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STRATEGY FOR THE DEVELOPMENT OF SMART CITIES

Retrofitting, Redevelopment, Greenfield Development, PAN City Development

Surya Dev Prakash[1], Apoorva D.L.[2], Jai Abhishek Omar[3], Ashwani Kumar[4]

[1,2,3,4]*Department Of Civil Engineering, Nitte Meenakshi Institute Of Technology, Bengaluru, India*

Abstract — *This paper describes about the several strategies for the development of smart cities which can be elaborated in the terms of Retrofitting, Redevelopment, Greenfield Development & PAN City Development. These four are the advanced techniques to be implemented for the fulfillment of projects under smart cities initiatives taken all over the world. The purpose of the Smart Cities Projects is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes. Area- based development will transform existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving liveability of the whole City. New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. Comprehensive development in this way will improve quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive Cities. With the help of green retrofitting of a building both owner and tenants can attain the benefits which are either tangible or intangible benefits. It will result in reduction in consumption of energy, utilities and water. Maintenance, new technologies and occupancy changes also need to be continually dealt with. Upgrading existing buildings not only helps to preserve the character of a place; it is an optimal solution for owners, tenants, the community and the environment.*

Keywords- *Strategy[1], Retrofitting[2], Redevelopment[3], Greenfield[4], Comprehensive[5]*

1. INTRODUCTION

Change in climate and demography, population growth, rapid urbanization and depletion of natural resources are the major challenge which must adapted by the worlds' great cities. It is necessary for its survival and thriving in coming days. Buildings are the foremost important component of the heritage, skyline and distinct character of the city. However they are a valuable asset to the city but they also consume significant energy, resources and investment from it. In Singapore, Sometimes, the gap between the demolition and rebuilding of the house is 10-15 years. However the adopted methodology is not sustainable for our future as the requirements of the resources are huge which are becoming increasingly rare day by day. However it will also result in wasting a huge amount of embodied energy in the materials. Any buildings which are going to be constructed must need to last minimum of 50 years and beyond. The very reason for this movement to urban area is urban centric economic development, employment, services, education and aspiration to be part of urban areas. Estimation by think-tanks and government agencies has expected that there will be approximate 100 % increase in population in the urban areas. It's expected to be around 590 Million in 2030 AD and 700 Million by 2050 AD. Upgradation of the existing buildings helps us in both ways by preserving the character of a place and providing an optimal solution for owners, tenants, the community and the environment under the benevolent Smart City Projects. The strategic components of area-based development in the Smart Cities Mission are city improvement (retrofitting), city renewal (redevelopment) and city extension (Greenfield development) plus a Pan-city initiative in which Smart Solutions are applied covering larger parts of the city.

1.1 RETROFITTING [1]

Retrofitting is one of the strategic components which when will be introduce planning in an existing built-up area, will help us to achieve several objectives for smart city like making the existing area more efficient and liveable along with others. In this method, generally an area more than 500 acres will be identified by the city in consultation with citizens. After identification and observation of the current situation of infrastructure services in the identified area and the vision of the residents, the cities will prepare a strategy to become smart. Since existing structures are largely to remain intact in this model, it is expected that more intensive infrastructure service levels and a large number of smart applications will be packed into the retrofitted smart city. The whole process of retrofitting must be completed in a shorter time frame, as it will lead to help and assistance in other part of city or another city of similar condition. SMART-RETROFITS are projects to mitigate major issues affecting urban resilience; are catalytic in nature, effective, requires policy initiatives & some investments for pre-take-off. Now days, one of the most commonly method used for the retrofitting for any buildings is Green retrofitting

