs the "Right of Way" of an infrastructure project, the executing agency / the government can acquire your property by compensating the land / property owner with TDR. TDR issued is permission for built-up area one and a half times the property originally surrendered.

b) How it works? Green Transfer of Development Rights.



c) Green Transfer of Development Rights – At a Glance

OBJECTIVE Complement existing limited source of TDR and at the same time promote use of Solar Power without subsidy at future solar parks, developed within 50 Km from the perimeter of BESCOM command area, grid linked through National Transmission Line backbone of Power Grid Corporation of India. **TARGET SEGMENT** HT Consumers of Bangalore Development Authority or Local Planning authorities within Bangalore, distributed power by BESCOM. BDA & BMRDA area also has large demand for TDR. Ideal stake holder mix includes but not limited to HT consumers of BESCOM in BDA & BMRDA. **OUTCOME** of the project will be increase the urban density, optimize per capita utilization of urban infrastructure and provide incentive to project developers to go for conventional energy bundled with minimum 40 % renewable energy, i.e. Energy Security, price stability. **POLICY MULTIPLIER EFFECT** **COMMAND AREA BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED - BESCOM** distributes more than 50% of total power distributed in the state. Bangalore contributes more than 40% to State Domestic Product of Karnataka, highest density of habitation & energy consumption in the state. **G-TDR USER** are Developer or owner of commercial & residential property in proposed clusters and growth nodes of BMRDA or in designated growth corridors

of BDA like Urban Redevelopment Zones; Ca-Mixed Residential Area and other uses where additional FAR is allowed, gets an opportunity to use GREEN TDR. It is similar to DRC referred in CDP 2015. G-TDR CONSUMED / PROJECT will be between 0.125 (12.50 %) to 0.25 (25.00 % - minimum DRC allowable for ZONE B of BDA i.e. the FAR shall not exceed 3.5 (350.00 %) in any case.

d) Green Transfer of Development Rights – Policy rollout mechanism

The Urban Development Dept has to talk to Energy Department and agree with empowering BDA or setting up an organization to administer TDR. Issue a Govt Order (GO) identifying Green TDR is another source of TDR. A real estate project developer desirous procuring TDR within permissible limits (for example, Total FAR including TDR is 4 within 150 m of metro station perimeters) would have to develop a grid linked PV power plant to take care of projects day time power requirements. The Developer applies for Green TDR after meeting conditions precedent for establishing PV Power Plant. The Green TDR issuing authority checks whether the real estate developer has developed the grid linked solar plant (of required capacity) to avail the TDR. Once the Solar Plant is established, the Real Estate project SPV is issued the TDR. Real estate market of Bangalore is still vibrant in this country. Today to increase the affordability of projects most of the developers are looking for TDR. There is a vibrant market for TDR. Real estate market is a more matured business and utility like DG, STP, WTP are part of project capital cost. The solar project being part of a real estate project gets non recourse funding. In Karnataka its difficult to get project Debt for standalone grid linked PV Power Plant till the land is converted, on the other hand real estate FDI Funds/ ReIT (under sebi guidelines) can go for conditional disbursement of funds for utility (captive consumption) of projects. With the use of Green TDR, Bangalore becomes dense & resilient (objective of BBMP Structure Plan 2031) and promotes consumption of Green power without spending money on directly subsidising solar power plant.

e) Green Transfer of Development Rights – Application case study

LEED GOLD rated commercial building on 1.2 Ha land, abutting BDA Mutation Corridor Road ROW > 30 M. FAR allowable is 3.25 & Ground Coverage is 40%. Gross rentable / saleable area is 0.47 Man SFT. Connected Load for the building is 4.91 MW and the Demand Load of the building is 6.138 MW (6.819 MVA @ 0.9 PF & 0.8 LF). Total Power consumption will be 43.012 MU/Year. Annual daytime power consumption will be 17.20 MU/Yrs (40 % of annual total) for 9.6 Hrs avg annual day lighting in Bangalore, to be met through generation of a PV Power Plant. 13.17 MWp PV Power Plant (Gross Plant size assuming 10 % loss of energy due to degradation) at 16.57 % Capacity Utilization Factor will generate 1.45 MU/Year/MWp, i.e. 17.20 MU/Yrs Project Cost (EPCC + Land + Evacuation infrastructure) @ Rs 7.5 Cr/MWp comes to around Rs 98.75 Cr. O & M Cost @ 14 Lakh/Year escalating at 6.7 % PA over 10 year period (tenure of plant debt) will be 25.11 Cr. G-TDR has to generate enough revenue to provide for 123.86 Cr over 10 year period. Lets assume lease rental of Rs 36/ SFT (net escalation of 2% PA) or selling price of Rs 4825/SFT. G-TDR required is 0.25 or 25%.

f) Green Transfer of Development Rights – Application case study takeoff road map.

i) Execution Process

The real estate project developer develops 13.17 MWp Grid linked PV Power Plant and gets additional FAR of 0.25 or 25 %. The power plant injects power to the grid and real estate project uses the power by just paying the required wheeling charges. The real-estate project or the power plant developer gets 90 % of the Carbon Credits in the 1st year and BDA gets the balance carbon credit. The carbon credit share of BDA becomes 20% in the 2nd year; 30 % in the 3rd year; 40 % in the 4th year and 50 % for the 5th year to the life of the project 25 to 30 years. In existing buildings and areas where new buildings cannot consume all the additional FAR, the balance will be treated as Transferable Development Rights (TDR).

ii) SMARTCITY Investment Trust (SMIT)

SMIT will also play the role of a regulator, established in Public Private Partnership. Benchmark capital and O & M Cost finalized by SMIT is used for computation of G-TDR and size of PV Power Plant. Technical due diligence of probable locations along with load flow analysis of KPTCL GSS / MUSS within BESCOM command are will be done by SMIT. Common SPV for real-estate project and PV power plant development.

