

# **Improving the Hardware, Retaining the Heartware – The Singapore Way to Sustainable Housing**

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# **Improving the Hardware, Retaining the Heartware – The Singapore Way to Sustainable Housing**

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## **ABSTRACT**

In the more than 40 years of providing quality and affordable public housing to Singaporeans, urban renewal has been a function of Singapore's Housing and Development Board. Estate renewal, especially in a country like Singapore with limited land resources, is the key to sustainable housing. In the renewal process, the need to provide a conducive and quality living environment, as well as preserve communities, has always been of utmost consideration. This means providing a healthy living environment, on personal, social and physical levels, through careful, extensive study and planning of design, construction and township development. The challenge is greater in the growing trend towards high-rise, compact city living in the 21st century and beyond.

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## **1 INTRODUCTION**

This paper addresses the issues of how Singapore has undergone urban renewal via its public housing development and redevelopment programmes since the formation of the Housing and Development Board (HDB) on 1<sup>st</sup> February 1960<sup>1</sup>. It looks at how the concept of community and sustainability determine the design, construction and renewal of public housing estates and towns. As society developed and transformed over time, the city has had to adapt to meet the ever-changing needs of the people in order to be sustainable. This paper subsequently discusses the strategies that have evolved and have been used in our island nation.

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<sup>1</sup> *Housing and Development Board Annual Report 1960*, p 7.

## **2 BEGINNINGS - A CONCERN FOR THE PEOPLE**

HDB was set up in 1960 to solve the housing crisis of the day, replacing the former Singapore Improvement Trust set up by the British Colonial Government in 1927. In 1959, with a population of 1,579,000<sup>2</sup>, an estimated quarter million people were living in badly degenerated slums and another third of a million were living in squatter settlements<sup>3</sup>. Most of these were located close to the city area, and were unsanitary and unhygienic. In such areas, crime was rampant, and the homes were also fire hazards. The primary role of HDB then was to provide low cost housing swiftly to meet the urgent housing needs of the lower-income groups, as their needs were not being adequately met by the private or even the public housing of the time. In the process, urban renewal in Singapore started with a desperate beginning to bring relief to the people.

## **3 BUILDING A SUSTAINABLE COMMUNITY**

“A community is a collectivity of actors sharing a limited territorial area as the base for carrying out the greatest share of their daily activities.”

Talcott Parsons

With HDB’s mission of housing the people, it has been part and parcel of public housing development to promote the building of communities and community bonding. A community can be defined as a group of people living in one place, usually sharing a common experience or interest.

### Meeting the Needs of the Community

With more than 84 percent of the nation’s population living in the homes we provide<sup>4</sup>, HDB’s role goes beyond that of just a housing developer. Our flats are meant to be

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<sup>2</sup> *Housing and Development Board Annual Report 1960*, p 5.

<sup>3</sup> Yeh, *Public Housing in Singapore, A Multi-Disciplinary Study*, 1975, p 5.

<sup>4</sup> *Housing and Development Board Annual Report 2002/2003*, p 92.

lifetime homes. The towns that we build have to be well planned, and able to support thriving and sustainable communities. Sustainable development can be defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”<sup>5</sup> To be sustainable, these towns must be able to provide for the whole range of needs of the individual and the community. The community’s need for communal areas, for example, where people can connect and build relationships, or places where activities can be held for social interaction, has to be catered for. All of these constitute a sense of self-sufficiency, whereby the town is able to meet the needs of its inhabitants.

### Family as a Unit of Community

One of the basic units of the community is the family. The interaction of the different families living within the same area is a common sight in HDB towns and estates. In 1964, when the “Home Ownership for the People Scheme” was introduced by the Government of Singapore to enable Singaporeans to own homes, the hope was to foster a greater sense of national identity by allowing Singaporeans to have a stake in the country through home ownership. Even then, flats were provided only to households with a proper family nucleus, the minimum being a married couple. This shows that the family unit was recognised as the basic building block of society. This emphasis has not changed since then. We are fortunate that our family ties remain strong. But we cannot take them for granted. We must ensure they are strengthened further because the 21<sup>st</sup> century will exert greater pressure on them.

