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CIDCO SMART CITY LAB @NIUA

TEAM
- Siddharth Pandit
- Manjali Arora Suneja
- Deepika Deo
- Priyank Khare
- Arjun Dev
- Sandip J. Nehe
- Lucie Lamballais

GRAPHIC DESIGN
- Deep Pahwa
- Devender Singh Rawat
- Bhavesh Bhanot
- Preeti Shukla

PROJECT COORDINATOR
- Ravindrakumar Mankar, ACP, Navi Mumbai

For any comments/suggestions please contact
Siddharth Pandit, Chair, CIDCO Smart City Lab at spandit@niua.org
Background
Clean air is considered to be a basic requirement to human health and well-being. However, air pollution continues to pose a significant threat to health worldwide and is a critical environmental issue that cannot be ignored. According to a WHO assessment about the burden of disease due to air pollution, more than two million premature deaths each year can be attributed to the effects of air pollution. More than half of this disease burden is from the populations developing countries (WHO, 2005).

The increasing trend of the global urbanisation results in high levels of air pollutants in urban areas and megacities, decreasing air quality. Transportation, road traffic, home heating, and industrial emissions, and other local anthropic actions are the major emission sources of air pollutants to the atmosphere.

Air pollution control and air quality monitoring is needed to implement abatement strategies and stimulate environmental awareness among citizens. For this purpose, CIDCO is proposing a pan-city air quality monitoring network.

Location
Pan City - Selected Locations

SMART CITY ACTION PLAN – PROJECT IN FOCUS

Extrusion Based Mechanical Biological Treatment for MSW

Background
At present CIDCO region in Navi Mumbai generates about 300 Tonnes per day (TPD) of solid waste, which is treated and disposed at a 35-acre Chal village site in Taloja. Currently the site is able to handle the present waste disposal requirement with “aerobic window composting” method. The site faces resistance from local communities due to odour, leachate generation, ground water contamination and spontaneous fires. With increasing garbage, more waste gets littered on the streets and starts choking storm water drains preventing water draining during the monsoon season. This leads to water accumulation and rise in a plethora of various respiratory and health disorders like malaria, dengue etc. Further land is a very limited and precious resource and the current method of using scientific landfills not only leads to rampant utilisation of the land resource but also threaten the aesthetic appeal of any area. This facility was initially designed to handle 55 TPD of municipal waste, however with consistent increase in population and quantum of waste generated at present the plant is handling 300 TPD of MSW. The existing facility has a 50 m x 100 m long composting platform, where the incoming waste is stored in forms of windrow for a period of 30 days, after processing the MSW the retained materials sent to the landfill area. Approximately 6 hectares of land, comprising 5 cells have been allocated for scientific landfill. Out of these, 3 cells have been used and closed and 1 cell is balance. As the waste quantum has increased considerably in the last 3-4 years, the balance 3 cells are expected to be exhausted in the next 2 years time. CIDCO does not have an alternative site to cater to municipal waste after that. Hence, it was decided to carry out processing and disposal of solid waste by adopting new MBT technology at the site vetted by IIT Mumbai and Hol迪拜.

Location
Chal near Taloja MIDC

Scale
City

Cost
Rs. 176 Crores

Detailed scope
With the view to tackle the garbage menace CIDCO has envisioned a “High Priority Garbage Disposal Plan” which will not only limit the ever-increasing land use pattern but also provide a modern garbage treatment and disposal methodology to the country. Currently most of the ULBs undertake public private partnership (PPP) contracts with various agencies for collection / transport and disposal of MSW based on a tipping fee model. Tipping fee charges vary from “no charge” to 1500 Rs/ton based on different regions, distance of transport and level of treatment. In some cases, agencies are also required to pay a “royalty fee” or “–ve tipping fee” to the Corporation. However none of the cases have proved to be a successful model for garbage disposal, which can be replicated. Garbage disposal continues to be a problem, with inability to meet the MSW 2000 rules and draft 2013 guidelines in spirit.

In order to avoid such a situation in future, CIDCO has decided to develop an MBT treatment facility, for the CIDCO region, which solves all the environmental problems and also meets the MSW 2000 guidelines in letter and spirit. CIDCO will have permanent ownership on the facility. A separate operation and maintenance contract will be given for a shorter duration of 3 to 5 years wherein the operator is given a free to operate and maintain the plant. The plant shall have an automatic, SCADA based control system. It will be completely enclosed, odour free, neat and clean.

The plant is to be installed initially to handle 300 TPD MSW and subsequently augmentable to 600 TPD of waste. The MBT scheme of waste management is as under:

- Primary segregation by Bio-methanation and Composting
- Primary sorting to recover recyclables
- Waste segregation into wet and dry fraction
- Bio-methanation of organics to generate electricity
- In- vessel composting of the digested sludge
- Segregation of waste
- Extrusion based process
- Extrusion press work

Progress
Tenders will be invited shortly

Benefits
The E-MBT process is specifically designed to treat both, inorganic and organic waste. Compared to other technologies E-MBT offers the following:

- Composting process is reduced to 7-10 days required in aerobic process systems
- Minimise human contact to avoid health hazards, odour and leachate
- No land, vector nuisance which is important as Airport is planned near to the area
- Disposal of only the inorganic inerts to the landfill area
- E-MBT facility will generate sellable products like compost, electricity, RDF and recyclables as stated under, which gives revenue and reduce operation and maintenance cost
- Recovery of Recyclables
- Segregation of organic and inorganic fractions and recovery of RDF
- Bio-methanation of the organic matter into biogas and generating electricity from the same
- Generation of Compost using completely enclosed In- vessel composting drums

The quantum of resources from solid waste treated by E-MBT method is as indicated in table.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Resource from input waste</th>
<th>% of Input waste</th>
<th>Quantum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recyclables</td>
<td>3 to 5%</td>
<td>18 tona/day</td>
</tr>
<tr>
<td>2</td>
<td>Compost</td>
<td>8 to 10%</td>
<td>60 tona/day</td>
</tr>
<tr>
<td>3</td>
<td>Electricity</td>
<td>0.5 – 1.2 MW per 100 T of input waste</td>
<td>4.0 MW/day</td>
</tr>
<tr>
<td>4</td>
<td>RDF</td>
<td>12-15%</td>
<td>72 tona/day</td>
</tr>
</tbody>
</table>
Interviews of Training Attendees

Mr. Vijay Shantaram Rane – Deputy Chief Fire Officer, Fire
The winning edge: communication strategy for leaders -
Indian Institute of Management, Ahmedabad
24th – 29th September 2018

You have recently attended a course on Communication, Presentation Skills and Report Writing. How was your experience?
I have done two residential trainings through Ujjwal. My training experience in both the trainings was excellent. The first training was on Understanding Environmental Laws for better Compliance in Centre and CISDI. As far as my department is concerned, my recommendation would be to have more technical courses relevant to our field.

Do you think this course helped you in your current role and how do you relate this course to your daily life (personal and professional)?
I am highly satisfied with Ujjwal services and I am willing to go for next training soon. I would also like to thank our management to provide us such a great opportunity.

What was the best part of this training? If you want to highlight anything in particular?
The participants were divided in groups of 4-5. After the lecture, the main members of the team were instructed to gather in a room and prepare for the next day. The best part of the training was that we were kept busy all the time. It was made very clear that their idea is to make the participants learn and not take the training casually.

How do you think if other CIDCO employees go for similar course would be benefited?
I would suggest this course for the top level leaders of the company. As CIDCO is doing some major projects, I feel this course will definitely help me in my current profile.

Who were your fellow participants and how was your interaction with other participants?
Most of the participants were from different SMGs. The interactions with them led to many healthy discussions. For every task or assignment, we were divided in groups. The discussions and interaction among the groups during the exercises helped us know each other and share our experiences

Ms. Poonam Amardeep Shinge - Assistant Law Officer, Legal
Understanding Environmental Laws for Better Compliance - Centre for Science and Environment
18th – 22nd September 2017

You have recently attended a course on Communication, Presentation Skills and Report Writing. How was your experience?
I have done two residential trainings through Ujjwal. My training experience in both the trainings was excellent. The first training was on Understanding Environmental Laws for better Compliance in Centre for Science and Environment. The faculty in this training were very good and made the topic really easy to understand. The second training in IIM, Indore also had excellent faculty.

Do you think this course helped you in your current role and how do you relate this course to your daily life (personal and professional)?
The training was very good and informative. The training was very well planned. It was a 5 and a half day programme with many faculties to supervise us. Every day was packed with exercises based on the lectures given during the training. On the last day, we were asked to give our presentation. So, I say that the training programme was very well organized.