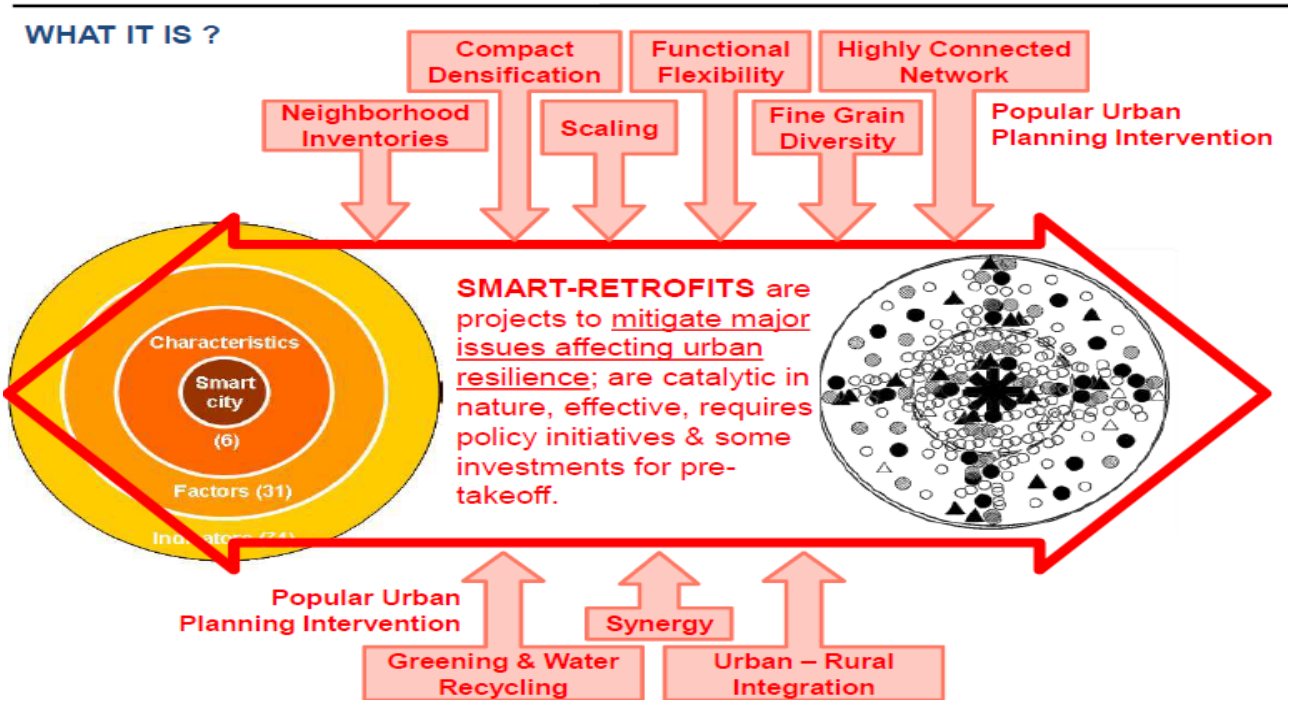

Figure 1: Smart- Retrofit

1.2 REDEVELOPMENT [5]

Redevelopment causes the tremendous development in infrastructure by using the mixed land use patterns and also increasing the density at the same time. When the area is more than 50 acres , then for the sake of concerns of citizens redevelopment is adopted. For example, By implementing high ground coverage, mixed land use is done by preparing new layout for the area. Vacant land represents both a significant problem and an attractive opportunity for many central cities. Vacant land and abandoned structures impose both economic and social costs on cities and the neighborhoods or districts in which they are located. On the economic side, such properties lower neighboring property values and tax revenues even as they create pressure to raise taxes to maintain service levels. Addressing the issue of vacant and abandoned land and structures, state governments play an important role as well. In many cases, the ability to overcome the problems associated with vacant properties and convert them to productive use requires legislative powers that are found only at the state level. Even when demand for new or restored land uses is sufficient for redevelopment to occur, the path to success is troubled by the displacement of previous residents and the elimination of their neighborhoods. Displacement can occur directly through property clearance and conversion to new uses, or indirectly through gentrification when land prices and rents are bid-up to a level unaffordable to the neighborhood's long-term residents. The redevelopment process can create winners and losers, with the losers too often racial and ethnic minorities and the economically disadvantaged. Physical and economic redevelopment are virtual imperatives for cities, but paths to redevelopment that minimize displacement and offset its negative consequences are unsure. Redevelopment has created new, vibrant central city areas. Historic buildings have been restored to physical and economic vitality. At the same time, affordable housing has filtered upward in price and economic class. Historic buildings have been lost. Residences and neighborhoods have been destroyed. People have been displaced. Two examples of the redevelopment model are the Saifee Burhani Upliftment Project in Mumbai (also called the Bhendi Bazaar Project) and the redevelopment of East Kidwai Nagar in New Delhi being undertaken by the National Building Construction Corporation.

For Bhubaneswar we can recollect the redevelopment proposal as :

- Redevelopment Plans underway to promote compact, higher density, mixed-use living in the urban core of the city.
- Redevelopment of Master Canteen Chowk as Bhubaneswar's new Town Centre and Multi-modal Hub

Figure2: Redevelopment of Master Canteen Chowk as Bhubaneswar's new Town Centre and Multi-modal Hub.

1.3 GREEN FIELD DEVELOPMENT

Greenfield development will introduce most of the Smart Solutions in a previously vacant area (more than 250 acres) using innovative planning, plan financing and plan implementation tools (e.g. land pooling/ land reconstitution) with provision for affordable housing, especially for the poor. Greenfield developments are required around cities in order to address the needs of the expanding population. from a legal perspective, the challenges in obtaining timely, effective, and affordable approvals for Greenfield residential development. In particular, we focus on the constraints on Greenfield developments (not all green fields are equal); the need to integrate land use planning with the provision of infrastructure; and the opportunities provided by the Special Housing Area legislation. Greenfield areas are seen as the low hanging fruit in terms of providing land for urban expansion, however the reality is quite different. There will be no perfect sites where the conversion of land for urban use will have no effects; all areas will be constrained, and the conversion of any area will need to occur in the context of compromises HAVING been made. One of the most important issues with Greenfield developments is to ensure that the development area can be appropriately served with infrastructure. New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services that includes physical as well as social infrastructure. One well known example is the GIFT City in Gujarat. For Bhubaneswar, the constituent proposal comprise of :

- Identification and Preparation of Town Planning Schemes as an urban growth strategy through effective management of land resources.

- Master planning of mixed-use integrated townships in Jagasara and Shyamapur.

Unlike retrofitting and redevelopment, Greenfield developments could be located either within the limits of the ULB or within the limits of the local Urban Development Authority (UDA). Some of the important determining factors about Greenfield development are:

- Areas of land that have never been used for construction, areas of natural, often grassed, land.
- Nothing to demolish, and no existing issues
- Cheaper to develop
- Demand for rural/suburban housing
- Easier to comply with environmental standards
- Profitable for local farmers to sell their land on, and they have a right to do so.

1.4. PAN CITY DEVELOPMENT

Pan-city development envisages application of selected Smart Solutions to the existing city-wide infrastructure. Application of Smart Solutions will involve the use of technology, information and data to make infrastructure and

services better. For example, applying Smart Solutions in the transport sector (intelligent traffic management system) and reducing average commute time or cost of citizens will have positive effects on productivity and quality of life of citizens. Another example can be waste water recycling and smart metering which can make a huge contribution to better water management in the city. Accommodating the concerns of mayors and municipal commissioners that pan city solutions should get more weightage rather than focusing more only on "area specific" and "project specific plan", the urban development ministry has said that 50% of the central assistance to each city is not project specific. This can be used for any component of the Smart City plan including interventions that can impact large sections of the city population.

For Bhubaneswar the PAN City Proposal as:

- 2030 Perspective Plan for Bhubaneswar Cuttack Urban Complex (2007)
- Preparation and notification of Comprehensive Development Plan (2010)
- Formulation of TOD supportive Zonal Development Plans (Ongoing)
- Citywide Transit Oriented Development Policy (Ongoing)

2. STRATEGIES OF RETROFITTING[1]

2.1. OBJECTIVES OF URBAN RETROFITTING

With the context of Bengaluru we can proclaim the objectives of urban retrofitting as:

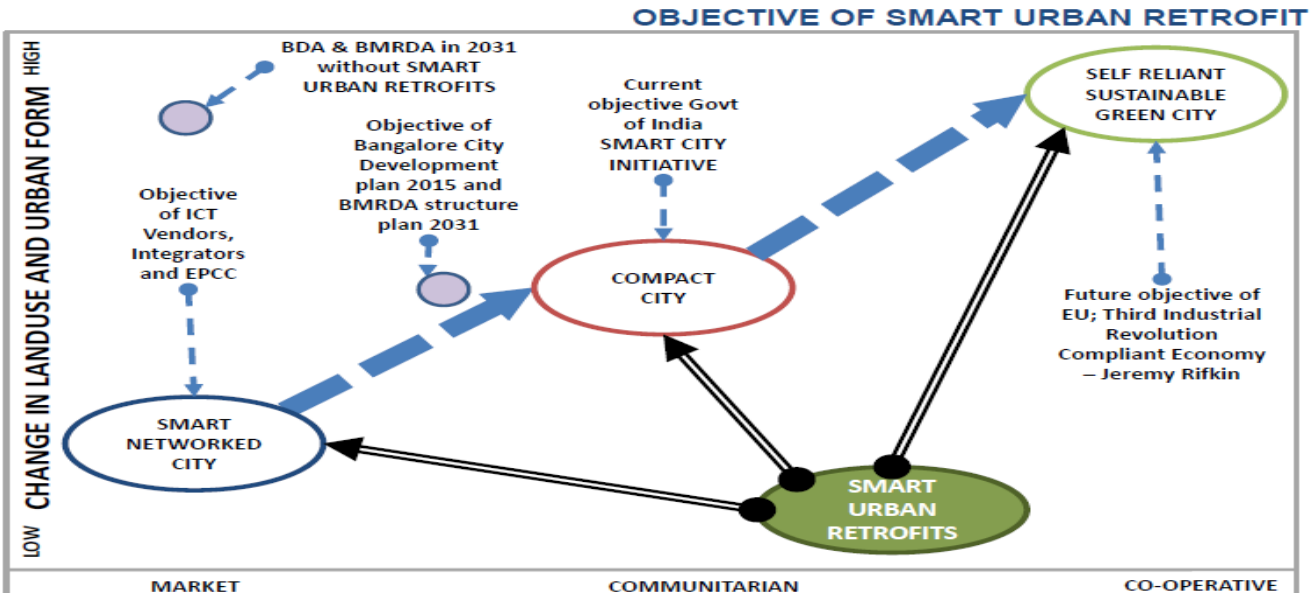

Figure 3: Objectives Of Smart Urban Retrofit

Urban resilience through nine popular planning strategies:

(a.) INVENTORIES

Inventory of neighborhood assets, liability, population and their interactive connections, that is benchmarked and the indicators are monitored.