The main design consideration for HDB flats has typically been to house individual families. The flats are self-contained units with ample living space, a kitchen and bathrooms. With growing affluence, people’s needs and aspirations began to evolve.

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<sup>5</sup> From the World Commission on Environment and Development: *Our Common Future* (Brundtland Report), 1987, excerpt taken from Cullingham, *Town and Country Planning*, p 166.

HDB responded by offering a wider range of flat sizes<sup>6</sup> to cater for these changes in lifestyle. In fact, the needs of the nation's families are continually transforming, such that housing forms introduced in the early years may no longer be suitable or sustainable. New forms are developed to address these changing needs, and some of the older forms have to be adapted. In this way, HDB is determined to provide affordable, quality housing and ensure the appropriate sizing of flats.

### The Family and The Elderly - "Ageing-in-Place"

Families in Singapore are undergoing a significant change. Our elderly population of residents 65 years and older has been projected to reach 19 percent of the total population by the year 2030<sup>7</sup>. This means that one in five Singaporeans would be an elderly person.

Since the 1980s, various high level committees have looked into the issue of the ageing nation. In 1998, the Inter-Ministerial Committee (IMC) on the Ageing Population was formed to study and make recommendations on the preparation of the nation for the ageing population in the new millennium. The IMC was chaired by the Minister for National Development and comprised representatives from the public, private and people sectors. The IMC focussed its efforts on housing, and recommended "ageing-in-place" to be the principle that would underpin housing policies. This means that the homes and the living environment created should allow our elderly population to live out their years with grace and dignity within a familiar and assuring environment. The IMC also recognised the need to have elderly-friendly features and barrier-free access within the built environment, as well as "software" items like community-integration strategies, care for the elderly schemes and policies, and greater choice in housing options for the elderly. This would allow

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<sup>6</sup> The flats built in the early 1960s comprised mainly 1-room (about 23m<sup>2</sup>), 2-room (about 37 to 42m<sup>2</sup>) and 3-room (about 59m<sup>2</sup>) flats. Subsequently, the 4-room flats (about 83 to 93m<sup>2</sup>) were introduced in the late 1960s, 5-room flats (about 121 to 123m<sup>2</sup>) in 1971 and the Executive flats (about 145m<sup>2</sup>) in 1979. The flat sizes were adjusted down in the later years as the family size reduced and also to maximise land use. HDB has also since 1985 ceased the building of 3-room and smaller units, as they were no longer in demand. See "Table 1 Types Of Flats By Year Building Commenced And By Sizes", from *Housing A Nation, 25 Years of Public Housing in Singapore*, ed. Wong & Yeh, p 65.

<sup>7</sup> *Report of the Inter-Ministerial Committee on the Ageing Population*, Nov 1999, p 14.

for greater family togetherness, as the elderly would find it convenient to live with or near their children, thus further encouraging the establishment of the community. This is very much the heartbeat of HDB, as it is one of the design philosophies underlying the development of public housing as lifetime homes.

### Places for the Community – Community Bonding

People who come to live together in the same place inevitably form relationships with one another, especially as they interact on a daily basis. As they identify with the place that they live in, it becomes the stage upon which their daily lives are acted out, where they live, work, play and learn. This sense of belonging is crucial to the development of the community, and HDB acknowledges its importance when it comes to developing schemes for urban renewal and improvement.

In HDB's Sample household Survey of 1998, the five places neighbours were most likely to meet each other were as follows (in order of importance):

- 1) along main corridors;
- 2) at lift lobbies;
- 3) at void decks / Residents' Corners;
- 4) in markets; and
- 5) along pathways / linkways to blocks.