Do you think this course helped you in your current role and how do you relate this course to your daily life (personal and professional)?
I selected this training because I felt it was related to my work profile. During the training programme it was introduced to many concepts related to planning field useful in our daily work in the planning department. Some of the concepts were very useful and are now being implemented in our projects for better results. Currently, I am working on a land acquisition project and I am trying to incorporate few learnings from this training.

What was the best part of this training? If you want to highlight anything in particular?
The training was very well planned and the faculty were very helpful. It was a very good learning experience for me and one of the best parts of the training.

Ms. Pranali Hemant Kudbe - Deputy Planning Officer, Sustainable Habitat - National Institute of Technology, Nagpur
7th – 12th January 2019

You have recently attended a course on Sustainable Habitat. How was your experience?
My training experience was very good and informative. The training was very well planned. A 5 and a half day programme with many faculties to supervise us. Every day was packed with exercises based on the lectures given during the training. On the last day, we were asked to give our presentation. So, I would like to thank the training portal Ujjwal in CIDCO.

Do you think this course helped you in your current role and how do you relate this course to your daily life (personal and professional)?
I have done two residential trainings through Ujjwal. My training experience in both the trainings was excellent. The first training was on Understanding Environmental Laws for better Compliance in Centre and CISDI. As far as my department is concerned, my recommendation would be to have more technical courses relevant to our field.

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The training was very well planned and the faculty were very helpful. It was a very good learning experience for me and one of the best parts of the training.

Mr. Yogesh Thakur – Accountant, Accounts
Advanced Financial Management - Administrative Staff College of India, Hyderabad
13th – 19th February 2019

You recently attended a course on Advanced Financial Management. How was your experience?
Course was very useful and the content of the course was very good. It helped me in improving my knowledge about financial management. The latest updates on GST in the course were very useful to know the current situation of our country. The overall experience was very good. The food, boarding and lodging facilities were up to the mark and everybody felt. I think everyone should attend similar kind of trainings.

Do you think this course helped you in your current role and how do you relate this course to your daily life (personal and professional)?
I have done two residential trainings through Ujjwal. My training experience in both the trainings was excellent. The first training was on Understanding Environmental Laws for better Compliance in Centre and CISDI. As far as my department is concerned, my recommendation would be to have more technical courses relevant to our field.

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I would suggest this course for the top level leaders of the company. As CIDCO is doing some major projects, I feel this course will definitely help me in my current profile.

What are your views about implementation of Ujjwal in CIDCO?
The training was very good. They had specified its Capacity Building model. It will go a long way.

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Date – 21st February 2019

The NITIA-CIDCO Smart City Lab coordinated a 5-day executive programme on ‘Insights on Urban Management’. Seven participants visited the Lee Kuan Yew School of Public Policy at National University of Singapore (NUS) to learn about multiple topics.

Female employees of CIDCO attended a 2-day training on Prevention of Sexual Harassment (PSh) in CIDCO. Many topics related to sexual harassment at workplace were discussed during the workshop.

Date – 15th April 2019

The syllabus on transparency in Government was provided by orthonmode, and it was a part of its training module for officers, and members of the local self government.

Date – 14th June 2019

Cidco@Smart Vol 4, Issue 548, 2018 Cidco@Smart Vol 4, Issue 548, 2018
Cities are complex systems; their economic, social and infrastructural components are closely interlinked with each other. They have proven to be engines of creativity, wealth creation and economic growth (Bettencourt & West, 2010). Each city has its own way of pursuing prosperity depending on the stage of socio-economic development, history and culture (UN-Habitat, 2013). Its attributes can only be understood in relation to their prevailing social arrangements, their economic system and the style of inducing spatial agglomeration (Scott, 2012). These systems depend on the interaction between the different actors in a city. It depends a lot on whether the communication is formal or informal; or whether the community is proactive to public participation or not.

Allen Scott (2012) points out that the core of a city resides in the theory that a group of actors cluster together in a geographic setting. They group to minimise the cost of their mutual interactions happening in the location of their inter-linked activities and take advantages of their jointly determined synergies, as a consequence of the size, scope and density of any social and economic order, refer to (Scott, 2012):

- Institutional arrangements
- Local markets
- Social interactions
- Capital-intensive infrastructure
- Efficient and cheaper production of goods
- Learning and innovating processes
- Intensifying the know-how

Diversity and multitude of ideas are natural for big cities and therefore, it is important to deal with combinations or mix of uses, rather than keeping them separate (Jacobs, 1961). The cohesive environment of the synergies, mentioned above, form the basis of an urban ecosystem present in every city. The level of efficiency and the availability of resources define the level of urban prosperity. Inefficient development notions and policies brings forward deprivation, inequality, instability and exclusion in a city. To understand better, UN-habitat (2013) identifies 5 categories of urban prosperity:

- Productivity
- Infrastructure
- Quality of life
- Equity
- Environmental sustainability

Evolving framework of an urban ecosystem views cities as heterogeneous, dynamic landscapes where multiple categories and the synergies (mentioned above) diverge (Grinn et al, 2008). A cohesive environment, where these categories and synergies connect and prosper at multiple scales, form the basis of an urban ecosystem.

Urban Ecosystems
Each urban system has its individual patterns and characteristics influencing its habitat. It functions as an interdependent system between provisions of public goods, work and social life. Any urban ecosystem can be highly interconnected and unpredictable (Macpherson et al, 2016). It has been observed that many significant and fast shifts in the social and physical structure of the cities are taking place. Some of the evident shifts can be seen in restructuring of local markets, renewal of urban landscapes, increased demand for housing, climate change, use of technology, etc. With the shift, urban ecosystems design now focus on integrative design, technological innovation and socio-technical transition. For a broader understanding in today’s context, we can say that a city should be capable of (UN-Habitat, 2013):

- Stimulating local job creation and promoting social diversity
- Recognising the importance of public spaces
- Providing social, political and economic conditions of prosperity
- Reducing disaster risks and vulnerabilities, especially in the poorer neighbourhoods
- Creating harmony between the dimensions of urban prosperity
- It is hard to imagine any complex system being run by a single authority or ideology. Any successful system requires proper functioning of its various elements. Efficiency of these elements is vital for the communities and individuals to flourish, thrive and sustain in a city. The key here is to walk a fine line and find the right mix of activities, to take initiatives and encourage people to participate actively (Betty, 2011). A comprehensive list is difficult to apprehend; however, there are a few elements that can always be identified for all the cities, some of them are mentioned below (UNDESA, 2012):

- Inclusive and locally rooted vision for cities
- Providing decent urban mobility for all
- Integrated planning of sustainable urban infrastructures
- Energy and water supply security and empowerment
- Sustainable construction processes, buildings and maintenance
- Promoting local skills
- Sharing data and knowledge
- Financing at all levels of the government

This issue of CIDCO@Smart further looks into these different elements in detail through various case-studies around the world. Each of these articles cover one or multiple points mentioned above. The different articles cover topics like:

- Accessibility to lower-income neighbourhoods
- Equitability of food
- Urban Heat Island effect
- Indicators for a slum redevelopment programme
- Impact of urban morphology on quality of life
- Self-organisation strategies in Amsterdam
- Low-emission zones in London
- Urban Sanitation and waste water challenge in India
Indicators for Slum Redevelopment Program

- Guidelines for a comprehensive and sustainable action

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**ACCESS TO JOBS AND ECONOMIC INTEGRATION**
Providing access to external job opportunities for the inhabitants of slums is a necessity, in the meantime, promoting the economic life inside the neighbourhood must not be neglected, and governments and NGOs can also foster the inhabitants’ skill development.

The Kojokrom market (Ghana) constructed sheds for the local market to ensure its economic importance.

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**WATER AND ENERGY SUPPLY**
A distribution system must follow 4 directions to be sustainable: reliability, education, funding and tenure requirement.

The Orangi Charitable Trust (Karachi, Pakistan) launched a micro credit programme to enable families to pay for sewerage and ensure its affordability.

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**HOUSEHOLDS BUILDINGS**
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The objective of enabling affordability of households can be reached through several policies. Examples like incremental housing development, sites and services programs, rental housing, social housing or housing cooperatives must be adapted to the project’s context.

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Addressing the risks should go through 4 phases: identification, stabilisation and control, reduction of the risk through technology and inhabitants’ education.

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To evaluate the impact of a programme requires to collect information before and during the implementation, in order to compare data. This can be done following the logical framework to identify objectives, inputs, outputs and outcomes of a project.