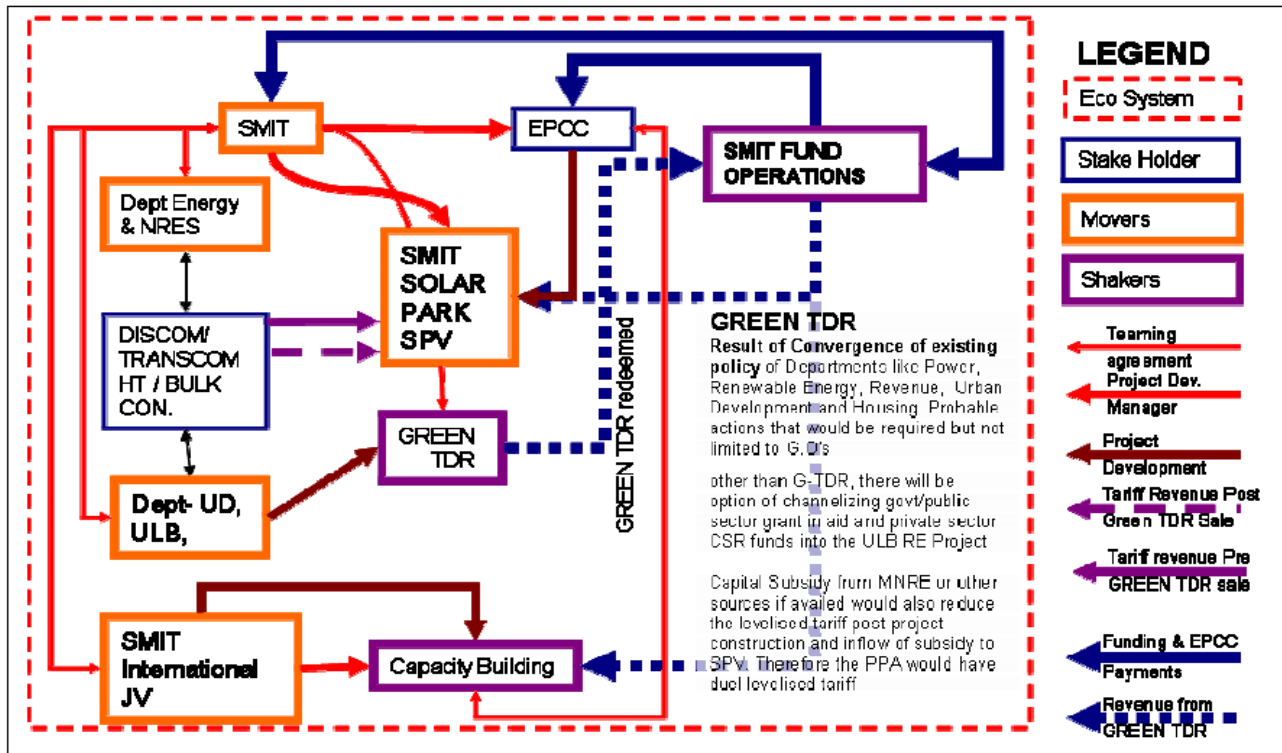
iii) SMIT's Dev. Mgmt. role

Would be limited to:

- Technical due diligence & PV Power Plant Cost finalization;
- Investment in the Solar PV field development excluding cost of energy storage systems;

- Secure & enforce tariff payment through enforceable and assignable power purchase agreement with either realstate project consumers or building facility Management Company (depending on customers' requirements & tenancy tenures).

g) Green Transfer of Development Rights- Administration & operation at a glance



- Future Built Form – Function reflects the aspirations**

a) SMART BUILT TO LAST

These buildings would be designed as energy efficient, recycle and reuse water, water usage reduction by demand side management, rain water harvesting, and onsite solid wastes management. Though the fixtures would be energy efficient, the built form would have features such that dependence on electrical energy for lighting, heating, cooling, etc. is also minimized leading to cost reduction and environmental conservation. These buildings would also have built in intelligence with automated control can be used to connect with other buildings and the service provisions can be managed efficiently. These buildings would have low carbon HVAC system supported by ABSORPTION CHILLERS for heating and cooling. Based on dynamic load balance study, the building electrical distribution and communication cabling would be done. The building would have an HYBRID INVERTER to distribute power and maintain the power factor. Modern hybrid inverters support inputs from Renewable energy source, DG/Fuel Cell, Grid Power and energy storage system. These inverters can also play the role of stabilizing the neighbourhood micro grid.