The meeting places of the community were shown to be the common facilities within the neighbourhood and common areas within the block. However, as HDB refined the designs of residential flats to improve convenience, better the accessibility, increase privacy, and have a higher design efficiency, common areas like the corridors and void decks had been reduced in size. Understandably, the opportunities for social interaction had been reduced as well. To supplement the reduction in social spaces, the "precinct pavilion" was introduced in the 1980s. This is a covered, unenclosed, free-standing structure of around 200 square metres in area. More recently, multi-storey car parks are designed to allow the incorporation of social/communal facilities. Currently, rooftop gardens are designed for on the roofs

of multi-storey carparks. These gardens are able to incorporate playgrounds and/or fitness areas, which add to the community spaces for the surrounding blocks.

HDB is currently considering the proposal of the “community mall” concept for its estates. This “community mall” will be a social corridor along which residents can meet and interact. It would link up between precincts, schools and various facilities of the town, and could have amenities such as convenience shops, pavilions with seats, etc. Within it, many activities could be organised to invigorate the community, such as cultural performances, *pasar malams*, festival celebrations, etc.

#### **4 SUSTAINABLE HOUSING**

Having established a common understanding on the importance of a sustainable community, HDB has implemented various housing policies and programmes to realise these concerns: urban planning to optimise land, and various estate renewal schemes to enhance and keep the communities intact. Working hand-in-hand, these have succeeded in creating vibrant towns and communities where the residents feel a strong sense of belonging to their heartland homes.

##### An Urban Planning Approach

With only 685.4 square kilometres<sup>8</sup>, the main challenge in planning for Singapore is its limited land resources, and demand for land will continue to increase as the economy flourishes and population expands.

Given the constraints on the availability of land, it is critical to maximise and optimise the land use and the development of established and mature estates or areas that have been developed to their fullest potential. This will reduce the need to create new towns. As much as possible, the undeveloped, green-fields sites would be reserved as options for future generation to develop. For areas without restrictive

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<sup>8</sup> From the Singapore Department of Statistics website: Statistics Singapore – KeyStats – Annual Statistics (updated 2 Oct 2003), <http://www.singstat.gov.sg/keystats/annual/indicators.html>.

height control, high-rise residential blocks are built to replace existing blocks as part of the urban renewal strategy.

HDB's urban planning approach crystallised in the 1970s. Towns were planned to be self-sufficient, with a comprehensive variety of facilities, ranging from institutions to commercial amenities to recreational parks, to cater for all interests and age groups. In the 1980s, the "precinct concept" was introduced to help residents foster a sense of identity with their neighbourhood and to promote social interaction. It is through self-sufficiency that the town becomes sustainable, and through the careful introduction of urban renewal and improvement schemes, that the town is able to rejuvenate itself, and adapt to the changing needs and expectations of its residents.

Since 1995, HDB has been working closely with the Urban Redevelopment Authority (URA) to produce the masterplans to redevelop entire HDB residential estates. With limited land resources, we "could not afford to leave tracts of land to deteriorate". Redevelopment plans include modernising the town centre, building new homes, upgrading existing flats and communal facilities, and improving the transportation network. As not all the facilities in the town would have been developed by HDB, planning comprehensively therefore would enable other service providers to locate their facilities appropriately within the estates. It is also crucial for HDB to continue to stay in touch with the market and regularly review our building programme to react promptly to market changes. The task of matching demand with supply would therefore always remain a challenge for HDB in many years to come.

### Rejuvenation of Older Estates

In order to sustain the community, the buildings and the physical environment need to be regularly and properly maintained to meet the needs and changing lifestyles of the residents. For the older estates developed in the 60s and 70s, HDB launched the Estate Renewal Strategy (ERS) to upgrade the residential buildings as well as to introduce more facilities into the towns. The more significant features under the Estate Renewal umbrella are the various upgrading programmes and the Selective En-bloc Redevelopment Scheme (SERS).