The 26 year-old Favela Bairro programme (Rio de Janeiro, Brazil) conducts a review of the level of services and satisfaction on a regular basis.

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**GOVERNANCE**
The various stakeholders present on a project should be organized around these four objectives: a clear administrative structure, a commonly defined focus, a specific methodology and a transparency obligation.

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A new physical sewage infrastructure and solid waste collection should be based on adapted dimensioning, a strong reliability and an educative aspect.

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Streets are the support for social life, commercial and cultural activities, and are the physical link with the rest of the city. Public transport networks newly created should be characterized by acceptability, adaptability, accessibility and affordability.
**Indicators for a Slum Redevelopment Program**

Informal settlements represent a significant part of urban ecosystems. Due to the booming economy, growth rate of cities in developing countries is much higher than the developed countries. Almost 32% of the urban population of the world live in the cities of developing countries (UN-Habitat, 2012). The same number was responsible for 50% of the urban growth globally between 2000 and 2012 (UN-Habitat, 2014). Unprecedented demand, lack of infrastructure and facilities creates marginalized populations and inequalities, leading to the growth of slums. The United Nations Habitat programme uses five characteristics to define slums (UN-Habitat, n.d.):

- **Inadequate access to safe water**
- **Inadequate access to sanitation and waste**
- **Poor structural quality of housing**
- **Overcrowding**
- **Inadequate residential status**

The interventions to upgrade conditions of the slums date back as far as 1969 when the Kampung Improvement Programme was launched by the UN in world’s first slum upgrading pro-grame (UN-Habitat, 2006). The aim of slum-upgrading programs is to tackle the issues mentioned above through a rather holistic approach. In India, tackling these issues can lead to improvement in the quality of life of at least 6 million households (Hindman, 2015).

This article takes a comprehensive look on some of the slum upgrading programmes and proposes common indicators that should be considered while designing slum redevelopment programmes. These indicators are broadly divided in three areas:

- Physical improvement
- Institutional systems
- Social policies

These indicators must comply with the context of the concerned upgrading program. Slums are organic neighborhoods following the ever-changing needs of their inhabitants. Narrow streets, hazardous locations and social frameworks must be considered while building a sustainable community that relies on the existing frameworks. Innovation is the key to create specific solutions for sustainable slum upgrading.

**Physical improvement**

Physical improvements visibly improve the quality of life and transform neighborhoods. Several programs advocate on the provision of infrastructures before solving the insecurity of tenure and other social concerns (De Soto, 2000). Some of the factors that should also be considered are as follows:

- **Steady Water and Energy Supply**
  - Mostly, slums lack a formal water and energy distribution system. The primary focus on providing the infrastructure, in many informal settlements, is often constrained due to the over-investment in formal infrastructure in access areas (Arias-Granada, Haque, Joseph, & Yanez-Paganis, 2018). However, it should also be noted that presence of a physical infrastructure alone is not enough. According to World Bank, the implementation of water and energy distribution system should follow the following steps (Arias-Granada et al., 2018):
    - **Funding**
    - **Tenure requirements**
    - **Education**
    - **Reliability**

Many households are not able to afford the implied expenses of a new water supply system. Re-development programs must include grants and subsidies to encourage the inhabitants to use the provided water and electricity supply network and the sanitation systems. For example, the Orange Charitable Trust in Karachi launched a micro credit programme to enable families to pay for sewereing (UN-HABITAT, 2014). Simultaneously, organising awareness campaigns can highlight the advantages of legal energy access and improve user-behaviour.

Furthermore, developing trust between users and providers spares reliability. The municipal networks must suffer no interruption, water must be clean and should be devoid of any bacterial contamination. For example, the slums of Dhaka have a water distribution system better than many slums, however, the quality of the water is not equally good, almost 57% of the dwellers still report quality issues (Arias-Granada et al., 2018).

**Efficient Solid Waste Management and Sanitation System**

In most slums, slums have no access to a proper drainage system (Hindman, 2015). The outdoor and indoor exposure to polluted water, in addition to open defecation, has a direct impact on inhabitants’ health (Nassar & Elayayed, 2018).

Improvements should integrate the following features:

- **Dimensioning**: The sanitation and waste management networks should be able to accommodate the area in influence, the amount of waste generated and the number of people responsible. Shared structures shall not exceed a limit, that can be settled at 2 households (UN-HABITAT, 2004).
- **Reliability**: The sanitary services provided must be available at any time and place and under any conditions.
- **Education**: Slum upgrading programs should raise awareness about waste management and hygiene behaviours.

The Asian Development Bank settled a system of efficient levels of collection in a few cities of Rajastan (Bikamer, Jaipur and Indore) (UN-HABITAT, 2004). Slum dwellers were hired to take care of the garbage collection and cleanliness of roads. This system is now sustainable and completely funded by the inhabitants themselves (ADB, 2003).

**Streets and Public Transport**

Streets and public transport networks help in creating a continuity essentially to erase the rupture between formal and informal neighborhoods. Proper streets have a great impact on social life and can serve as an outdoor extensions of living spaces; they are a vital support for commercial and cultural activities too. Thus, the transformation of the neighbourhood must preserve the community supported framework and its social advantages. Similarly, public transport passing through a neighbourhood provides access to basic services, jobs and other opportunities in the city (UN-HABITAT, 2014). As a structural component, the transportation network must be efficient. This is characterised by its:

- Acceptability
- Adaptability
- Accessibility
- Affordability

While integration of streets network with the informal settlements seems simple, however, it must be well planned. The new street network should be build around the existing network in order to build a coherent infrastructure for the area. Public transport and access for emergency vehicle should be clearly delimited (Sheeh, 2009).

**Households and buildings**

Dwellings in slums have specific characteristics:

- Poor construction quality and organic disposition of the different households. Households can be usually located closely to each other and not well lit or ventilated. Redevelopments or relocations with proper space management requires construction of new households, following three major characteristics:
  - Good construction quality of the new dwellings ensures sustainability of the programme over the years. Well-constructed houses coupled with a tenure security programme, gives the citizens a sense of belonging and encourages them to stay longer (Vogga et al., 2012). This also highlights the necessity of compliance with building codes, standards and laws (UN-HABITAT, 2004). Slums households must be adaptable as per the demands of the inhabitants and the overall objectives. Several redevelopment projects construct pre-designed buildings without adapting to the context.
  - For example, 26% inhabitants of Serra do Xeré in Sao Paulo, Brazil faced greater expenses when they were relocated to a neighbourhood not designed as per their previous livelihood (Cavaleiros & Aikos, 2015). The needs of the dwellers play an important role during the conception process. In informal economy systems, workshops and shops are often installed within the house or in public spaces directly connected with the house. Women, children and the elderly tend to sociate a lot within these spaces. These common areas are a vital part of the social framework of slums (Susuki-Black, Bardhan, & Haque, 2015). Citizen’s participation is one of the best ways to identify and accommodate these specific and changing needs. For example, in Dharavi, combined housing addresses the needs of the inhabitants (hereafter Shekh, 2015). After consultations and specifying their needs, the inhabitants can rent or buy the modules and then choose to extend their house to this latest. This combined housing system provides a flexibility necessary for the families living in slums.

**Figures**

- Figure 1 – Combined housing (Menshawy et al., 2016)

- Figure 2 – Metrocable in Medellin, Colombia

- Figure 3 – Slums households must be adaptable as per the demands of the inhabitants and the overall objectives. Several redevelopment projects construct pre-designed buildings without adapting to the context.

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**Facilities**

Providing proper health and education facilities help in tackling many social issues. For this, three objectives must be followed:

- **Adequate capacity**: Addressing the needs of the area the facility serves, without building oversized facilities.
- **Localisation**: Accessibility for the community and coherence with the environment and the public aimed.
- **Management**: The role of governments, NGOs and private parties in administration and funding should be defined during the first stages of the programme (Sunikka-Blank, Bardhan, & Haque, 2015). As a structural component, the transportation network must be efficient. This is characterised by its:

- Acceptability
- Adaptability
- Accessibility
- Affordability

- **Natural hazards**

Due to their irregular development without proper planning, slums are usually more vulnerable to natural disasters than conventional neighbourhoods. Although, resilient cities have started adapting to the effects of natural disasters,
but slums are not entirely integrated into this approach and lack protection against floods, fires and landslides (UN-HABITAT, 2014). In most cases, relocation seems like the only possible solution, the concentration however should also be on reducing the risks and hazards by (Betancur, 2007):

- Identifying zones of high risk.
- Installing infrastructures of stabilization and environment control.
- Using technologies and knowledge that reduces the risk, especially in the construction of these buildings. These must follow good environmental practices.
- Educating the local population about adapted behaviours.