(b.) COMPACT DENSIFICATION

• As the gross urban density increases, the coverage of no of resident per pipe or road length increases. In the case of water supply network, there is also increase in the distribution efficiency due to per capita pipe loss reduction.

• In the case of reduction in per capita road length with increase in density, reduces CO2 emission as place of work & recreation is near to the residential areas.

(c.) SCALING

• Scale-free structure is one where global order emerges from local orders; a complex web gets created due to bottom-up evolution of the small scale and its integration at higher scales.

• The spatial distribution and the intensity of connections in a resilient city obey a scale-free distribution. The more scale-free the city becomes, the more it can absorb and even build new structures, when it's subjected to constraints, without upsetting the stability of its structure.

• A scale-free structure is rigid like a rock but flexible like a tree. The anthropogenic interactions with a scale-free structure are similar to a honeybee that suckles flower for
nectar without destroying it.

• Resilient cities present urban elements at all scales with a universal law characteristic of complex natural systems. This law links the frequency and the size of urban elements.

(d.) FUNCTIONAL FLEXIBILITY
• It means 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.

• 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 in-habitants, reducing per capita cost of utility distribution and increased access to utility.

(e.) FINE GRAIN DIVERSITY (refers to mixed use)
• At the neighborhood 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.

• Includes diversity in population to balance the community, the community pattern include a balance of people at every stage of the life cycle, diversity in income, values & lifestyle.

(f.) HIGHLY CONNECTED NETWORK
• Implies full spectrum of streets of various lengths, width and spans adapted to different speeds and to different flows. When some connections are cut, others are created to compensate for the cuts and maintain the urban system in operation.
• Social networks as well as street networks show characteristics such as a high level of clustering.
• These are complex evolved street patterns with node and its intersection with another street as a link.

(g.) SYNERGY
High density and mixed use is key strategic assets of urban areas that help to use energy more efficiently through synergy approaches resting upon energy systems integration and compact energy efficient housing.
• The power factor of a micro-grid catering to the need of a dense and diversified development tends to be at unity, leading to its optimal use and capacity enhancement.
• Cascading and recycling energy flows according to their quality (electricity, mechanical, thermal) improves the stability and the resilience to unexpected events of flood, drought, storm, peak load, etc.
• Another type of synergy is though neighborhood development initiatives like

1. Solid waste to energy projects
2. Effluent treatment plant treated water used for flushing the surface water drainage system and street cleaning during dry months
3. Using the treated effluent rich in nutrients for hydroponics food, grown in rooftop green houses.

(h.) GREENING, WATER RECYCLING & URBAN RURAL INTEGRATION

• Water recycling and grey water use, improving runoff management and developing new/alternative water sources; storage facilities and autonomously powered water management and treatment infrastructure.

• City's green infrastructure reduces GHG emissions, as they are carbon sink.

• Green's also enhance pedestrian and cycling environment, regulating energy consumption, enabling environmentally sustainable nutrient recycling and local food production.

• Greens of different hierarchy spatially distributed throughout the urban environs, improves resilience through flood mitigation, erosion control, and maintaining water availability.

2.2 CITY LEVEL SMART RETROFIT PROJECTS UNDER CONTEXT OF BENGALURU

• Green TDR (Transfer of Development Rights)
• Solar Green House & Green Retrofits for existing PV Power Plant
• Solar Human Resource Capacity Building.
• Neighbourhood Solid waste to power plant.
• Solar PV Modules globally competitive made @ India.
• Smart City Investment Trust (SMIT).
• Urban Morphology Studies for planned future.
• Energy Smartness.
• Smart Urban System – Virtual Health City and Smart City broadband network.

3. STRATEGIES OF REDEVELOPMENT[5]

3.1. OBJECTIVES OF REDEVELOPMENT

Following are the eight sections which are essential for any redevelopment plan in smart city. Local initiatives, community networking and organization are vitally important to ensure that community networking and organization are vitally important to ensure that future
development and change occurs.
The eight areas defined as redevelopment strategies are:

(a.) WATERFRONT REVITALIZATION

Waterfronts are a pervasive and critical resource in most Adirondack hamlets, yet the hamlets for the most part have not taken full advantage of this resource as an open space
amenity for attracting investment. Waterfronts occur in many shapes and forms in the Adirondacks; in fact, the great variety is itself worthy of note. These range from the many trout streams which slice through the core of hamlets to the placid waters of small lakes that provide interesting settings for hamlets in the Park.

- **USE OF RELEASED WATERFRONT SITES**

Many old industrial sites or tourist hotels which historically occupied prime locations along waterfronts have been removed in recent years offering outstanding sites for possible waterfront development in hamlets.

- **WATERFRONT TYPES**

There are several waterfront types found in Adirondack hamlets. To assist hamlets in identifying waterfront characteristics, these types are listed below with assets described for each. Some of the categorized waterfront types: Riverfront, Wilderness Shoreline, Lakefronts.

- **MARINAS AS WATERFRONT OPPORTUNITIES**

A growing need for boat and waterfront facilities on Lake Champlain and several large Adirondack lakes suggests the development of marinas and associated activities as a possible waterfront approach for some hamlets. These should be developed at the scale and level of complexity appropriate to the size of the lake and demands of the public.

- **WATERFRONT PARKS AS COMMUNITY OPEN SPACE**

One possible function of a waterfront within a community is to provide a park or open space. The park may either follow a river or lake edge through a community or be developed at critical locations within the village. Such an open space can enhance the visual characteristics and create activities which would improve the waterfront area around it. The area can give the hamlet a sense of place and serve as the central arrival point for visitors. A tourist or visitor centre within the park would allow visitors to enjoy the scenic beauty of the waterfront location while informing them of activities and events occurring in the hamlet and surrounding area. Others might use the park for passive activities such as sitting or strolling along the waterfront. Hamlet a sense of place and serve as the central arrival point for visitors. A tourist or visitor centre within the park would allow visitors to enjoy the scenic beauty of the waterfront location while informing them of activities and events occurring in the hamlet and surrounding area.

(b.) RECREATION AND TOURISM

In looking at recreation and tourism as a redevelopment strategy in hamlets, we must first understand what is meant by these two terms. Recreation represents the great range of activities which people do for sport and relaxation-primarily outdoors. Skiing, swimming, boating, hiking and snowmobiling are only a few of the recreational offerings of the Adirondacks. Generally these activities require a certain type of location, such as a beach or snowy mountainside; they

usually need some preparation or organization of a site, such as a ski lift or a boat dock; and they often demand special equipment, such as skis, canoes, fishing reels or snowmobiles. Tourism is a much broader concept and one
more difficult to illustrate by listing specific attractions, functions, events, and services which draw visitors to the Adirondacks and enable them to enjoy their stay. In addition to outdoor recreation activities, tourism includes experiences such as theatres, theme parks, and museums. Scenic drives through the park, tours of small villages, and stops at antique shops are part of tourism. This is the industry which can be seen in the form of motels, restaurants, camping sites, fast food establishments, and amusement parks throughout the Adirondacks. Requirements are as many and varied as the activities themselves. Some are site specific, such as an auto tour of the High Peaks region; others are much more widespread and oriented to people and activities, such as the location of a
sporting goods store or gas station.