Upgrading, as the name implies, aims to transform the older housing precincts into quality living environments comparable to the latest ones. The strategy effectively replaces the Repairs & Redecoration Scheme to spruce up the common properties of old blocks of flats after a period of time. The key aim of upgrading is to bring the quality standards of these older precincts up to par with current ones so that the residents can benefit from new facilities and amenities without needing to be uprooted from their homes, thereby keeping existing communities intact. In addition, the cost of the upgrading works is co-shared with the Government and apportioned according to the flat type and upgrading package selected by the residents. For those who face difficulties paying for the works, HDB also has various payment schemes in place to make upgrading affordable for all.

There are currently 3 main types of upgrading to HDB housing estates namely the Main Upgrading Programme (MUP), the Interim Upgrading Programme Plus (IUP Plus) and the Lift Upgrading Programme (LUP), with varying levels of improvement works. Of the 3, the MUP is the most comprehensive, for its aim was to bring the standards of older estates closer to that of newer ones and targets HDB blocks completed up to 1980. To date, a total of 123 precincts have come under the programme since its launch in 1989. The programme covers improvements to the flat, the block and the precinct, with the objective to upgrade the total living environment without uprooting residents, thereby keeping communities intact. Recognising the space constraints in the smaller flats and to improve the functionality of the older flats, residents are offered the option of having an additional space of about 6 square metres, attached to their individual units. This feature meets changing lifestyle needs without having residents move out of their comfortable homes. At the precinct level, new amenities are introduced and older facilities replaced. During upgrading, the multi-storey car park (MSCP) is sometimes built to replace the existing surface car parks. With this provision, more outdoor space for greenery and recreation is created, on the ground level as well as on the roof deck of the MSCP.

This concept is further made possible with the use of precast technology that allows the residents to continue living in their home while the precinct undergoes upgrading.

Construction works, as a result, are completed faster and noise and dust are kept within tolerable range.

Often, the MUP is coupled with LUP to provide barrier free access to all flats, either by upgrading the lifts to stop on every floor (where technically feasible) or adding new lifts. Although this provision reduces the opportunity for interaction at the lift lobbies and corridors, it is part of the Government's effort to make the HDB flats accessible and suitable for the ageing population in Singapore.

SERS was announced in 1995 as part of the Government's renewal plan to rejuvenate and intensify developments in older or mature estates. Old blocks of HDB flats with redevelopment potential and which are deemed as under-utilised by today's planning standards are identified, demolished and newer blocks are built in replacement. The newer blocks are often taller and of higher density for better utilisation of land. As of today, a total of 50 sites on prime land have been announced for redevelopment. Different from upgrading, the affected residents are able to make use of the financial benefits and allocation priorities given to upgrade from their present, smaller flat to buy a newer flat nearby. They would be able to enjoy the new facilities and features of a modern living environment, without leaving the neighbourhood and the ready amenities that they have become accustomed to.

Apart from preserving the strong family and community ties built over the years, through the surplus units from SERS, the Government is able to attract young families to live in the mature estates, to bring new life into the older towns. This helps to achieve a more balanced demography among the estates.

At present, the selection of precincts for redevelopment is very much independent of one another. Annually, each individual Town Council recommends the blocks to consider for the various types of upgrading. These would then be assessed based on the towns and any preference or commitments by the local MPs before the final recommendations are made to the Ministry of National Development. For SERS, the selection exercise is based on the economic viability of redeveloping the existing site, the economic profile of the residents and the potential yield achievable by the new development. The potential yield would need to promise a significant increase in

enhancement in terms of plot ratio, indicating the financial viability of the site, before any recommendations can be made. As the majority of the selections are precinct-based and recommended by individual parties, there would be difficulties witnessing a wholesome outcome of the redevelopment strategies. In addition, soft areas that allow the estate to evolve and grow with the community must be incorporated. Thus HDB plans to explore a more comprehensive redevelopment urban plan; with macro planning in a broader perspective, concentrating on certain mature towns and areas with higher redevelopment potential.