In Medellín, Colombia, most informal settlements were located on the hills and were subject to landslides and other geological risks. The PRIMED redevelopment project resulted in the recovery and stabilization of 70% of high risk areas (Betancur, 2007).

Institutional Systems

Governance

Owners and tenants, civil society organisation, the private sector and national and local governments have different interests and visions for the neighbourhood they live in. The institutional systems must have:

- A clear administrative structure: Coexistence of different organisations must be organised within the project to enable collaboration and avoid the concentration of powers.

- Clear objectives: A clear and focused plan brings the actors together to negotiate and set basis for efficient partnerships.

- Defined approach and methodology: Strategies of the program must be clearly defined. It must avoid favouring and rely on partnerships with the existing social forces.

- Transparency: Helps the inhabitants in understanding the role of each stakeholders and the organisation, and simultaneously in preventing corruption. In Kenya, the KENSUP programme created a local authority called Settlement Executive Committee to avoid conflicts between their stakeholders (UN-Habitat, 2011). At the same time, local governments must also commit to provide infrastructure and state authorities should facilitate the implementation of policies (Cities Alliance, 2013).

Tenure Regularization

Slum residents have varying tenure security and are under constant risk of eviction. In Africa in 2007, more than 2,700,000 people in Africa and around 8,730,000 in Asia and Pacific suffered forced eviction (OHHI, 2009). This is a barrier to access credit and improve the quality of the house (Menshawy et al., 2016) (Syagga, 2012).

- Security of tenure also supports the effective implementation of legal water and energy access. The process can be monitored by a national or local government, even if community organizations and international development agencies can have a role to play (Fernandez, 2011).

- Community engagement: A recording of land transactions must be feasible to avoid the concentration of powers.

- Identifying leaders to facilitate the implementation:

- Monitoring and Evaluation:

- Enabling affordability of households:

- Tenure type must be engineered according to the local context. Registered freeload may not be the ultimate objective.

- Customers/land tenure processes can be promoted when they don’t discriminate vulnerable social groups as poor and women.

- A participatory enumeration, a form of community participation, must be advocated to collect more precise data.

- A recording of land transactions must be carried out, over the long term, thanks to tools implemented in the short term to simplify procedures.

- Community integration through the ladder of participation of women in the decision-making process (Sunikka-Blank et al., 2019). An active participation of women in the decision-making process at all levels of conception makes the community integration more inclusive.

- Property rights control should not primarily consider men as the default choice. In 2009, women were head of one third of all Venezuelan households (Fernandes, 2011). In the Peruvian programme of Commission for the formalization of Informal Property, land titles were given jointly to wives and husbands (Fernandes, 2012).

- Brazil evaluated the impacts of the upgrading project on the quality of life of the inhabitants. They compared the initial objectives to the effective benefits, using data from the beginning of the project and data collected 10 years after through surveys. The subjects covered are the residents’ satisfaction, the benefits accrued to the population, and the level of infrastructure and services (Fons, Riley, & Ramirez, 2000).

- Social Policies

- Community Participation:

- Top down actions and resources from higher institutions usually fail to generate local engagement and acceptance (Menendid & MacDonald, 2017). When relocating, building the project together with the inhabitants can help it correspond to their needs and avoid the failure experienced by several projects (Cavalheiro & Alberto, 2015). The project can assess the level of community integration through the ladder of citizen participation. It characterizes the degrees of popular integration in the decision-making process.

- Monitoring and Evaluation:

- Evaluating the impact of the implemented policies can improve the methods used. Today, there is a lack of this kind of systematic and complete evaluation of every slum upgrading programme (Goytia & Dorna, 2019). The key principles of a programme evaluation can be summarised through the logical framework structure keeping in mind the impact:

- The inputs: The policies implemented that operate within the various topics related in this article.

- The outputs: can be an increase in the dwellers’ income, a better literacy rate or a drop in crime, for example. Thus, results, a strong database is advocated.

- The programme Favela Bairro in Rio de Janeiro (UN-HABITAT, 2011):

- Promoting and encouraging market development and capacity building within the slum population. This measure can have a direct effect with policies of households and in infrastructure building and with community participation.
Self-Organisation in Amsterdam:

A city—a meshwork of players, comprises of people with common interests pursuing their lives in different ways. There are many unpredictable collaborations between the stakeholders to achieve their individual, commercial or political goals (Landa, 2000). These collaborations develop a pattern of connections based on the hierarchy in the society or the styles of interaction that define the community structure. Therefore, the focus of planners should be on implementing short-term, slight changes to adapt accordingly (Batty, 2011).

The traditional Dutch approach in planning with specific details. This included distribution of activities, spatial layout and even the visual appearance of urban blocks. The dense urban spaces left very little scope for redevelopment with lesser density and future projects. These cases can be seen in many city centres of Dutch cities having an evident mix of activities but limited scope for redevelopment.

However, Netherlands has also been trying to develop co-operation strategies among citizens, civic organizations, entrepreneurs, etc. for many years now (WWF, 2008). The new structural vision of Amsterdam 2040 follows the old spatial planning approach, yet on many important points they have diverged from the previous structural plans. The emphasis in these cases is on addressing the social needs and concerns. The visual aspects are complimentary (WWF, 2008).

Organic planning (Butler, 2014) focuses on creating conditions to allow diverse local initiatives for an incremental urban development. The stakeholders, here, are directly responsible in creating a demand-driven urban ecosystem (Ravos and Rao, 2015). Organic planning approaches a multi-layered view emphasizing on inter-dependence between processes of different scales and different moments (Byrne, 2003). The multi-layers of the urban system can be broadly divided into three levels (Boonstra, 2015):

- Macro – Society or neighbourhood
- Meso – Network of established players
- Micro – Group of independent agents

This new approach has brought interesting development strategies in many neighbourhoods of Amsterdam. This article takes the case-study of Oostenburg in Amsterdam and explores the development strategy of the local authority. The neighbourhood has an interesting approach to bring diversity in activities, avoid homogeneity or polarization, encourage small-scale entrepreneurs and have temporary land use to adapt to the changing socio-economic context. It emphasizes on realizing a coherent relation between social desires and spatial development through different approaches.

Oostenburg, Amsterdam

Oostenburg is one of the three (Oostenburg, Kattenburg and Wittenburg) islands in the north-eastern part of Amsterdam. The island was built in the 17th century by the Dutch East India company for warehouses and a shipyard. Given the strong historical influence on its structure and planning, the municipality is taking special considerations for the conservation of the urban values. On the south-western side, four buildings of early 20th century, named after the architect Van Gandthallen, received the monument status in 2001 because it constituted “great historical, architectural and urban values” (Loos, 2014). After the collapse of the industries, the area went through a lot of clean-up and regeneration. Although some parts of Werkspoor are still preserved, the island, however, lost its vibrancy with the decline of the industries and its locational isolation.

Amsterdam’s dense urbanization brings opportunities for growth in Oostenburg. The INIT building was built in 2000, it has the district’s wharf on the ground floor and offices on the upper floors. In 2004, real estate company Stadgenoot bought the Van Gandthallen buildings. For many years, many professional and cultural activities were hosted there. In 2008, Stadgenoot bought the remaining area of Oostenburg north exceptINIT and the south-western area.

Decision Making Process

From 2004 to 2008, Stadgenoot made many unsuccessful plans to re-develop the area, primarily due to lack of clear vision for political and social development (Stadgenoot, 2013). These failed interventions alongside 2008 crisis made Stadgenoot re-strategize their development plan. Therefore, in 2011, Stadgenoot and the municipality eventually intervened with an ambition to create a mixed environment for working and living.

In the initial stages, the plan was to develop an open structure connected to the environment. Instead of developing a single master plan, the development plan was implemented in stages where the land is sold in small lots, individually. The sale and development of parcels, and investment in public spaces and facilities is taken care from the profits of the sale of previous parcels of land.

The focus was on creating a good outdoor public space and have limited vehicular access, by:

- Visualising the yard floor as a unifying element and as a medium to promote pedestrian and bicycle movement
- By avoiding traditional building block layout

In a general outlook, most of the outlines for the design and the program is fixed, but the island, on the inside, has a lot of freedom and flexibility for better spatial solutions. Through a series of products, a framework of rules for the development of the spaces were developed, this framework identifies four qualities of the island. (Urhahn, 2016)
3. Contrast
The neighbourhood has an industrial presence but also accommodates bars & restaurants. The architecture and activities are diverse.