b) Include Renewable energy in bundle of energy consumed by the building

There would be provisions for retrofits to convert waste to energy insitu where possible. If not feasible, the building owner might go for long-term power purchase contract with upcoming WASTE TO ENERGY power producers. The energy thus procured from IPP is consumed by the building by paying wheeling charge to the distribution company. BIPV & rooftop solar PV System, that integrates well with built for architecture, would be the most desirable in-situ energy generation system.

c) HEART OF SMART BUILDING - Integrated Building Management System (iBMS) that

iBMS automates and integrates the various sub-systems of a building on a single platform. Brings together all the electro-mechanical systems such as HVAC, Lighting, Plumbing, STP, Fire Fighting & Fire Alarm, etc. installed in a facility along with most commercially available sensors and controllers, on a centralized system. iBMS integrates off-the-shelf cameras; surveillance systems and access control systems into the same platform and is compliant with most major protocols in the Building Management domain. iBMS provides real-time central monitoring and control of all equipment, such as Chillers/Heat Exchangers, Cooling Towers, Chilled Water Pumps, Air Handling Units, VAVs, Fresh Air Systems, Fan Coil Units, Water Tanks, Pumps & Sumps, Lighting, Energy Meters, Electrical Systems, Room Control, Sewage Treatment Plant, Plumbing System, etc. The iBMS ensures synchronization of all system components to deliver optimized performance and energy efficiency. Additional component demands get automatically routed into an analytics platform for insights into how energy savings can be accomplished, i.e. it should be designed to be fully compatible with any future energy management solution.

d) ENERGY MANAGEMENT SYSTEM for each dwelling unit of the building consisting of a one view Dashboard at the Distribution Box (DB).

EMS provides a concise view of the most relevant information on a customizable dashboard that displays key information on a single screen. The Dashboard displays a personalized and real-time view of a building's energy consumption and energy wastage in monetary figures. It is fully customizable and can be configured for any number of unique users, to display the most important information based on each user's roles and responsibilities. It can provide very powerful and insightful information in real time like ambient conditions with temperature (present, high, and low), humidity, and CO₂ levels, the basis for the energy requirement for the day. The Dashboard can be configured to include various widgets to display information suitable for different users in building like Operations Manager or the Facility Management Team at owners association end and dwelling unit resident (owner / tenants).

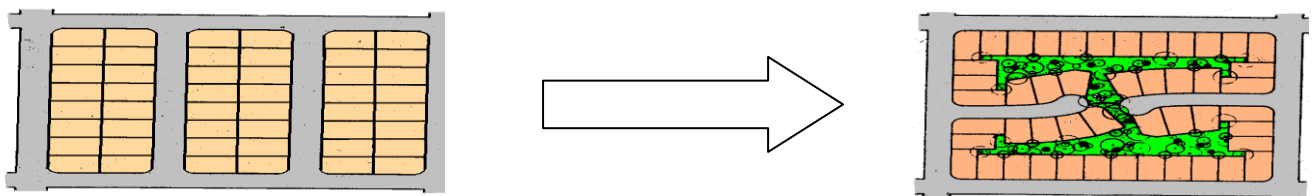
• Community scale redevelopment & housing regeneration

a) Restructured Neighborhood (1/4th to 1/5th Communities): layout Post land Pooling.

i) Neighborhood Restructuring by land pooling

Land pooling results in equitable and efficient land development. It is readjusting uneven land by bringing fragmented land holdings together to constitute a larger land parcel. Thereafter infrastructure is developed on the land, and part of it is then returned to the original owner/s after applying a formula. This formula compensates the authority or the entity which undertook the development for the infrastructure and other provided services by allowing them to sell or retain a part of the original land. Though seemingly complicated, this approach is actually a highly effective way of achieving development while simultaneously promoting social justice. Andhra Pradesh is using land pooling method for take-off and development of Amaravati the new state capital. The state had acquired 31,000 acres from about 18,000 farmers by committing an annuity of Rs 50,000 per acre for 10 years and simultaneously giving back 1,250 sq yards of residential plot and 200 sq yard of commercial plot in the new city for every acre. The Andhra Pradesh government further provided incentives to the original owners of land by exempting them from capital gains tax and stamp duty on the first sale. The land holdings of farmers vary from 40-50 acres to less than an acre. 50 % of the entire land acquired will be utilised for development of trunk infrastructure and social infrastructure, 25 % will be given back to original land owners and the balance 25 per cent will remain with the government for other uses. Based on more than half a century experience of Land Pooling activities in Gujarat and recent experiences of Andhara Pradesh to acquire land for Amravati, the upcoming state capital, suitable amendments to Town & country planning act of Karnataka can be made.

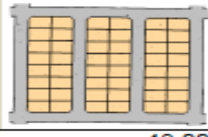
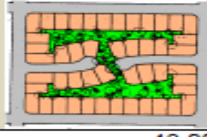
(e.) Neighbourhood restructuring & development numbers



Revised master Plan 2015 in Bangalore Development Authority Revised master Plan 2015 in Bangalore Development Authority r allows are Land uses namely Commercial (Central), Commercial (General) & Industrial (Hi coverage is 60% and FAR is 3. minimum of 10 % of area for Park and 5% of area be reserved and maintained by the respective For a Community Level project where an existing neighbourhood of 48 x 150 SqM plots including municipality owned street) is converted to a fused neighbourhood, joint venture agreement under Indian Contracts act should w power of attorney to the project proponent, followed by registration of Joint venture agreement. Thereafter the project proponent approaches

the municipality to get approval of the master plan. After approval Back grid iron plots, part of community Information Modelling system compliant map of the project area is prepared.