As part of the ongoing evolution of our housing programmes, the SERS programme is being modified to look into redevelopment in terms of “sub-areas” of the town. Where individual precincts were considered on a stand-alone basis, a study is now underway to consider redevelopment in terms of recognisable districts, or “sub-areas”, of the town. This would mean that precincts that were previously considered as not viable on its own can possibly be now in the programme, as the redevelopment of the “sub-area” will involve several precincts, and the economic viability is taken into consideration *in toto*.

In the 2003 survey done on residents who have undergone the SERS programme, after settling into their new flats, almost 90% of them indicated that they were supportive of the programme<sup>9</sup>. Almost 80% of the residents surveyed had also agreed that SERS had helped to preserve community life in the estate. The survey showed that residents were strongly supportive of the programme, and also that they strongly felt that the community was kept intact.

To remain relevant is part of the concept of sustainability. Striking a balance between the needs and ideals of every Singaporean while optimising our limited resources is never an easy task. As the residents would be greatly affected financially, physically and mentally by these estate renewal schemes, consultation sessions are arranged and announcement exhibitions are held to get their feedback and support on the renewal plans before implementing the programmes at their precincts. This enables

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<sup>9</sup> The survey covered 3012 households from 10 completed SERS contracts.

HDB to carry out the appropriate urban renewal schemes to cater more closely to the residents' demand.

### Improvement to Existing Units

For elderly living in 1-room rental flats, HDB has undertaken the Project to Improve the Living Conditions of the Elderly, jointly with the Ministry of Community Development and Sports since 1993 to meet their physical needs. The blocks are upgraded with new items such as lifts on every floor. Inside the flat items like non-slip tiles, support grab bars in the toilets, and an alert alarm system provide safety and security for the elderly tenants. With these improvement works, fully funded by the Government, the mobility and independence of the elderly is greatly enhanced.

### Allowing for Ageing-in-Place

Ideally, our elderly should live with their children for care and support. However, with urbanisation and the prevalence of nuclear families, family living has taken on a different dimension: young couples seeking greater independence and privacy, and the elderly, who are financially independent and healthy, each prefer to maintain separate homes of their own.

Housing and the built environment have the ability to facilitate the independence and self-sufficiency of the elderly. In order to meet their changing needs while sustaining family ties and the community, HDB has embarked on several strategies to allow the elderly to live out of their retirement with dignity and security, in an environment that is familiar and assuring to them. The most recent of all is the Studio Apartments (SA) introduced in 1998.

SAs are purpose-built<sup>10</sup>, budget-priced flats with elderly-friendly features. They are located in mature estates with a higher percentage of elderly so that, while

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<sup>10</sup> SA units are in ready-to-move-in condition with pre-installed fixtures and furnishings. They are also purpose-built elderly-friendly and have safety features that aid mobility and independent living, such as pull-cords linked to the block's alert alarm system, support hand bars, completely level floors with no curbs and lifts big enough to accommodate a stretcher.

maintaining their independence and privacy, they are able to preserve community ties and continue living in a familiar environment close to their children, friends and peers. Priorities for selection are also given to elderly with children living nearby to encourage family bonding and support. Social needs of the elderly are also taken into consideration when designing the SA. Communal facilities managed by voluntary welfare organisations are introduced into the SA to promote volunteerism among the elderly and other age groups and to provide a support network within the neighbourhood, thereby creating a total living environment.

In the pilot batch, HDB introduced only standalone blocks of SA. Although the response was very positive, with 99 percent of the units sold<sup>11</sup>, a more integrated housing environment with other HDB flat-types forming a larger community is in the pipeline. SAs are now being offered to SERS affected lessees as well. This is very appropriate as a large proportion of the SERS households are elderly who could take the opportunity to buy a smaller unit and use the surplus cash generated for their retirement needs. Furthermore, with different age groups of residents staying together, chances of inter-generation interaction will also increase. This would allow the elderly to “age-in-place” gracefully within the community.