To ensure contrast in activities and the architecture, the land owned by Stadplan is being developed in parcels. Size of the plots varies; the development plan suggests maximum width of a plot but does not put any restrictions on the depth. The plot width is coupled with the front orientation of the buildings. There is a lot of scope for variation in height, roof shape, and provide light and air through the cluster of the buildings.

4. Toughness
The heavy industrial history and the rugged architecture gives a strong visual impression and an identity to the island. The older buildings in Oostenburg appear as a single block with simple but robust detailing. The activities opening on the street are encouraged, especially if the side is waterfront. The buildings run into each other. The roofs of the buildings are more open towards the side facing the water.

The development plan follows the same line of visual appearance around the van Gendthallen building. The indoor and outdoor public spaces run into each other. The roofs of the buildings are decided on what fits best, they do receive proper attention and are not cut-off abruptly. Aiming for a higher level of interaction and liveliness, balconies on the side of the street are encouraged, especially if the side is waterfront. The buildings are more open towards the side facing the water.

Van Gendthallen building offers temporary work spaces capable of adapting to different needs of different organisations. The offices in INIT building and nightlife in Roest is already active. This mix of activities makes Oostenburg capable of attracting public and keep the place active.

Response
The land in Oostenburg is of high demand due to its location and proximity with the city centre. The sale of the plots in the first parcel began in 2017. Currently, sale of DIY plots in the 9th parcel is active and construction in 5 parcels is under-going (Oostenburg.nl, 2019). The end of construction is stated to be around the end of 2020.

CONCLUSION
The outcomes of these cases manifests specific physical growth, urban form and morphological or functional patterns. It allows the urban systems to distribute the decision-making power to its diverse actors and avoid the dominance of a single actor (or activity). It’s tendency to self-organise the development safeguards the interests of the actors and maintains a dynamic socio-spatial nature (Boonstra, 2015).

The distinctions (agency, rules and physical order) in decision-making process carry out the transformation process in their own way. This results in a complex environment capable of self-organising itself through multiple interventions. The development plan has four design principles (Rauws, 2015):
1. Smallscale sub-plans
2. Incremental development strategies
3. Carrying structures
4. Loose rules

It is also important to understand that these development plans are highly contextual and depend on the level of interaction. The planners’ style of intervention and the style of mediation in this complex set-up depends on the context and the understanding of the social system (Tien, Bekkerling, and Heijnderop, 2014). A good interaction among the actors can only come with a strong sense of community building. It may not be active and prevalent in every case. Therefore, such a solution can be implemented only after a deep understanding of the neighbourhood or the city. In absence of strong and dense pre-existing networks, taking an intervention like this can be too much work, even if the actors are skillful and committed (Uitermark, 2015).

From the case-study, it is also evident that the nature of urban planning is not entirely self-organising. It requires interventions at multiple levels to safeguard the interests of the actors. Therefore, the true role of the actors and the level of freedom they eventually enjoy while developing their spaces is always in question.
Urban Heat Island Effect

Causes and Remedies

Development in the urban areas cause changes in the landscape. Vegetation and open spaces is replaced by the buildings and infrastructure and the permeable surfaces get converted into impermeable surfaces. In a typical urban area, the surfaces are darker, impermeable and the vegetation is relatively lesser. The modified land surface in cities, compared to rural environments, affects the storage and transfer of both radiative and turbulent heat (Parvantis, Stigka, Fotiadis, & Mihalakakou, 2015). It leads to a phenomenon where the heat gets accumulated due to the urban construction and other human activities, leading to urban heat island (UHI) effect. The most noted observation about UHI effect is that the temperature of urban region is higher than the rural region (EPA, 2008). This difference can be as much as 2.5°C during the summers (Albarn et al., 2003). The urban heat island phenomenon is caused by two factors:

1. Intrinsic nature of cities (anthropogenic activities like vehicles, air conditioners, etc. along with urban vegetation, urban canopy, wind blowing, surface characters and land use planning forming the urban structure)
2. Extrinsic factors (climate, prevailing weather circumstances and the seasons)

These factors increase the energy consumption in buildings in the effort of procuring thermal comfort and results in increased air pollution, eventually leading to increased greenhouse gas emissions and negative impact on health of citizens of developing cities (TER, 2017). It has been noted that the indoor temperature leads to 2.4% increase in electricity consumption (Albarn et al., 2003). Urban flooding during heavy rains, traffic along with increased temperature, diminishing lakes, increase in temperatures during summer some of the negative environmental terrestrial effects of a rapid urbanization (TER, 2017). These environmental impacts are a result of the combination of Urban Heat Island and Global Warming effect. This article talks about the Urban Heat Island effect and explores the cooling strategies adopted by Sydney to reduce the impact.

Causes and Effect of Urban Heat Island

Due to the lack of green spaces and the effect of the intrinsic and external factors discussed above, surface temperature rises (Dismore, 2017). Natural surfaces absorb more radiation in comparison to man-made structures like roads and buildings having lower albedo. As a result, natural surfaces is always cooler than an urban surface. Evaporation from water releases energy and cools the surface temperature. As the heat capacity of asphalt and concrete is lower than other types of surfaces, the better radiation falling on the built surface causes the air temperature to rise. Therefore, rise in surface and air temperature is directly proportional to the height of the built-up areas.

Conditions of the available natural resources and the climate in the urban ecological system is affected by the increased surface temperature (Ningrum, 2018).

Urban Heat Island and Climate Change

Changes and development in radiative and thermal properties of urban infrastructure are causes of urban heat Island also. The functioning of a building has impacts on the local microclimate. A study by Ningrum (2016) shows that the cooling effect of night is slowed down by tall buildings. The heating effect occurring in cities or specific areas leads to a change in the climatic conditions of the region leading to local climate change. Local climate change is different from climate change, their effects are limited to the local scale and decreases as the distance increases. Global climate change caused by increase in sun’s intensity or greenhouse gas concentrations are not locally or regionally confined (EPA, 2008).

Adaptation and Mitigation Strategies

Urban areas need better development planning and a balance between social, ecological and economic factors. The correct ratio of built-up and open spaces, control over the growth of built-up areas, more sensitivity for the open spaces are few of the many things required. This can be done through spatial development planning associated with sustainable development and creating a comfortable urban environment. Some of the adaptation strategies can be:

- Developing the green and blue areas within a city
- Managing the growth of built-up areas of the buildings

Suitable areas can be developed by forming roof gardens or more trees can be accommodated in the streets as they are a better heat-stress suppressor (Ningrum, 2018). To mitigate the urban heat island effect, the thermal environment around the buildings should be improved by using material of lower absorptivity, larger thermal conductivity and higher reflectivity (Ningrum, 2018). Durable white roofing materials and cool coloured roofing available for coating, tiles, painted metals, and fibreglass asphalt shingles are being produced by manufacturers (Albarn, 2016). To directly reduce the energy use in buildings, shading devices, trees and cool roofs should be installed more often. In addition to cool roofs, urban vegetation and higher albedo and emissivity pavements reduce the temperature of the surroundings by a few degrees (Albarn, 2016). For water drainage, many paving materials and paving surface technologies have been characterized such as coloured concrete, white topping, chip seal, permeable pavements and grasscrete. These cool paving technologies are currently used in many specific applications (Albarn, 2016).

Effective urban cooling in a city requires the correct strategy of cooling depending on the available factors, factors like the state of development, aspect ratio, sky view factor, inner city CBD, inner and outer suburb areas have different strategies for urban cooling and should be carefully examined as per the character of the city before implementing. Local weather conditions and spatial configurations must be carefully considered before the application of urban cooling methods. The urban context of the cities can be divided into three categories (Dismore, 2017):

- Inner city: Tall buildings surround the public spaces. Due to the shade of the buildings, urban surfaces are partially protected from the solar radiation. Therefore, in smaller public spaces, like plazas, pedestrian open air malls, using high emissivity cool-paving and building envelope treatments prevents ventilation and facilitates less heat storage.
- Inner suburbs: Two to six storey buildings surround the public spaces and due to the shade of the buildings, public spaces are partially protected from solar radiation. Depending on the city’s latitude, solar radiation may also reach the public spaces. To complete the shadow over urban canyons an opening of temporary and tree canopy shade may be used.
- Outer suburbs: The development is low density in many cities and has a high sky view factor. Typically, in this urban form, area comprise mainly of single or double-storied buildings. The public spaces are generally not protected by the solar radiation by the shade of the surrounded buildings. Therefore, the main sources of shade in the plazas are tree canopy and shading by trees.