- **THE PARK-WIDE APPROACH**

Having reviewed recreation and tourism in abroad sense, we will now suggest some specific development ideas for hamlets. These will be offered at three levels. The first will look at parkwide developments which can take advantage of the unique assets offered by the Park as a whole. The second will examine sub regional programs applicable to clusters of hamlets. The third will describe guidelines for individual hamlets and the ways these might be applied.

(c.) INDUSTRIAL DEVELOPMENT

Sensitive industrial development concepts constitute a significant element in this manual. What we propose is to set the stage for creative industrial development and to illustrate several success stories that can be referred to by hamlets throughout the Park in their individual efforts to
attract industry. The Saint Paul Port Authority redevelops blighted, contaminated, and underutilized properties in industrial areas.

(d.) PUBLIC SPACES[12]

Public spaces have a significant effect on our overall well-being. Be it green parks, open plazas or shaded atriums, or even the streets that people use every day. Public spaces provide us relief from the dense urban environment. As social venues, public spaces also help to strengthen social identity, as well as offer opportunities for community bonding and building inter-cultural understanding. At the
same time, public spaces help to humanize the urban environment by promoting life outside of buildings. They bring economic benefits not only by drawing in more customers for nearby businesses, but also by making Singapore a more attractive city to live, work and play in. As Singapore becomes more densely developed, public spaces become even more important in maintaining a good quality of life and sense of well-being. As our city grows, we have planned for more new public spaces. In addition, we will look at enlivening and activating existing spaces through good design and programming. Singapore is called a garden city for good reasons. Indeed, plans to create or enhance public spaces have always included bringing nature into urban areas and providing shade. The project team re imagines how a bus stop can be transformed from an everyday transitional space into a meaningful and multi-functional social node. Designed as a kit of parts, the multi-functional bus stop could include a garden, library, gallery, bike park, playground, kiosk and energy farm. This pilot project in Jurong Lake District demonstrates how collaboration can encourage a more participatory design process from the community, to shape the design towards a more relevant and purposeful one, to inspire the community to not just rethink public space and infrastructure design but

Figure 4. Multi Functional Bus Stop

be an integral part of that design process. We can tap on the wealth of expertise and experience of different stakeholders and design professionals through collaboration to create better public spaces for all. We can look forward to more comfortable public spaces in the city. To help ensure that public spaces are comfortable, guidelines on the provision of sufficient shade and seating will also be formulated for future projects. In addition to its eco-friendly features, the mixed-use development at Tanjong Pagar will have a sizeable public space called the City Room that will be integrated with an upgraded Tanjong Pagar Park. When completed, the project will be a prime example of how well designed public spaces incorporated into commercial developments can help to transform an area from just a functional space into an attractive destination.

Figure 5. Artistic Impression of Public Space at Tanjong Park

(e.) HISTORIC RESOURCES[9]

As a leader in Historic Preservation, Weber Murphy Fox (WMF), in conjunction with the Borough of Bellefonte Pennsylvania, Preservation Pennsylvania & the National Trust for Historic Preservation, and the Planning and Community Development Office of Centre County, sponsored the public presentation "Introduction to Leveraging Historic Resources, Redevelopment and Heritage Tourism in Your
Community" held at the American Philatelic Center in Bellefonte, PA on December 7th, 2011 the event introduced attendees to the Federal Historic Preservation Tax Credit Program (which can generate cash for building rehabilitation), the preservation and rehabilitation technical assistance available to property owners, and the economic
and heritage tourism benefits of preserving historic community assets. Robert Lingenfelter, RLA, LEED AP BD+C, Land Planning & Development Associate at Weber Murphy Fox, highlighted the economic benefits of Open Space Assets, such as Parks and Greenways, and Historic and Cultural Resources like Heritage Area and Recreation Assets. According to the 2010 "Community Preservation Values Survey" by the PA Historical and Museum Commission and Bureau for Historic Preservation, when asked what resources enhanced the character of their community, the top five responses included "parks and open spaces" and "historic buildings, sites and districts". Robert also summarized the history of the Match Factory Complex, the Talleyrand Park expansion, and Arts and Crafts Fair in Bellefonte, Pennsylvania, citing the community's ability to leverage these Historic, Natural, and Cultural resources to attract Waterfront Redevelopment.

4. STRATEGIES OF GREENFIELD DEVELOPMENT

Greenfield smart city opportunities and centralized municipal tenders are few and far between. The majority of these cities – even those with balanced municipal budgets - will be seeking private funding to complement their existing resources. The development of public-private partnerships, in which the participants share the risks and the benefits, are high on the agenda of most smart cities. Greenfield approach which involves creating a new smart city within or in the vicinity of an existing town or urban centre. While these Greenfield developments represent only a small percentage of the total population they provide a valuable opportunity to build services and capabilities into the community using this infrastructure within a relatively short space of time. Therefore it is our recommendation to use Greenfield development sites as the test bed for new smart community and smart home concepts, which will accelerate the adoption of new technologies and will lead the way for other existing communities to follow suit.

4.1. Implemented strategies of Greenfield Development in some countries

- **KITAKYUSHU, JAPAN**
  - New City with focus on energy management.
  - Supply of natural gas energy through steelworks' transmission network
  - Supply of hydrogen produced by the steelworks by
  - pipeline to areas within the district.
  - Development of HEMS and BEMS, which can be coordinated with community energy management.
  - Community level energy management center providing advanced energy control.
  - EV charging infrastructure
  - The extension of the new technological systems
  - and business models

- **MASDAR, UAE**
  - Major planning and design principles to reduce the
    energy consumption by natural lighting and ventilation
  - Creating clean tech energy hub
  - Entry of Automobiles is restricted in the city. Major transportation systems include Public transport, Electric vehicles and NMT.
  - Advanced monitoring system to track energy
  - consumption of individual buildings.

- **NAYA RAIPUR, FIRST GREENFIELD SMART CITY OF INDIA**[11]
  - Spread across 8,000 Hectares, Naya Raipur is the first well-planned green field eco-friendly smart city of 21st century in India
  - Naya Raipur is the fourth well-planned State Capital of the country after Gandhinagar, Chandigarh and Bhubaneswar
  - Over 2500 hectares of public spaces, parks and landscaping, and is the first Indian city to be surrounded by a 500 metre wide Green Belt
  - Naya Raipur has been included in the JNNURM scheme and it is a demonstration city under the GEF/ World bank assisted Sustainable Urban Transport Project (SUTP) being implemented by the Government Of India.

- World class amenities including 18-hole Golf Course, Theme Township, Convention Centre, IT SEZ, Shopping Malls and Multiplexes
- Processing Zone (PZ) and Non-processing Zone (NPZ) each of land with an area of 10 hectare
- Logistic hub in 100 Acres, IT SEZ, Sports city, Theme township, Amusement park, Jungle safari and Gems & Jewellery SEZ are under development
- Knowledge park having world class educational institutions including IIM and IIIT
- Bus Rapid Transit System (BRTS) is under development
- International cricket stadium

5. STRATEGIES OF PAN CITY DEVELOPMENT

A pan-city smart solution should benefit the entire city through application of ICT and resulting improvement in local governance and delivery of public services. The SCP should contain one or two such Smart Solutions. Generally, 'smartness' refers to doing more with less, building upon existing infrastructural assets and resources and proposing resource efficient initiatives.