• **Process & Technology to reduce cost**

SI.No	Transformation of Neighbourhood – From Rigid Grid Iron back to back Plots to Fused neighbourhood.	Grid Iron B2B Plots		Fused Organic	
					
0.00	No of Plots (Nos)	48.00		48.00	
	Minimum Plot Size (SqM)	150.00		150.00	
	Land Use	SqM	%	SqM	%
1.00	Gross Block Development	8640	100.00	8640	100.00
1.10	Net Residential	7200	83.33	7200	83.33
1.20	Internal Road (9M ROW)	1440	16.67%	810	9.38
1.30	Cluster Level Open Space - accessible to public	0	0.00%	630	7.29
1.40	Building Foot Print				
1.41	Normal Low rise low density individual Housing - 60 % Plot coverage	4320	50.00%		
1.42	Akrama sakrama Low rise low density Row Housing - 75 % Plot coverage	5400	62.50%		
1.43	Group Housing - 1/3rd of plot area			2400	27.78
1.44	Utility & Civic Amenity			2400	27.78
1.50	Green - landscaped area within plots, not accessible to public			2400	27.78
2.00	Utility	Grid Iron B2B Plots		Fused Organic	
		M	M /Plot	M	M /Plot
2.10	Sewer line- Backyard connection	360	7.50	340	7.08
2.20	Water main	528	11.00	472	9.83
3.00	Built Up Area	Grid Iron B2B Plots		Fused Organic	
		SqM	%	SqM	%
3.10	Normal	12960			
3.20	Post Akrama Sakrama (20 % Increment)	10800			
	Gross Built Up area - Post Restructuring of neighbourhood (Group Housing FAR of 3.5, 150 m from metro station perimeter road)			33264	
3.30					100.00
3.31	Existing Residents share			10800	32.47
	Public Share (In lieu of internal road converted to Cluster Level Open space) - for EWS & affirmative action by BDA			2425	
3.32					7.29
3.33	Developers Share - To sell at market prices			20038	60.24

There are two main ways to reduce the time and cost of housing construction in order to produce affordable housing on the scale required. Value engineering is an approach that involves money-saving designs, efficiencies in procurement, and “lean” processes. Industrial approaches to construction can produce additional savings in cost and time. The combination of these methods can reduce costs by about 30 percent and time to completion by 40 to 50 percent.

1 Based on typical medium-density affordable housing development cost breakdown.

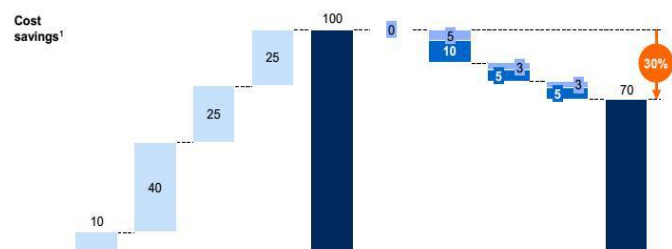
2 Based on 36-month baseline schedule.

3 Includes foundations, superstructure, and landscaping.

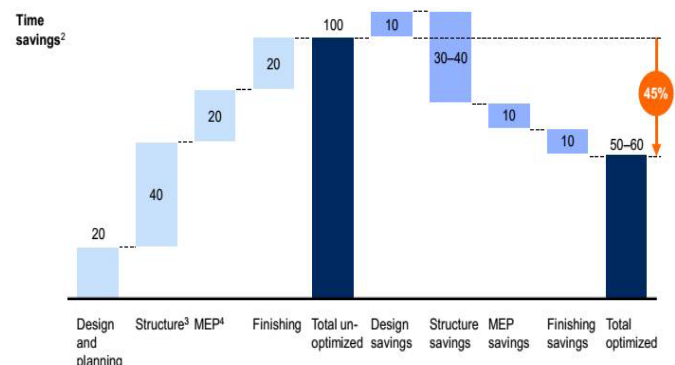
4 Mechanical, electrical, and plumbing.

Value engineering and industrial construction methods can cut costs by 30 percent and construction time by 40–50 percent

% of total



NOTE: Numbers may not sum due to rounding



SOURCE: Expert interviews; McKinsey Global Institute analysis

a) Value Engineering: BIM compliant Design development process.