## **5 CHALLENGES**

Public housing planning and policies cannot remain static. Improvements and innovations in planning, design, construction, and maintenance must be regulated to create a more sustainable living environment in the longer term.

### Rejuvenating the City Centre with Public Housing

For the past 30 years, the planning focus for the Singapore city centre has always been to develop it into a business and financial hub to drive the country’s economic development. Today, apart from meeting the functional needs of the business community, it is important that the city centre is developed into a vibrant quality place

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<sup>11</sup> *Housing and Development Board Annual Report 200/2003*, p 32.

as well. According to the feedback received from the Focus Group<sup>12</sup>, Singaporeans would like to have “a more attractive and liveable city”.

As a result, in the Concept Plan 2001<sup>13</sup>, URA placed a strong emphasis on increasing the live-in population within the city. Currently, there are 30,000 homes or 3 percent of the population within the city centre. URA’s aim is to increase this figure to 7 percent in the future, or 120,000 homes. Introducing additional homes in the city will build up the critical mass of population in the Central Area to sustain the activities of the city around the clock. This will inject more buzz and excitement to the business district, especially at night and on weekends or holidays.

The concept of living in the city is indeed now a key lifestyle in many major cities around the world. People are rediscovering the benefits of living in the city; spending less time commuting from home to work, having more time with family and friends, and being closer to shopping, eating and entertainment outlets. A more compact and denser urban environment is also considered more efficient and sustainable in terms of land resource management. With a larger consumer base in a compact area, the public transportation, commercial and institutional facilities would be more economically viable.

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<sup>12</sup> The Focus Group was set up in August 2000 as part of the public consultation programme in preparation for the Concept Plan 2001. To reach out to a wide spectrum of Singaporeans, the focus group comprised professionals, interest groups, industrialists, businessmen, academics, grassroots and students. The focus group in turn consulted many members of the public.

<sup>13</sup> The Concept Plan 2001 is the long-term plan strategic plan for Singapore’s physical development renewed every ten years. Its aim is to improve the quality of life and to sustain Singapore’s economic growth by safeguarding land to meet its social and economic needs. This time round, the vision is to build a thriving world-class city in the 21<sup>st</sup> century. With regards to housing, the key thrust is to “build new homes in familiar places” and to create “high-rise city living – a room with a view”.

In tandem with the Concept Plan 2001 and as part of the urban renewal strategy, the Government launched the Duxton Plain Redevelopment project in August 2001. The intention was to “build higher, to inject more housing in the city centre and to offer more housing choices, including affordable HDB apartments in the heart of the city”. In the long run, there will be a good mix of private and public housing in the Central Area. The 50-storey, residential development, comprising 1800 dwelling units, will replace the existing two rental apartment blocks at Duxton Plain. It will create a new phenomenon of a super high-rise, super high-density<sup>14</sup> living environment in the heart of the city, the first of its kind in Singapore.

### Beyond High-Rise, High-Density Housing

High-density, high-rise housing has often been criticised as lacking soul. With more people living together on a smaller plot of land, chances of interaction increases. However, chances of conflict increase as well. With good planning and architectural creativity, this can be minimised or overcome. A balance between physical intensification and social and mental well-being has to be achieved. Successful examples can be seen in Japan and South Korea where high-density housing has resulted in interesting and liveable housing forms.

For the Duxton Plain project, the importance of community bonding will not be compromised with this new initiative of a high-rise, high-density living environment. A variety of interesting spaces within the development for people to interact and hold social functions, places where a sense of community could be forged, would be provided for in the form of communal gardens, mid-level sky parks and rooftop gardens. Furthermore, with the intention to retain neighbourly relationships and to promote family ties, priority allocation will be given to the relocated tenants and to applicants with parents living in the nearby estates. When completed by end 2007, the projects will attract younger residents and new households to rejuvenate the city centre. Public opinions and feedbacks were also sought during the public exhibition

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<sup>14</sup> HDB generally builds at a density of 2.8 plot ratio and no more than 30-storeys high. More recently, some developments have built up to 4.0 plot ratio and 40-storeys at selected locations. For the Duxton Plain project, the density and height will be increased to between 7.4 and 8.4 plot ratio and up to 50-storey. Plot ratio refers to the ratio between the total floor area and the site area.

on the winning schemes. This imbues a greater sense of belonging as the residents have a hand in shaping their living environment.