Case Study: UHI in Sydney

Intrinsic and extrinsic factors

Intrinsic factors in Sydney are relatively hot and humid. Highest monthly mean temperature of the city is 29.5° Celsius and daily sunshine during summers is of 7.5 hours on an average. The maximum mean monthly rainfall of 17 mm, rainfall in the month of July is slightly lower than in autumn but higher than spring and winter (Dismore, 2017). The studies suggest that the Urban Heat Island Intensity (UHI) ranged from a mean of about 2-4°C and average daily peaks of 7°C (Parvantis, Stigka, Fotiadis, & Mihalakakou, 2015). Sydney increasingly experiences the UHI due to its numerous urban development projects (Sharif & Lehnert, 2006). It is estimated that the combined effect of Global Warming and UHI will increase the temperatures by 3.7°C (Argüeso, Evans, Fita, & Lehmann, 2014). It is estimated that the heat island effect and solely responsible for the extreme heat events in Sydney (Dismore, 2017).

The effective energy efficient measures such as increased levels of tree planting in streets and parks, appropriate orientation, increased shading and application of reflective painting on the building envelope can also be employed. The integration of these design techniques and adaptation in existing and new building designs can considerably reduce air-conditioning and increase the indoor thermal comfort of the occupant.
Towards Better Air Quality: 

Case study of London’s LEZ

Introduction

Noxious air quality and its long-term effects on human health has been a growing concern for many years now. WHO estimates that outdoor air pollution is responsible for 29% of all deaths and diseases leading to lung cancer. It also has an impact on the health of children and the elderly. In London, the inhabitants live in an area exceeding World Health Organization guidelines for air quality (TL, 2019). More than 9000 people die every year in London because of air pollution (GLA, 2017). It has been found that the most deprived areas and areas with children were also the most exposed places to air pollution (Kelly, 2021). It shows that tackling the issue of air quality relates to tackling various other linked social issues, such as social inequalities for example.

Air pollution is today characterized by the presence of specific components. The World Health Organization identified the most harmful pollutants before editing guidelines to limit their concentration.

- PM for Particulate Matters, categorized by the size of the particle (PM2.5 is particles with a diameter of less than ten micrometers (µm)).
- NOx for nitrogen dioxide
- CO for carbon monoxide
- NO2 and sulfur dioxide

London is mostly concerned by the PM and NO2 pollutants (GLA, 2016; WHO, 2017) where the road transportation has a major role to play. Half of the NOx, PM2.5, and PM10 emissions are produced by the vehicles on the roads in London (GLA, 2017). In 2008, the city had the worst outdoor air quality in the United Kingdom and one of the worst of Europe (WHO, 2017). In 2008, the city had the worst outdoor air quality in the UK and one of the worst in Europe (TL, 2008). Moreover, the authorities always had the obligation to work towards EU quality norms whose first policies on the subject were launched in 2005 (European Commission, 2017).

Since the 2000s, the number of Low Emission Zones (LEZ) initiatives in Europe has increased, with leading cities achieving similar results. In September 2017, there were 237 LEZ in 12 countries in Europe (Ademe, 2018). The principle idea is to tackle the traffic congestion on roads and performance of the vehicles. These two factors are responsible for a greater part of the air pollution in our congested cities and large cities. On similar lines, the London city hall decided to implement a Low Emission Zone (LEZ) as the key action to tackle its issue of rising air pollution. The LEZ enforces exclusion of the polluting vehicles from a zone including the city. Through the interventions, emissions are projected to consequently reduce and incite people and companies to buy modern and cleaner vehicles. This article explores the case study of the LEZ in London and looks into their interventions and regulations taken by the authorities to regulate the issue of increasing air pollution in London.

The London Low Emission Zone

The analysis of London’s air quality in 2003 showed that emissions were already decreasing due to better upcoming new vehicles. The objective was to accelerate this trend in order to reach WHO’s guidelines faster, and to ensure every area in Greater London achieve it (AEA, 2003). To do so, the Low Emission Zone was introduced in 2008. Two policies were to be implemented through the LEZ:

- decrease in the number of vehicles on the road
- modernization of the fleet in order to reduce individual emissions.

The proposal for a Low Emission Zone came directly from the Mayor Transport Strategy and the Mayor of London in 2006 (Wilson, 2006). The scheme is now managed by Transport for London (TfL). Moreover, the London Local Air Quality Management (LLAQM) agency was created in 2016. It monitors air quality in each borough in the capital. Their role is to declare the places exceeding limit value limits, ensure an Action Plan is in place and updated, and annually report the monitoring.


effect at priority locations such as schools, and tackling inequalities.

With EU and UK limits concerning air pollutants.

Read WHO guidelines by 2010. These are more lenient than EU levels because they concentrate solely on the health issues and do not emphasise on the environmental aspects.

These are labels characterizing a vehicle’s emissions of PM and NOx. The higher the number, the more restrictive the norm. A small synopsis has been explained in figure 2. The implementation of the LEZ follows 4 stages. This incremental process attempts to reach the initial goal without generating a crisis for the vehicle users because of restrictions.

It was noted that the Low Emission Zone has a national impact as a large proportion of the national fleet comes to London at any given time (AEC, 2003). The indicators are fixed in a way to find a balance between costs to industry and the impact on air quality. A last Stage 5 was added to reach Euro IV norm for NOx for the bus fleet of London. The main objective is to become the first zero-emission bus fleet in Europe.


London 2008

<table>
<thead>
<tr>
<th>PM2.5</th>
<th>PM10</th>
<th>NOx</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5</td>
<td>19.1</td>
<td>28.6</td>
</tr>
</tbody>
</table>

In order to control the access to the LEZ, TfL installed a CCTV surveillance system at multiple locations in London. Fixed or mobile cameras can read license plates and create a database of the violators. This information is then compared to the database from different organisations that identifies each vehicle in Great Britain. TfL reported a 95% rate of compliance for every phase of the implementation (Ademe, 2018). In 2008, it was predicted that this monitoring system would cost £50 million and each year, the running costs would be £80 million. It was also predicted that the system would yield £43 million through fines and entry taxes (TL, 2008). Users can pay to enter the LEZ with a non-compliant vehicle, providing a daily fee from £100 to £200. Infractions are punished by a fine from £100 to £120.


In the Second Stage, the city introduced a Congestion Charge Zone (CCZ). The municipality also settled a Congestion Charge zone in 2003 to enter in the central London area. It operates from 7am to 10pm during weekdays. Every vehicle, except motorcycles, disabled drivers, electric vehicles and collective transport, is affected and must pay a £15.5 daily fee to drive within the zone. The objective is to reduce congestion and pollution in this area. In comparison with the previous year, the traffic reduced by 25% and parking in the area increased by 66%. Moreover, all the net revenue is spent on improving public transport across London (TL, 2019). The objective is to favour a switch to public transport, well-developed in this area.

Other Policies Promoting Better Air Quality

The LEZ has significant impacts on the air quality in London. It is not sufficient and is integrated with various other policies. Recently, London implemented the first Ultra-Low Emission Zone (ULEZ) of the world in the central area of London. It replaces the former T-Charge (basicity charge), and will operate within the same boundaries at all times of the day. In this area each vehicle required to be of specific norms. The standards are:

- Euro 3 for two-wheeler cars
- Euro 4 for petrol cars
- Euro 5 for diesel cars
- Euro VI for heavy vehicles.

The vehicles not meeting the emission standards will have to pay £32.5 for light vehicles, and £100 for heavy vehicles. This fee is in addition to the congestion charge that operates in the same area. Its boundaries are proposed to be extended in October 2022 to the northern and southern circular roads of London (TL, 2019).

Since 2008, many other initiatives have also emerged. Transport for London launched a Freight Quality Partnership to set up a dialogue with freight industry, local governments and environmental groups. Good construction logistic practices, cleaner technologies and right-time deliveries are some of their projects to limit the impact of freight delivery on air quality (ADAM, 2018).

The Energy Master Plan of London also plays a role in air pollution reduction. An important part of emissions is due to residential activities. The use of bad quality fuels, for example 37% of NOx emissions (GLA, 2017). Implementing and promoting a decentralised energy network tackles part of the issue. Here, the local authorities provide heat and power demand locally and can therefore control the origin of this energy by privileging cleaner energy production systems (GLA, 2017). This is also a way to regain a local control on the pollutant sector. This contribution is vital as a great part of London’s air pollution comes from its outdoor buildings (Walton, 2015).