5.1. IMPLEMENTED STRATEGIES

 Advanced home automation services based on the intelligent energy pricing and billing system .

- An integrated e-mobility solution based on a stationary car-sharing solution is planned
- Deployment of smart street lighting
- Smart Traffic system to optimize traffic flows and detect incidents earlier
- Environment and infrastructure sensing
- Virtual citizen services solution, where administrative services are provided through a high-definition, remote video kiosk.

- **DHARMSALA, HIMACHAL PRADESH, INDIA**[10]
  - Passenger Information System for Bus and Ropeway services
  - Smart street lighting with CCTV cameras, Wi-Fi, Public Announcement Systems
  - GPS enabled smart underground dustbins
  - Citizen Smart Card
  - Citizen e-services

- **JALANDHAR, INDIA**

Pan City Strategies for Development are as follows:

Sectors	Smart Proposals
Public Transport & ITMS	• Bus based public transport with ICT enabled Automatic Vehicle Location System (AVLS) and Public Information System (PIS) • Camera based Traffic Violation Detection and enforcement
Safety and Security	•Installation of the CCTVs (Video crime monitoring) •Automatic reporting of trouble spots
Solid Waste Management	•Door to door collection and scientific disposal •GPS to track waste collection vehicles •Sensor in waste bins to send bin-fill alerts •Mobile App/ SMS facility for public to send alerts garbage littering •Waste to Energy (and fuel) Plant
Street Lighting	•Hybrid LED lights
Water Reuse	• Reuse of Treated Water from STPs
E-Governance	• Kiosk Based access to services
Fuel & Gas	• CNG buses to ply at Pan city level

Solid Waste Management	•Door to door collection and scientific disposal •GPS to track waste collection vehicles •Sensor in waste bins to send bin-fill alerts •Mobile App/ SMS facility for public to send alerts garbage littering •Waste to Energy (and fuel) Plant
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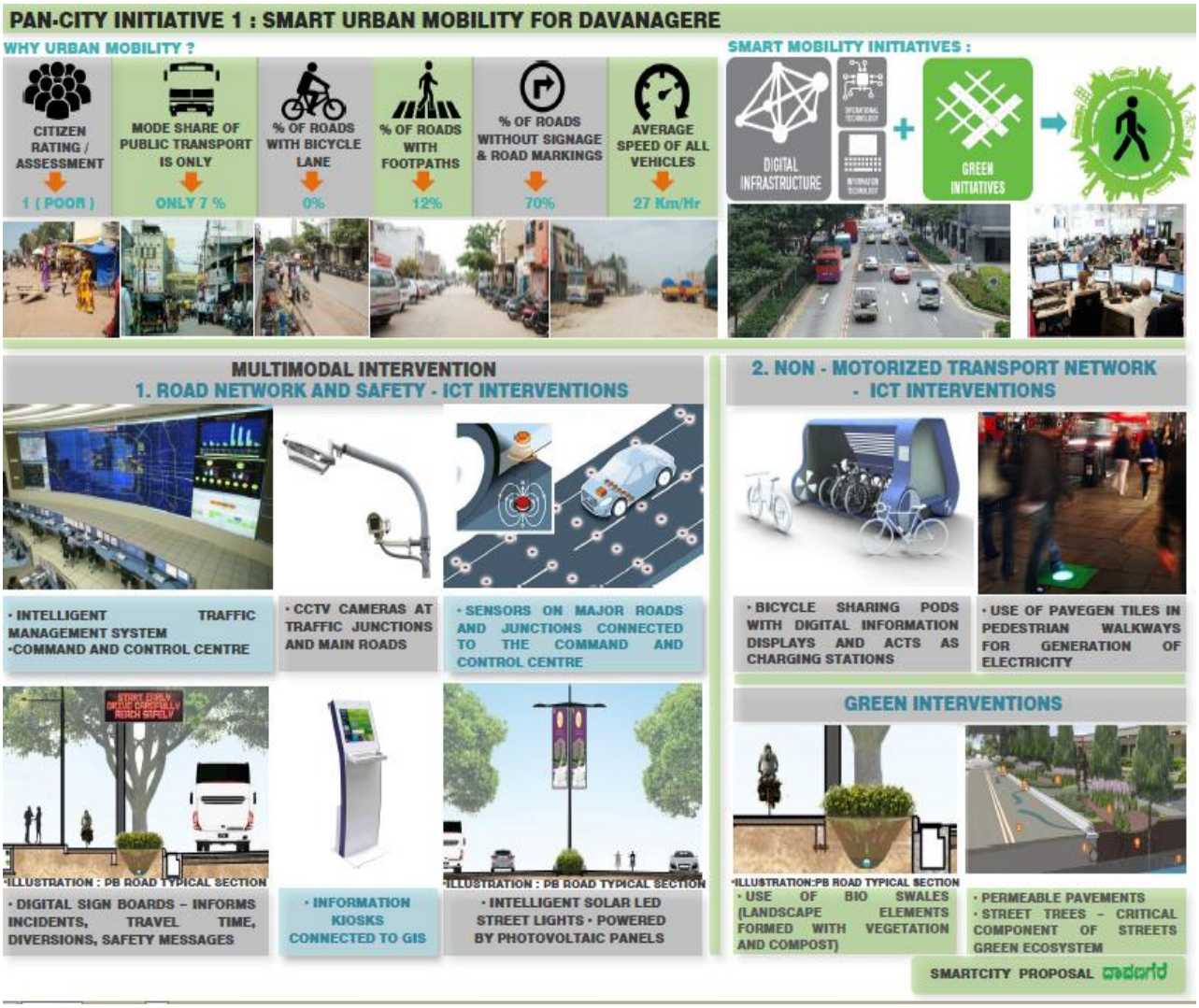
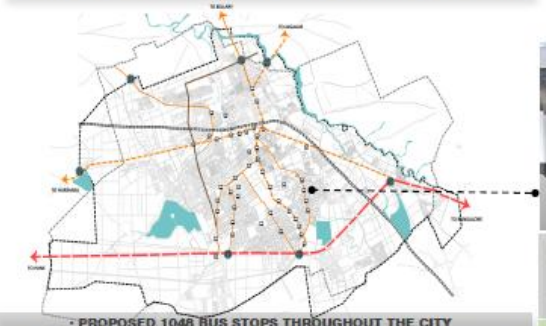
- **PUNE, INDIA: PAN City Proposal:**[6]
- Increase public transport usage through better availability and reliability by developing a smart Pune Public Transport System against the 50% benchmark Pune's Public Transportation usage is only 18 percent.
- Reduce congestion through Intelligent Pune Traffic Systems which comprises of adaptive traffic management. Peak hour average is only 18kmph.
- Ensure equitable distribution of 150 lpcd water to 100 percent citizen 24 X 7, along with best-in-class customer experience.