Hence, the challenge for HDB lies in meeting the intangible social and qualitative aspects of public housing, which was made even more demanding due to the constantly changing population, lifestyle and expectations. With the social pressure requesting for greater expression of the individual and community aspirations, HDB has to take on the task that requires a more interactive approach to public housing, one where there is greater people involvement and people orientated.

### Sustainable Green Environment

Another aspect of sustainable housing falls into the category of greening the built-environment. Greenery plays an important role in bringing relieves to the high-density development. Apart from the usual practice of landscaping the ground level, HDB has also embarked on projects to introduce vertical greening and rooftop gardens to MSCP.

Vertical greening was introduced both to the residential blocks and the MSCPs, aiming to soften the physical edge of the concrete buildings. This is especially so for the MSCP as the concrete square box is often viewed as a harsh intrusion to the environment.

Concrete roofs of the MSCPs are often seen as heat traps<sup>15</sup>. Research has shown that by planting on top of these roofs, the plants would absorb the heat and prevent the concrete from storing it. The plants also cool the area when the water they transpire evaporates. In order to minimise the impact and to contribute to sustaining the environment, in recent years, HDB MSCPs rooftops are designed as roof gardens as an additional recreational space for the resident's enjoyment. A pilot project with National Parks Board (NParks) and the National University of Singapore (NUS) was also launched this year to research on extensive green roofs. Different

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<sup>15</sup> Studies have shown that these concrete roofs trap heat and could make the surface temperature rise as high as 60 deg C. Associate Professor Wong NH from National University of Singapore conducted a study showing that temperatures in built-up areas were 4.5 deg C higher than in a rural area where there are much more greenery.



from the usual roof garden, the green roof will only serve as visual and ventilation purpose, and not meant for residents' usage. It also cost less and requires lesser maintenance, an option that can be implemented to existing MSCP roofs. If the project is successful, we would expect to see more of such green roofs in Singapore.

### New Technologies and Improvements

Being the largest housing developer in Singapore, HDB is also constantly involved in new technologies and improvements to make our homes more sustainable and lasting.

Construction process that used to be heavily labour-intensive has since become more technology-reliant. The use of prefabrication technology employed since 1980 has not only increased site productivity, but also ensured better quality construction as the pre-cast components are being produced under strict factory-controlled conditions. Finishes and fittings are also being incorporated into the prefabricating process to improve the construction detailing and minimise works on site. 3-dimensional components such as household shelters, toilets with full finishes and fittings and lifts shafts can be hoisted and installed readily and efficiently.

With higher quality of construction and materials, buildings would be expected to last longer. However, regular maintenance and repair will still be necessary and pertinent to the long-term sustainability of the buildings and their components. As such, to help homeowners maintain their property, HDB recently launched a resident's handbook that contains tips on how to carry out simple repairs.

## **6 CONCLUSION**

Having built some 800,000 flats in 43 years to house 85 percent of the Singapore population, HDB towns are a very integral part of life in Singapore. As the public housing authority of Singapore, HDB is always improving our planning and rejuvenation strategies so that they remain relevant to all the changing needs and aspirations of Singapore and Singaporeans. Continuous efforts are also made

through planning and design to develop each town as a vibrant and sustainable community, as HDB's mission statement reads: "We provide affordable homes of high quality. We promote the building of communities."

Hence it has always been HDB's vision and challenge to build homes where people of different cultural backgrounds can live, work and interact within a new high-rise and high intensity environment; creating a living environment that will encourage social interaction, and foster and strengthen community ties.

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