The US National Building Information Model Standard Project Committee has the following definition:

Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. Traditional building design was largely reliant upon twodimensional technical drawings (plans, elevations, sections, etc.). Building information modelling extends this beyond 3D, augmenting the three primary spatial dimensions (width, height and depth) with time as the fourth dimension (4D) and cost as the fifth (5D). BIM therefore covers more than just geometry. It also covers spatial relationships, light analysis, geographic information, and quantities and properties of building components (for example, manufacturers' details). For the project professionals, BIM enables a virtual information model to be handed from the design team (architects, landscape architects, surveyors, civil, structural and building services engineers, etc.) to the main contractor and subcontractors and then on to the owner/operator; Each project personnel with limited access adds discipline-specific data to the single shared model. This reduces information losses that traditionally occurred when a new team takes 'ownership' of the project, and provides more extensive information to owners of complex structures. The advantage of being BIM compliant is that every element and component of the building is accounted for, the good for construction drawing is detailed enough for construction with highest tolerance, and thus there is negligible difference between contract drawings, good for construction drawings and as built drawings. BIM encourages only serious and efficient contractors/ vendors to participate in bids and acts as an entry barrier for others. BIM helps in reduction of at least 30 % construction time and 25% savings due to its compatibility with industrial construction methods.

b) Industrial Construction Technology - Pre Fab RCC

Components – Greenfield project

The cost of land in any respectable Bangalore suburb is not less than Rs 6000/ SFT. If the FAR is 2.5 (rare) the land cost component to salable built up real-estate is Rs 2200/ Sft of saleable area. Construction Cost (Residential) – Excavation, Finishing excluding Overheads, PMCC, Licence/Permit/NOC & Liaison are:

- Conventional RCC Building @ Rs 2500/Sft
- Pre Fab (factory outside site -50 Km Lead) @ Rs 2250/Sft
- Major part Pre Fab – Temp Factory within site green area, closed or relocated before occupancy certificate @ Rs 1800 - 2000/Sft due to
 - Benefits from 10 % VAT exempt.
 - Transportation cost saving.
 - Client provides the cost of plant equity in the form of 20 %
 - Mobilization advance, paid against bank guaranty.

Adding Rs 150/Sft soft cost (overheads, consultants fee, liaison fee and approvals) and additional Rs150/Sft developers margin, the average selling price of the developer has to be more than Rs 5000/Sft of saleable area for smaller projects and Rs 4500/Sft for large projects, using factory made & finished prefab components. Cost of 1000 SqFt (super built up flat) in a Bangalore suburb would be between Rs 45 to 50 Lakh.

c) Industrial Construction Technology - Pre Fab RCC Components – Brownfield redevelopment

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c) Industrial Construction Technology - Pre Fab RCC Components – Brownfeild redevelopment

i) Development Numbers

Sl.No	Land Use or Built Up Area	SqM	%
1.00	Gross Block Development	8640	100.00
2.00	Net Residential	7200	83.33
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3.30	Developers Share - To sell at market prices	20038	60.24

ii) Development Cost and selling price

Sl. No	Item	Unit	Value	Rate Rs / Unit	Amount Rs Cr
1.00	Cost of Land				
1.10	Development overheads & Transit accommodation - Year 1	SqFt	357920.64	26.00	0.93
1.20	Development overheads & Transit accommodation - Year 2	SqFt	357920.64	28.60	1.02
1.30	Development overheads & Transit accommodation - Year 3	SqFt	357920.64	31.46	1.13
2.00	Cost of Construction				
2.10	Housing - Pre Fab factory Made (50 Km Lead)- Excavation to finishing	SqFt	357920.64	2250.00	80.53
2.20	Overheads, consultants fee, liaison fee and approvals	SqFt	357920.64	150.00	5.37
3.00	Profit Margin (10 % of const cost only)	SqFt	357920.64	225.00	8.05
4.00	Total		357920.64		97.03
5.00	Saleable area	SqFt	215614.26		
6.00	Selling Price			4500.37	

In a redevelopment project within the city, even when the developer sell his share at price equal to Rs 4500/Sft (price of affordable house in suburb), his profit margin is Rs 225/Sft i.e. $1.5 \times \text{Rs } 150/\text{Sft}$. Profit from sale of Housing for EWS & affirmative action of BDA is excluded.

• Swiss Challenge Method – Neighborhood & Housing Regeneration Pilot

SMART CITY INVESTMENT TRUST (SMIT) governing the issuance of Green TDR and its administration would be also administering the pilot 'neighbourhood & housing regeneration project'. To explain the concept, let us assume that SMIT plans to redevelop a 1.11 Ha urban neighbourhood adjacent to Metro Station of Indiranagar- Bangalore, a medium-sized neighbourhood in East Bangalore, Karnataka, India. Indiranagar is bounded by the Ulsoor to the west, Domlur to the south, Byappanahalli to the north and Vimanapura to the east. Indiranagar is one of the most expensive localities in Bangalore. Indiranagar was formed as a BDA layout in the early 1980s, and was named after the former Prime Minister of India Mrs Indira Gandhi. In the beginning, the locality was primarily a residential area. The area was dotted with large bungalows and independent houses, mostly owned by defence personnel. The Information Technology boom in Bangalore in the late 1990s converted Indiranagar and its two arterial roads (100 Feet Road and Chinmaya Mission Hospital Road) into a commercial area. Indiranagar is an important residential and commercial hub of Bangalore. Indiranagar is divided into 2 stages, with the 1st stage being the largest. Unlike the southern and western areas of Bangalore which have a predominantly Kannada speaking population or the northern areas of Bangalore which have large populations of Muslims and Tamilians, Indiranagar is a cosmopolitan locality with people from all parts of India living in harmony with each other. The Namma Metro Purple Line runs through Indiranagar and has two stations within the neighbourhood – Indiranagar and Swami Vivekananda Road.