This last observation underlines the necessity of collaborations for national and European policies to tackle air quality issues. London authorities relies on data and information provided by the Convention on Long-Range Transboundary Air Pollution adopted in 1979. It has been ratified by most countries of Europe and North America and identifies specific measures to be taken by parties to cut their emissions (UNECE, 2018).

Evolution and Impacts

The graphs below present the decrease in concentrations of pollutants in the air by 2017. The LEZ has led to a significant reduction due to the direct impact of the LEZ policy. However, we can qualify this assessment by looking more closely at the different graphs. The WHO objectives in roadside or inner London is yet to be achieved and there hasn’t been any significant changes in the levels of PM10. The most polluted areas still lack in providing proper quality of life to inhabitants. This amelioration might not only be due to the LEZ implementation. Many factors have to be taken into account, however we can reasonably think that the impact on road transport has been significant.

Conclusion

Air pollution in India is a major crisis and needs immediate action. There. However, a LEZ alone is not sufficient to reach the WHO’s requirements. Many efforts still must be done on other sectors such as industries, housing or non-road transport. Moreover, it is important to note that improving the air quality and reducing the pollution is a global concern. The upcoming challenge is to gather these various ambitions into collective action from the cities, the governments and the international agencies.

Figure 2 – The 4 stages of the Euro norms

Figure 3 – Trends in NOx in London, 2000 to 2016

Figure 4 – Trends in PM10 in London, 2004 to 2016

Figure 5 – Trends in PM2.5 in London, 2004 to 2016

Source: Greater London Authority, 2017
**Urban Food Systems:**

- **Case Study of Baltimore Food Policy Initiative**

**Introduction**

A highly urbanised world puts tremendous influence and demand on the food systems, affecting their management, functioning and performance (Jang et al., 2017). The diet of the people and the style of production and distribution of food affects its accessibility, affordability, the related job opportunities, etc. Currently, the cities lack relevant data and empirical analysis on food systems (Jang et al., 2017). The lack of data leads to a lack of understanding issues and prioritising relevant projects and programs. Inefficiency of policies leads to inequitable access to food leading to creation of food deserts.

An area where inhabitants have low access to affordable and healthy food is referred to as a food desert. The definition and the way to measure it varies. Some focus on the number of stores within a specific distance (Henderson, Smith, & Ellenkamp, 2006), and some other emphasise the quality of food available (Cummins & Macintyre, 2002). The John Hopkins Centre for a Livable Future, designates an areas as a food desert if:

2. Supermarkets and grocery lacking accessibility due to higher logistic cost (Walker, Kane, & Burke, 2010). Testimonies and case studies show people travelling 1h to reach the first affordable supermarket (Butler, 2018).

As people tend to make food choices based on the availability in its/her surrounding areas (Furer, Stogniew, & McIver, 2001), food deserts have a high impact on the inhabitant’s health. Being far from a supermarket or in an inaccessible environment favours an unhealthy diet (Koore, Dier Roux, Nettleton, & Jacobs, 2008). Rose & Richards, 2008). In comparison, Baltimore city was at 23.2% (Feeding America, 2019), and 23.8% in 2014 (Biehl et al., 2017).

**2018 Baltimore City Healthy Food Priority Areas**

![Map of the Grocery Store Incentive Areas](Image)

![Map of the Grocery Store Incentive Areas](Image)

**Source:** County of Baltimore, n.d.

**Origins of BFPI**

From the early 2000’s, various individual efforts started taking place in Baltimore to tackle the food insecurity (Santo, Yong, & Palmer, 2014). To bring these stakeholders together, the mayor of Baltimore launched in 2009 the Baltimore Food Policy Task Force and released a list of recommendations as a roadmap for action for a healthy and sustainable food system (Santo et al., 2014). In 2010, this led to the establishment of the Baltimore Food Policy Initiative (BFPI), a new intergovernmental collaboration. The Food Policy Action Coalition put together as much as 60 Baltimore stakeholders (NGOs, farms, universities, businesses, hospitals, residents), with the objective to drive a concrete implementation of recommendations (Santo et al., 2014). City of Baltimore, (2018).

The objective of the Baltimore Food Policy Initiative is to improve health outcomes by increasing access to healthy affordable food in Baltimore City’s food deserts (City of Baltimore, 2018). Its actions can be parted in 3 areas:

- **Actions on demand:** promote nutrition assistance and address food accessibility
- **Promotion of alternatives:** promote grassroots initiatives (with the help of RFEA) and urban agriculture
- **Actions on supply:** increase the number of stores and the quality of food proposed

BFPI acts at a local level, even if it can advocate on policies at state and federal level. They work with organisations in order to improve practices, and change regulations at the city level. The city level policies concentrate on adapting the offer; Accessibility, affordability and diversity are essential to provide variety to everyone, to encourage and foster food diversity, which is not sufficient, and policies for health and food security must also act on demand. Concerning health issues, studies show that it is more efficient to act at the household level by improving the food access. In addition, food assistance with the neighborhood level by providing a supermarket or a store (Ver Ploeg & Wilde, 2018). For this purpose, solutions such as food assistance, targeted food price subsidies, or not having to buy. The use of technology in urban planning practices is also been used to improve sales of healthy products in small retail stores (Mancino, Guthrie, & Judd, 2016). There are new solutions to explore and involves various actors. The example of Baltimore illustrates how cities can have an impact on the existence of food deserts. It affects the inhabitant’s health through the enhancement of their quality of life.

**2018 Baltimore City Food deserts**

![Map of the Grocery Store Incentive Areas](Image)

![Map of the Grocery Store Incentive Areas](Image)

Source: City of Baltimore, n.d.

- **Supermarket**
  - Number: 122
  - Food Retail Incentive Area
    - Number: 150

- **Small Grocery and Corner Stores**
  - Number: 525
  - Food Retail Incentive Area
    - Number: 120

- **Environment**
  - Number: 4,000
  - Food Retail Incentive Area
    - Number: 200

- **Public Market**
  - Number: 6
  - Food Retail Incentive Area
    - Number: 30

- **Overall**
  - Number: 763
  - Food Retail Incentive Area
    - Number: 100

**BFPI also launched the Homegrown Baltimore programme.** The objective is divided in 3 components:
- **Grow local** – promote urban agriculture
- **Buy local** – link producers and consumers with farm markets and make arrangements between farmers and schools, institutions and universities
- **Eat local** – provide education and incentives to promote consumption of locally produced food. For example, a partnership with the Managerial and Professional Society enables their employees to earn 250$ on participating in CSA (Community Supported Agriculture). In a survey held in 2014, 85% of the participants agreed that participating in CSA has consumed healthier food.

Some indicators give an overall idea of the impact of the BFPI policies in the city of Baltimore. The Feeding America website indicated in 2017, 23,1% of the Baltimore citizens lived in food insecurity, compared to the 23,2% in 2015 (Feeding America, 2019). BFPI part of the Millen Urban Food Policy Pact and received an award in 2015 for their use of intergovernmental collaboration.
Impact of Urban Morphology on Social Life:

- Case Study of La Duchère, Lyon

Introduction

Buildings and public space morphology strongly impact the living communities. Social interaction is one of the major design elements in urban planning. Apart from providing a living space for the inhabitants, housing should also offer spaces for public life to incubate. Building such neighbourhoods is a challenge with no perfect solution. However, in the late 90s, the outline of an ideal emerged (Urban Task Force, 1999). This ideal advocates compact and interconnected neighbourhoods, a mix of use and a variety of housing types, detailed below:

1. Interconnected neighbourhoods: Any urban unit is always in interaction with its environment. Pedestrian friendly areas are advocated because they encourage sustainable and inclusive mobility network. However, it doesn’t mean cars should be moved out of the city. Despite their negative impact on quality of life, they are essential to deliver complete mobility solutions (Congress for the new urbanism, 2001).

2. Compactness: With the objective of preserving the natural land, it is essential to favour use of brownfields and re-use built areas. It enables connecting amenities inside and outside the neighbourhood. Neighbourhoods should have a discernible centre and defined borders, connecting amenities inside and outside the urban unit is always in interaction with its environment. Pedestrian friendly areas are advocated because they encourage sustainable and inclusive mobility network. However, it doesn’t mean cars should be moved out of the city. Despite their negative impact on quality of life, they are essential to deliver complete mobility solutions (Congress for the new urbanism, 2001).

3. Mix of use: Linking mobility with mixed land use makes the neighbourhood more attractive and habitable. It enables connecting amenities inside and outside the urban unit is always in interaction with its environment. Pedestrian friendly areas are advocated because they encourage sustainable and inclusive mobility network. However, it doesn’t mean cars should be moved out of the city. Despite their negative impact on quality of life, they are essential to deliver complete mobility solutions (Congress for the new urbanism, 2001).