- **PAN CITY INTIATIVE : SMART URBAN MOBILITY OF DAVENGERE**[11]



MULTIMODAL INTERVENTIONS
3.PUBLIC TRANSPORT NETWORK & INFRASTRUCTURE



- PROPOSED 1048 BUS STOPS THROUGHOUT THE CITY
- 50 BUS STOPS IDENTIFIED IN DAVANAGERE CITY FOR UPGRADATION UNDER PHASE I IMPLEMENTATION

ILLUSTRATION : TYPICAL PROPOSED BUS STOP
- PROPOSED 1048 BUS STOPS THROUGHOUT THE CITY WITH UPGRADED ICT FACILITIES
- DIGITAL TAGS AND SIGNAGES , REAL-TIME BUS TRACKING AND PIS INCORPORATED

ILLUSTRATION : PROPOSED TYPICAL ROAD SECTION ON PB ROAD
- BUS STOP EQUIPPED WITH ALL ICT FACILITIES

GREEN INITIATIVES
- POWER GENERATION • USE OF SOLAR PANELS ON THE BUS STOP ROOFS
- CHARGING POINTS FOR VEHICLES AND OTHER DEVICES

SMART PARKING

- REAL-TIME DATA ON PARKING SPACE AVAILABILITY AND ROUTE USING ICT
- RESERVATION OF PARKING SLOTS USING WEB BASED APPLICATIONS

- SMART METERING
- FEE BASED SERVICE

SMART PARKING CONNECTED WITH THE COMMAND AND CONTROL CENTRE

INTERMEDIATE PUBLIC TRANSPORT WITH PASSENGER INFORMATION SYSTEM

AUTORICKSHAWS

ELECTRIC AUTORICKSHAWS

CYCLE RICKSHAWS

INFORMATION KIOSKS SMART TICKETING
- PASSENGER INFORMATION SYSTEM
- GIS MAPPING
- REAL TIME JOURNEY PLANNER

NEW ECONOMY MARKETS CREATED:
1. SOLAR POWER GENERATION
2. SOFTWARE INDUSTRY
3. DATA AND CALL CENTRE
4. MARKET FOR MAINTENANCE OF ELECTRIC VEHICLES
5. BACK END ENGINEERING SUPPORT

EXPRESSION OF INTEREST RECEIVED FOR PARTNERSHIP IN THE ABOVE INTERVENTIONS BY ACCENTURE AND KPIT TECHNOLOGIES.

SMARTCITY PROPOSAL

PAN-CITY INITIATIVE 2 : ICT INITIATIVE – CROWD MAPPING + INFORMATION KIOSKS

CROWD MAPPING – A PUBLIC ENGAGEMENT PLATFORM

CROWDSOURCING – 1. ALTERNATIVE CIVIC ENGAGEMENT STRATEGY THAT IS NOT BOUND BY TIME AND LOCATION. 2. CAN BE PERFORMED ON THE WEB, MOBILE PHONES, OR OTHER MEDIA.

CROWDSOURCING → DATA COLLECTION | CREATING A SENSE OF COMMUNITY | SOLVE PROBLEMS | GATHER KNOWLEDGE | HELP PEOPLE IN CRISIS | ANSWER QUESTIONS

FACETS OF CROWD MAPPING
1. BUILDING A REAL – TIME SOCIAL CHANGE NETWORK AND BUILD AN ONLINE COMMUNITY AND ADDRESS CITY'S NEEDS
2. POSTING OF CITY CENTRIC PROBLEMS THROUGH COMMUNITIES OF CITIZENS
3. PROVIDE CITIZENS WITH USEFUL INFORMATION ON VARIOUS ISSUES – PUBLIC WORKS, MAINTENANCE, TRAFFIC, EVENTS
4. RECORDING OF COMPLAINTS POSTED AND DOCKETED WITH A UNIQUE NUMBER AND GRIEVANCE REDRESSAL SENT TO CONCERNED AUTHORITY
5. GIS TECHNOLOGY, TO LOCATE ACCURATELY THE POINT OF ISSUE.
6. MOBILE SMS AND APP BASED PLATFORM, REACHING OUT TO LARGER CITIZENS.

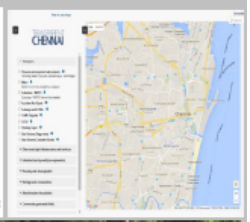
PROPOSED GOVERNMENT PROJECTS EASILY ACCESSIBLE TO ALL CITIZENS THROUGH THIS PUBLIC PLATFORM

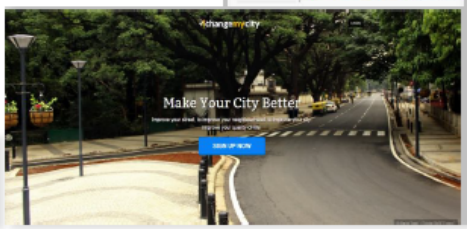
TYPICAL CIVIC ISSUE COMPLAINT FORM

BENEFITS OF CROWD MAPPING
- CREATE A DATA MARKETPLACE
- IMPROVEPUBLIC/PRIVATE PARTNERSHIPS
- SUPPORT POLITICAL AND STRATEGIC INITIATIVES
- IMPROVE OWN DECISION MAKING