Indiranagar is well connected to most areas of Bangalore with the buses of the BMTC, which also maintains a bus depot in the area. Neighbourhoods of Indiranagar include HAL 1st, 2nd and 3rd Stages, Defence Colony, Jeevan bheema nagar, Kodihalli, Old/New Thippasandra, GM Palya, CV Raman Nagar, Old Madras Road, Ulsoor, Domlur, Old Airport Road.

AAKRAMA SAKRAMA allows BUILTFORM deviation such that the final AS BUILT AREA'S increased value add is less than equal to 20%.

Urban redevelopment and Housing renewal would be done by SMIT as per the requirements of ZONING OF LANDUSE AND REGULATIONS(Approved by Govt vide G.O. No UDD 540 BEM AA SE 2004, Dated: 22 – 06 – 2007, part of the Revised Master Plan 2015). Pre takeoff activities by SMIT will include but not limited to

- Identification of multiple neighbourhoods for redevelopment in phases by SMIT.
- SMIT identify stake holder's residents and public sector organizations owning land (revenue, non revenue and trusteeship) and signs teaming agreement with all the stake holders. It is agreement to pool land to redevelop the neighbourhood with additional amenities and better service quality of utility.
- SMIT undertakes Technical due diligence of the identified neighbourhoods and prepares a BASE CASE DEVELOPMENT PLAN.
- Organise stake holder discussions to finalise the built up area share of Individual land owners. This would be equal to legal gross built up are post akrama sakrama2 dispensation, not the illegal portion of the house.

- BDA would be equal to pre re-development revenue area of roads and civic amenity minus the internal road & civic amenity area of BASECASE DEVELOPMENT PLAN.
- Project Development Company (PDC) and its Engineering Procurement Construction Company (EPCC).

SMIT calls for bid to identify consortium of Project Development Company (PDC) and its Engineering Procurement Construction Company (EPCC).

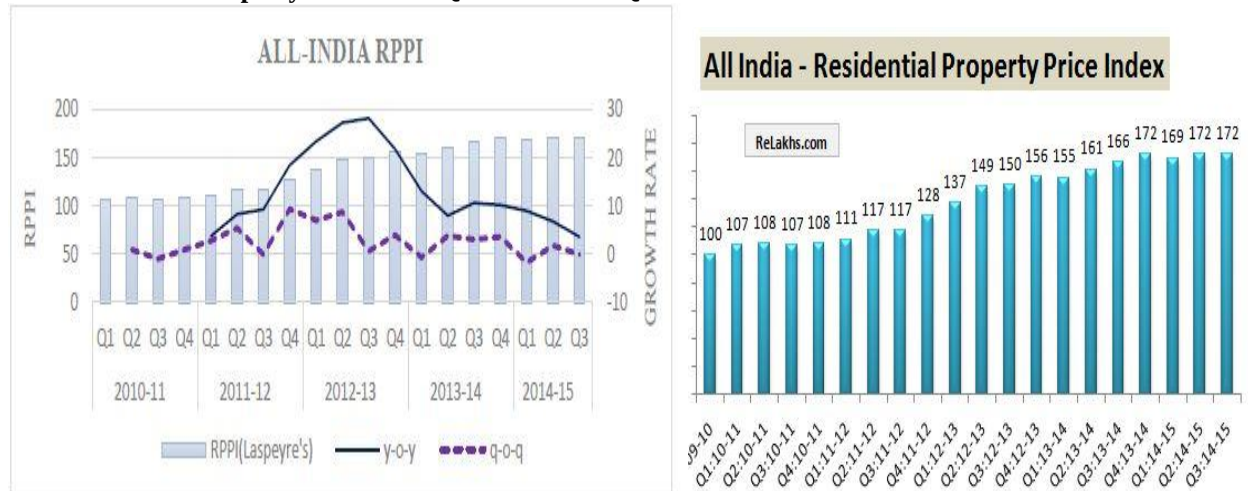
- Project Development Company (PDC) and its Engineering
- Procurement Construction Company (EPCC) is selected for best value to residents & stake holders in terms of-
- Developer offering to take less built up area w.r.t its share computed in the BASE CASE DEVELOPMENT PLAN. This would be the share of SMIT – The project development manager, and PDC- EPCC combine has to either sell or rent back the stock at predetermined minimum value. Profit from development manager's share would be earmarked for estate management & renewal sinking fund.
- Tenure of free of cost O & M and facility management service.
- Transit accommodation plan and time taken to complete the projects.
- BIM compliant good for construction drawing prepared by PDC-EPCC combine is approved by SMIT before resident's shifts to transit accommodation.

The selected PDC-EPCC combine is given work order after SMIT is satisfied with compliance with Transit Accommodation and its location. In the event the STAKEHOLDERS form a consortium and would either undertake to do the redevelopment themselves, they would have to pay back SMIT the audited cost of the pre-takeoff / pre development activities. The above process is derived from popular "Swiss Challenge Approach". It is a very transparent and competitive way of development of unique urban infrastructure and utility pilot through Suo-Motu proposal (DPR with good for construction engineering) by SMIT . Swiss Challenge Approach is also a preferred route to get the implementable project executed in time by a confident PROJECT DEVELOPMENT COMPANY.