PUBLIC VOTING TO PRIORITIZE IMPORTANT PROJECTS TO BE IMPLEMENTED

CASE EXAMPLES OF CROWDMAPPING IMPLEMENTED IN OTHER CITIES





ONLY TAX PAYERS IN THE CITY CAN VOTE THROUGH THIS POLLING PLATFORM

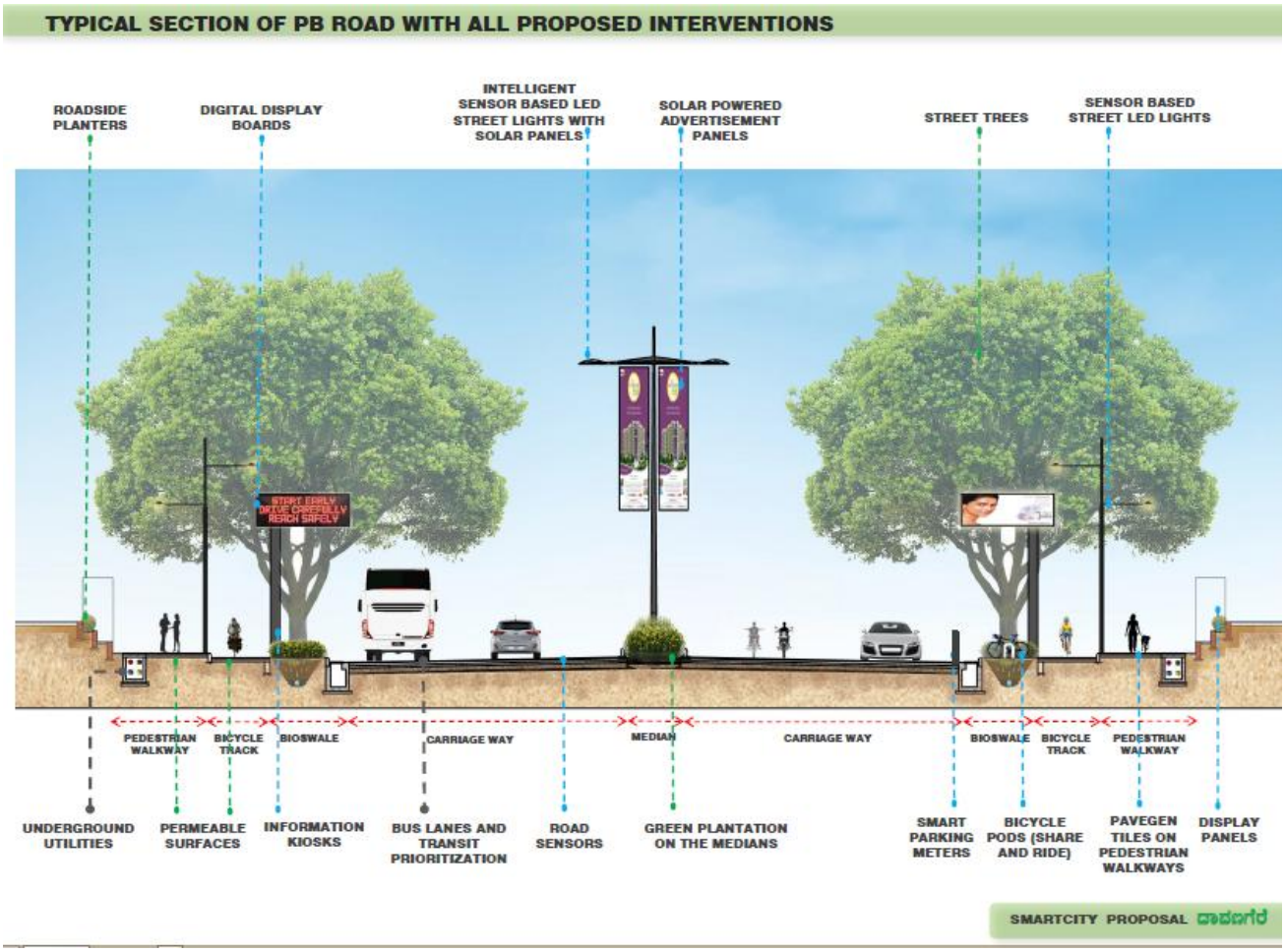
CROWDMAPPING PLATFORM INCORPORATES THE FOLLOWING INITIATIVES

ONE CITY ONE WEBSITE
- A. ONE SINGLE WEBSITE TO LINK ALL GOVERNMENT DEPARTMENTS AND CORPORATIONS IN THE CITY
- B. FACILITY TO HAVE ALL ONLINE TRANSACTION – 2 WAY COMMUNICATION SYSTEM
- C. EASY & CONVENIENT COMPLAINT REGISTRATION AND TRACKING
- D. CITY APP - MAJORITY OF WEBSITE FUNCTIONS TO BE ON THIS CITY APP

ONE CITY ONE NUMBER
- A. IVRS AND VOICE BACKED 4 DIGIT SINGLE NUMBER
- B. ASSISTANCE FOR ALL CITY INFORMATION
- C. DIRECT CALL FORWARDING TO ANY GOVERNMENT OFFICIAL
- D. CALL RECORDING FACILITY TO ENABLE COMPLAINT ESCALATION

CITY ON G.I.S MAPPING AND WIFI HOTSPOTS
- A. ALL UTILITIES MAPPED TO ENABLE SUITABLE INTERVENTIONS BY ANY GOVERNMENT AGENCIES
- B. LOCATION AND RECTIFICATION OF UTILITY FAULTS ON REAL TIME BASIS
- C. WIFI HOTSPOTS AT IMPORTANT LOCATION WITHIN THE CITY

SMARTCITY PROPOSAL



- **PAN CITY INITIATIVE FOR THE CITY OF BAREILLY**[13]

The City "Bareilly" in Uttar Pradesh has been selected as one of the Smart Cities to be developed under the Ministry of Urban Development (MoUD), Government of India's Smart City Mission. In order to participate in the 'City Challenge' proposal competition, Bareilly is now required to formulate its own unique PAN City Smart Solution (A Smart Solution that could be applied City wide) and prepare the Smart City Plan in consultation with the citizens and other stakeholders.

The Ideal Smart Solution:

a. **E-Governance and Citizen Services**
i. Public Information, Grievance Redressal
ii. Electronic Service Delivery
iii. Citizen Engagement
iv. Citizens – City's Eyes and Ears
v. Video Crime Monitoring

b. Waste Management
vi. Waste to Energy and Fuel
vii. Waste to Compost
viii. Waste water to be treated
ix. Recycling and Reduction of T&D Waste

c. Water Management
x. Smart Meters & Management
xi. Leakage Identification, Preventive Maintenance
xii. Water Quality Management

d. Energy Management
xiii. Smart Meters and Management
xiv. Renewable Source of Energy

xv. Energy Efficient and Green Buildings

e. Urban Mobility
xvi. Smart Parking
xvii. Intelligent Traffic Management
xviii. Integrated Multi Modal Transport

f. **Others**
xix. Tele Medicine and Tele Education
xx. Incubation/ Trade Facilitation Centers
xxi. Skill Development Center

6. CASE STUDIES FOR STRATEGIES

6.1 CASE STUDY IN RETROFITTING[2]

Hackbridge, London, UK

In 2005, the London suburb of Hackbridge, with a population of 8,000 people, took up a decade-long project to become the first zero-carbon area in the UK. It started by taking up mass retrofitting of all homes to improve energy use, promoting green businesses and local food schemes so as to cut down on carbon emissions. The plans for retrofitting included proposals for new eco-friendly homes, more shops, leisure and community facilities, jobs, sustainable transport and pedestrian/ cycle initiatives, improved networks and open spaces.

Figure 6 : Retrofitting- Zero Carbon ,Hackbridge, LONDON, UK.

Problem statement

Around 45% of emissions in the UK derive from buildings. Although the Government attempted to address the low carbon agenda with respect to new build, via progressive regulation towards a low carbon standard, the fact remains that around 70% of buildings still existed that will be in use till2050. For this reason, low carbon retrofitting of existing buildings was of vital importance.

Smart Solutions

Bed ZED (Beddington Zero Energy Development)was designed to be carbon neutral, protecting the environment and supporting a more sustainable lifestyle. Bed ZED utilizes a number of innovative
technologies to enable it to operate with zero energy use which include:

- Zero energy—The project is designed to use only energy from renewable sources generated on site. There are 777 square metres (8,360 sq ft) of solar panels.

- High quality—The apartments are finished to a high standard to attract the urban professional.
- Energy efficient—The houses face south to take advantage of solar gain, are triple glazed, and have high thermal insulation.
- Water efficient—Most rain water falling on the site is collected and reused

Benefits

- Space-heating requirements were 88% less.
- Hot-water consumption was 57% less.
- The electrical power used, at 3 kilowatt hours per person per day, was 25% less than the UK average; 11% of this was produced by solar panels. The remainder normally would be produced by a combined-heat-and-power plant fuelled by wood chips, but the installation company's financial problems have delayed use of the plant.
- Mains-water consumption has been reduced by 50%, or 67% compared to a power-shower household.
- The residents' car mileage is 65% less

6.2 Case Study in Redevelopment

Nordhavn Copenhagen, Denmark

The urban regeneration of 200 hectares of industrial area and former shipping docks in Nordhavn in Copenhagen, Denmark, is based on the concept of providing living spaces around two large public spaces and several smaller parks. With an aim to become the world's first carbon-neutral capital, Copenhagen has launched an ambitious project in Nordhavn to recycle resources, using renewable energy and sustainable transport. Nordhavn is proposed to be the new waterfront city district in Copenhagen. The area is being transformed from an active industrial port into a modern residential and business Quarter. One can say that Copenhagen is growing inwards instead of outwards.

Figure 7: Redevelopment, Nordhavn in Copenhagen, Denmark

Problem Statement

Copenhagen is growing - and at a rapid rate. The capital is therefore being expanded with new neighborhoods with new opportunities to live and work.

- The growth of the city makes it increasingly dynamic and diverse, but it also presents a number of challenges. The population will grow by 18% by 2025, equivalent to 100,000 new residents, or 19 new residents every day.
- This requires the construction of new homes. The alternative for the capital city is simply that people will leave the city.
- The increasing rate of commuting in the region has already put Copenhagen's traffic system under pressure.

Good accessibility is one of the main prerequisites for an
attractive city that can benefit both the residents and businesses of Copenhagen.

Smart Solutions

- In the future, the former industrial area will be transformed into a dense, compact urban district with both housing and offices, located on piers and jetties and surrounded by canals, water basins and the open sea.

- Like the Cycle Super Highways, The Bicycle Snake is part of the City of Copenhagen's strategy to become the best cycling city in the world by the end of 2015. The goal is for 50% of all journeys to work and school/college to be made by bicycle in 2015.
- By 2025, 90% of Copenhagen's cyclists will feel safe in traffic and their travel time will be reduced by 15%. The bridge helps to achieve this strategy by improving accessibility and safety for Copenhagen's cyclists, because it will navigate the cyclists away from pedestrians, traffic and staircases, which are an obstacle on the current route. It will also provide yet another shortcut for the journey through the city.
- The winning proposal for Nordhavn is based on six themes, which match the six points of the vision. The themes are as follows: Islets and Canals; Identity and Cultural Traces; Five-Minute-City; Blue and Green City; CO_2-Friendly City; and Intelligent Grid.

Benefits

When completed, Nordhavn will have room for 40,000 residents and an equal number of work places. The new city district will literally be built on top of historical Copenhagen. Nordhavn has been extended several times to provide a bigger commercial harbour. Urban development in Nordhavn shall help to counteract the trend towards increasing levels of commuting in the region, by creating new local homes and workplaces. This will allow people to cycle to work or commute by train to centrally located workplaces.

6.3 Case Study in Greenfield Development

Modderfontein, South Africa

The main focus in Modderfontein was building an economic opportunity friendly city. The area will be developed into a financial hub, with as many as 35 000 houses, an educational centre, a hospital and medical centre, and a sport stadium.

Figure 8: Greenfield Development, Modderfontein, South Africa

Problem Statement

The problem was the need of huge capital investment required for creating satellite town and inviting the foreign investment (financed by Chinese firm ‘Shanghai Zendai’).

Smart Solutions

- Work on the first set of 300 residential units and some of the roads were already under way. Chinese firm Shanghai Zendai planned to develop the 1,600 hectares of land into the "New York of Africa".
- The development was a 15- to 20-year project that would see between 30 000 and 50 000 housing units of different types and sizes being built, ultimately housing about 100 000 residents. The project will be market driven, and depending on what clients or developers wants.

Benefits

- The development will become a hub for Chinese firms investing in sub-Saharan Africa. The Modderfontein site is located between the central business district of Sandton and OR Tambo International Airport. It is on the Gautrain route, and the development will also include the completion of the Modderfontein station. The Gauteng Provincial Government says the new city will benefit Johannesburg's residents. There is also possibility for collaboration with local contractors.

6.4 Case Study In Pan City Development
Hafencity, Germany
HafenCity, Hamburg is a project of urban regeneration where the old port warehouses of Hamburg are being replaced with offices, hotels, shops, official buildings, and residential areas. It is the largest inner-city development in recent years, which has experimented with e-mobility through electric bicycles and electric cars in a car-sharing model as an alternative means of transportation. HafenCity brands itself as "A City of Plazas, Parks and Promenades" to stress the importance of public urban spaces in the city. In this new district, squares, promenades and parks serve not only as links between various forms of architecture and uses, but also as high quality elements in the environment.

Figure 9: Pan-city Development , Hafencity, Germany

Problem Statement
The central aim of this large scale urban development is geared to create a compact city of short journeys with residential areas that are compatible with the neighboring port activity.
Sustainability innovations include new approaches to heat supply, a tailor-made certification system for buildings, sustainable mobility concepts, flood protection and the development of a sustainable urban structure

Smart Solutions
- **Smart Building Solution**: Advanced home automation services based on the intelligent energy pricing and billing system are proposed (Transparency and flexible pricing are key). Smart solutions are planned that aims at expanding district heating and increasing energy efficiency.
- An integrated e-mobility solution based on a stationary car-sharing solution is planned
- Deployment of smart street lighting
- Smart Traffic system to optimize traffic flows and detect incidents earlier
- Environment and infrastructure sensing
- Virtual citizen services solution, where administrative services are provided through a high-definition, remote video kiosk.

Benefits
According to the analysis of the urban spaces the headline findings can be summarized in the following five remarks
- It seems that the design of public space in HafenCity allows a good balance between clear regulations for uses and flexibility of individual occupancies.

- Large events provide important opportunities for people to discover open spaces in HafenCity and to become familiar with the culture of different uses of the spaces.
- Greater opportunities for the development of a specific Socio-culture of the area can be identified in HafenCity.
- The urban mobility finds a balance between pedestrians, bicycles and traffic car.
- The difference levels are exploited to differentiate private domains from public ones, as well as to provide public spaces in the water edge.

7. CONCLUSIONS

The concept of smart city means very different things to different cities. As per the requirements of area based developments as well as the development based on available resources each and every strategy is proclaimed to be promising and playing very important role to make this world a better to live in under smart city project. Since already construction of building as well as several components of infrastructure of cities have been already developed so retrofitting is the better smart solution in such case. Greenfield development came in to picture since the developed cities facing the problem of ecological imbalance so requirement of greeneries in our modern developed is very important so as Greenfield development. In the case of redevelopment, the human settlements and serviceable infrastructures became the requirements which is to be fulfilled by implementation of this strategy over the under-developed cities throughout the world. Now talking about last but not the least one the pan city development strategy which is the backbone of the of infrastructure development in metropolitan, developed, cities with high population as well as facing rapid urbanization cause the pan city strategy to be highly utilized as well as of great economic and social infrastructures. So all the strategies of smart cities development providing us the smarter solutions to remark the overall development of infrastructures in the smart cities project.

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10. **BIOGRAPHIES**

"Surya Dev Prakash[1] is pursuing his Bachelor Of Engineering, Final year, Civil Engineering in Nitte Meenakshi Institute of Technology, Bangalore, India with his tremendous research works in Smart City Projects."

"Apoorva D.L.[2] is pursuing her Bachelor Of Engineering, final year of Civil Engineering in Nitte Meenakshi Institute of Technology, Bangalore, India."

"Jai Abhishek Omar[3] is pursuing his Bachelor Of Engineering, final year of Civil Engineering in Nitte Meenakshi Institute of Technology, Bangalore, India."

"Ashwani Kumar[4] is pursuing his Bachelor Of Engineering, final year of Civil Engineering in Nitte Meenakshi Institute of Technology, Bangalore, India with several areas of research in Smart city projects."