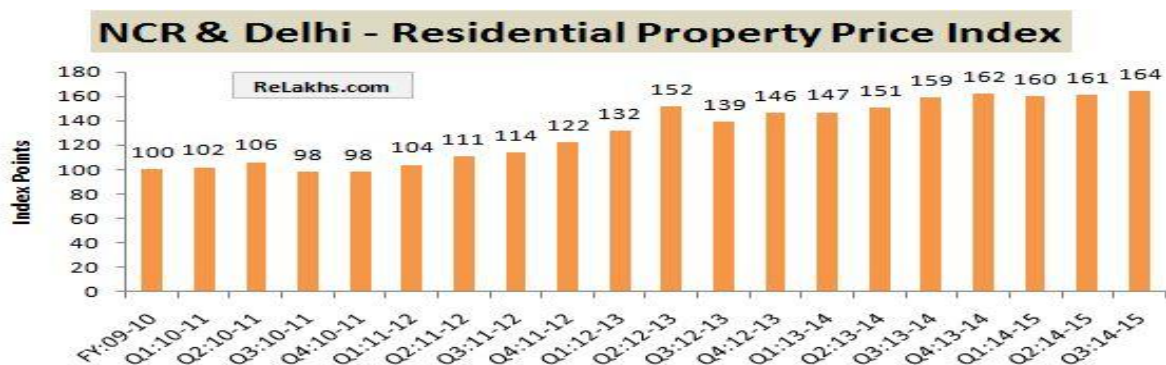
V. AFFORDABILITY OVERVIEW GRAPH

Residential Property Price Index (RPPI) moved up to 172 points in Quarter 3 of 2014-2015, from 107 points in Q1 of 2010-11, an increase of almost 61%. Over this period, the highest growth in RPPI was recorded in Jaipur whereas the lowest growth was recorded in Greater Chandigarh and Hyderabad at around 40% .

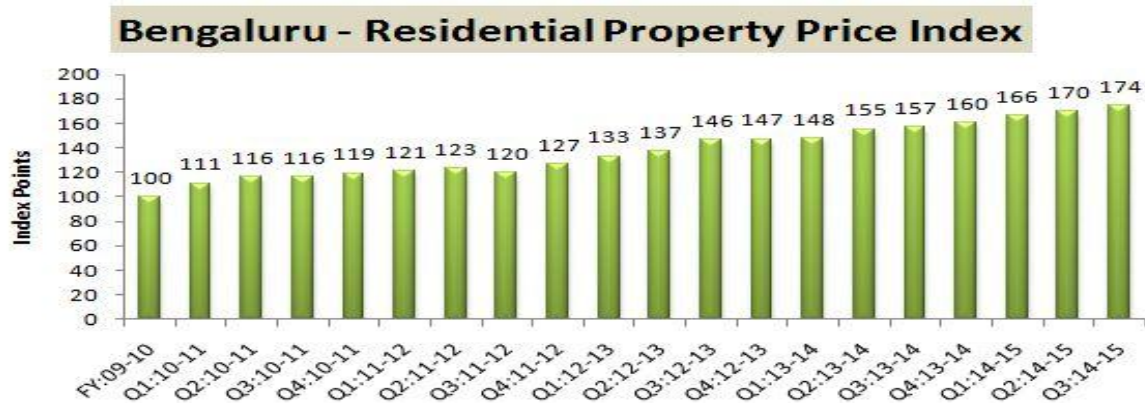
- Residential Property Index-Quarter &Quarter Growth All over India:



- Residential Property Index-Quarter &Quarter Growth of Delhi/NCR :



- Residential Property Index-Quarter &Quarter Growth of Bengaluru:



VI. SMART GROWTH IN MARYLAND, USA: A Case Study

Since Maryland was the first state to pass legislation that specifically related to smart growth in 1997, one could speculate that they should be the furthest along in implementing that policy. However, it is also possible that other regions learned from Maryland's mistakes in smart growth implementation and have achieved better results. Bethesda Row has been recognized by the EPA, the Washington Smart Growth Alliance, and the Congress for New Urbanism as an excellent example of smart growth (U.S. Environmental Protection Agency). The checklist on the right gives an overview of all the smart growth principles illustrated in the project. Notice, the definition of what constitutes smart growth is loose; a development only has to show a few of the principles to be considered smart growth. Tellingly, this development does not include a range of housing choices. Here's what it does include:

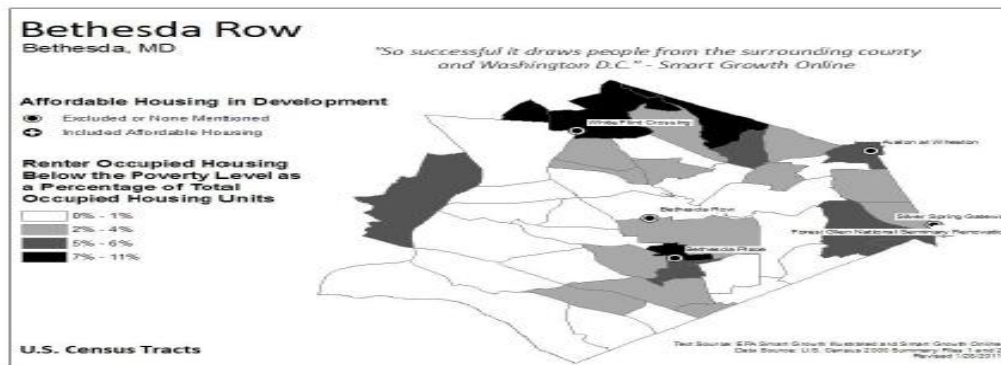


Figure 8. Renters Below the Poverty Level, Bethesda, MD

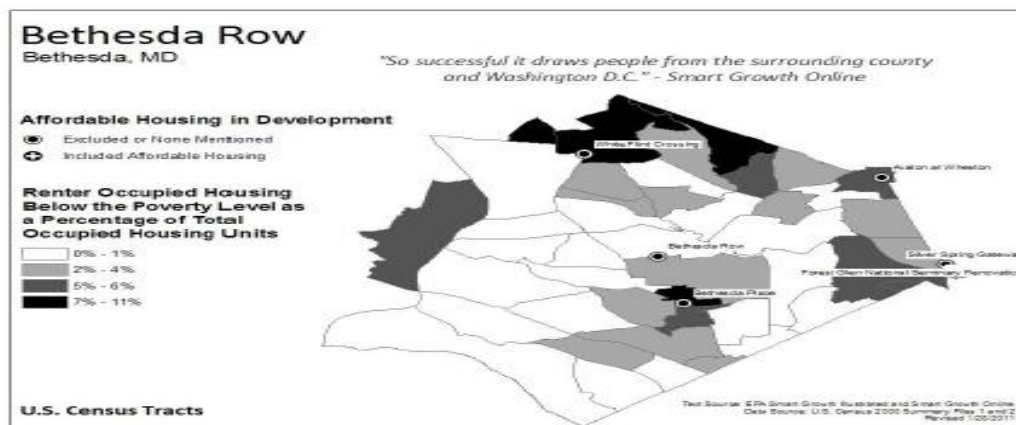


Figure 9: Affordable Housing in Development

Bethesda, MD located at the entrance of a bookstore act as a central meeting and gathering place in Bethesda Row (Environmental Protection Agency, 2010). Further research on our part subsequent phases include a new supermarket and all the residential space revealed that the housing component of Bethesda Row consisted of 180 luxury apartments (Upstairs at Bethesda) and (Maryland Real Estate Rama, 2009). This distinction is important because families that rent are at greater risk for being displaced, whereas the displacement of homeowners by the market is more likely to be gradual through increased taxes or lengthy and often contentious buy-out processes. If the Bethesda Row development is so successful that draws people from the surrounding community and Washington, D.C. should not this area also become a more attractive place to live? The areas to the north as well as directly to the south have small populations with incomes below the poverty level living in rental housing. This rental housing it not necessarily affordable for these families, but somehow they manage to remain. Are they reaping the benefits of the sustainable mixed-use developments? Maybe they are somewhat; perhaps they have greater access to amenities and benefit from living in relatively wealthy areas with good schools. But unless, they have guaranteed affordable housing, they are at risk and Bethesda Row, located near the edge of downtown Bethesda, Maryland, illustrates the revitalization of a suburban commercial district into a mixed-use, walkable downtown. The project is so successful that it draws customers not just from surrounding neighborhoods, but also from around the greater Washington metropolitan area. The development creates a thriving, pedestrian-friendly streetscape. Both the sidewalk design and parking solutions are key to making the project a walkable neighborhood. Brick sidewalks, trees, fountains, plazas, and outdoor seating all encourage residents and visitors to walk around the mix of local, regional, and national retailers and restaurant. The project is being built in seven phases on parts of four city blocks. When complete, it will contain 360,000 square feet of retail and restaurant space, 140,000 square feet of office space, and 100,000 square feet of residential space. Phase Four was completed in 2002.

VII. CONCLUSION

Housing affordability could be lost even in markets that are responsively regulated as a result of new state laws and regulations, but most importantly, requirements and incentives that are proposed at the federal level to encourage compact city policies. There are a number of initiatives that seek to spread smart growth policies throughout the nation, including proposed bills in Congress — such as surface transportation bills and the “cap and trade” bill, which contains potentially costly compact city transportation and housing provisions. If families are forced to spend more on housing, they will necessarily experience a lower standard of living. Moreover, house price escalation is likely to resume in prescriptive markets when the economy returns to normal, because the excess of demand for residential land relative to supply will remain. California will be at particular risk of further affordability losses because of its greenhouse-gas-related planning requirements and its already overly restrictive regulations. Eventually these initiatives are likely to

increase the cost of housing and decrease discretionary household incomes. Prescriptive land use regulations should be rolled back. This would increase housing affordability. House prices have fallen in virtually all prescriptively regulated markets and could begin rising inordinately again as housing demand increases. Metropolitan areas that are responsively regulated already enjoy the benefit of lower cost housing for their citizens.

VIII. REFERENCES

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