4. Housing diversity: Just like mixed land use, a broad range of housing types is essential in creating a sense of community. At the same time, it is necessary to allocate tenures for social housing. It attracts people of diverse ages, ethnicities, and incomes (Congress for the new urbanism, 2001). Thus, interaction between different parts of the society, enhanced by compactness and mix of activities, leads to an enriched community.

However, things were not the same in the 50s. In this period, France faced a nationwide housing shortage. In 1946, there were 5 million inhabitants without proper housing facilities (Fourcaut, 2010). Slums began to develop in cities’ outskirts and the city centre dwellings suffered hygiene and sanitary issues. The urgency for the need of housing infrastructure started rising. The French government responded to this crisis by building rapidly and in large proportions (Fourcaut, 2010). The newly created neighbourhoods had all the necessary equipment: schools, shops, public services and places of worship. It corresponded to the ideals of modernity of the time, and the comfort provided contrasted with the former living conditions of the inhabitants (Hersenoul, 2016). This article analyses the impact of the urban form of these constructed buildings on the inhabitants and their social relations. It explores the case study of La Duchère in Lyon, France, a housing project representative of this category. It is currently in a state of flux, implying a concrete transformation of its urban morphology.

La Duchère

The preferred form of buildings in La Duchère is that of long and high buildings. In addition to high density, these buildings have an economic benefit to construction: the crane is installed on rails and builds housing along a straight line, following the “Crane Road Technology” (Bachelet, Bres, Djirikian & Lot, 2006). The road network is similarly structured around a North-South breakthrough within the neighbourhood. The urban form of the entire neighbourhood is therefore determined by this criterion of simplicity. The urban block disappears to favor an operational framework. The high density of buildings frees up spaces to integrate vast public spaces. This is how the traditional street disappears, as the road frame remains on the peripheral and circumvents the set it without entering it.

The Decay of a Social System

The response of inhabitants to these buildings is heterogeneous. Some of them boast larger, airy and bright housing, especially compared to previous insalubrious housing (Dagneau, 2019). On the other hand, critical voices rise, concerning the same kind of housing projects in France: Promiscuity is deplored, while public spaces are vast but empty (Scherna, 1960). These testimonies started bringing about considerations that quickly highlighted the weaknesses of the urban construction of the district. Public spaces are omnipresent on the ground, but remain empty and little invaded by the inhabitants, whose high up habitat is not connected to these spaces (Urban Task Force, 1999). It was then realized that buildings, through their morphology, eliminated the relationship with the street (Urban Task Force, 1999). These features are representative of a specific architecture regarded as overwhelming cubic and monotonous blocks (Scherna, 1960).

The zoning method is privileged in the neighbourhoods of French housing projects built during the 50s (Fourcaut, 2010). The functions are clearly separated in areas of work, housing, traffic or recreation. This form of urbanization, even with high density, is not conducive to socialization. The inhabitants meet less new acquaintances and have fewer close relations (MOURADIS, 2018).

In addition, green spaces are also rare in La Duchère, despite its direct proximity with the Valdon Park. It is an underutilized asset that is totally cut off from the neighbourhood due to the disruption by the massive buildings. Prior to the time of construction, this rupture is also present between the district of La Duchère and surrounding neighbourhoods. There are very few connections amongst the inhabitants despite being close to each other spatially. Due to the north-south road breakthrough, there is a scarcity of east-west traffic preventing any dialogue with surrounding areas, particularly because of the real rupture in the road space created by the “barré des 1000”, long tall buildings extending from north to south.

The choices to demolish “barré des 1000”, the numerous transformations of the buildings and public spaces impacted the neighbourhood’s morphology. By doing so, three modes of development came forward:

1. Replacing 15-storey buildings with medium-sized buildings (maximum of 7 floors) helped in recreating the lost relationship with the street, while maintaining a similar density. More openings are now created towards the street, in contrast with the former buildings that only had few main entrances leading to parking space.

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Seeing the street from the window makes it possible to consider one’s dwelling as part of the urban space and in relation with its other inhabitants (Urban Task Force, 1997). Through this, social interactions are expected to be no longer limited to the corridor or the building.

2. The newly created urban blocks integrate the public green spaces within them. This design intervention has two functions:

- First, the urban space becomes more permeable for the surrounding natural spaces that become a part of the neighbourhood and provides a better quality of life for its inhabitants.
- While being located inside the islets, these places are now accessible to all. A buffer space between the public and the private sector works as a place of exchange to favour more social interaction. Inhabitants can

3. New habitat forms are more heterogeneous, in order to overcome the monotony criticized by the inhabitants. The coordinating organization “Mission Lyon La Duchère” launched numerous architecture competitions for each block, leading to a myriad of architectural styles. They clearly make a rupture with the brutalist and functionalist architecture of the former long buildings. The scale of the neighbourhood seems more human and pleasant.

To support this new dynamism, a spacious plaza at the centre of La Duchère has become the heart of citizens’ life. Adding urban furniture like stairs and trees help in making it a pleasant place, at all times even when it is empty. Streets organization was also enhanced. By eliminating the rupture created by the “barre des 1000”, east-west traffic lanes emerge. They form a physical link with the surrounding neighbourhoods and help in limiting the social isolation suffered by the housing project. The pedestrians now have a choice of different paths to access, each offering a different experience of the neighbourhood. This enables the public spaces to encourage more interaction between the people, buildings and services.

Conclusion

The transformation of the district of La Duchère now lasts for 16 years and is expected to end by 2025. This project has been carried out over a long term in order to perceive the impact of the urban project on the social functioning of the district. The first analysis draws a positive assessment, as in 2014, 67% of the inhabitants thought that the quality of life has been significantly enhanced (GVP La Duchère, 2018). The last parts of the project must complete this development in order to achieve a real success.

This neighbourhood was a pioneer in 1958 for the new French housing policy. In 2018, it is pioneering innovative urban forms. These initiatives are inspired by many projects all around the world, and can inspire many others. The case of La Duchère is useful for cities struggling with social issues in some neighbourhoods, or seeking for any urban transformation. It is already possible to analyse the consequences of urban transformations, and to see to what extent it is applicable to another context.

In any case, those neighbourhoods, deeply and voluntarily transformed, must be subject to a constant interest, as understanding the habitat in its social context is essential to ensure sustainable development of future urban spaces.

Figure 4– The renovation project

Source: GVP La Duchère, 2018

Figure 5– The transition in perception from private to public space

Source: GVP La Duchère, 2018

Legend

Private
Semi-private
Public

Evolution of public space

Source: Lyon Figaro, 1991

Source: GVP La Duchère, 2018

Figure 6– Evolution of public space

Source: GVP La Duchère, 2018
Urban Sanitation and Waste water challenge of India:
- Imperative of Water Demand Management and Non-Sewered Sanitation Systems

Summary
Owing to the largest demographic growth of 1.86% in India, there was large scale crop failure and cattle deaths in central and western India. Yet but if not having a drinking water crisis of acute magnitude that is currently happening year after year all over India. Two-thirds of India is semi-arid and arid. In this context, drinking water security should be seen as a challenge of reducing dependence on surface water supply, maintaining sustainable recharge and reusing of treated water. Guiding policy framework for urban sanitation should be a paradigm shift from supply side solutions to water demand management and reducing the wastewater footprint.

The most effective way to implement water demand management is through regulation. For water harvesting, maintaining household rainwater tanks and decentralized waste water (for non-drinking purposes) at the household and bulk storage at society level. Chennai made water harvesting a compulsory requirement to its building rules1, while Bengaluru 2 achieved it making its residential societies and commercial and educational institutions set up their own waste water treatment plants treating first flush water directly into nearby water bodies.

Water, specially drinking water, is a human right. India is signatory to the 2010 UN Declaration on Right to Water and Sanitation. “The new Jal Shakti Ministry promises the “No water, No Siri” (tap water) using surface and ground water, depending on requirement, and structuring for conservation and sustainability to balance supply.”3

However, more household tap-water connections and sanitation facilities will result in more wastewater generation. One of the most effective ways of reducing the water footprint of cities is by focusing on decentralized Non-Sewered Sanitation (NSS) solutions.

Managing waste demand, reducing wastewater footprint and reuse of treated water from our STPs and decentralised Faecal Sewage Treatment Plants (STPs) should be prioritized to bring about a paradigm shift for the management of providing tap-water for every household by 2024.

Sanitation and Urbanisation in India
Increasing urbanisation of India is putting significant pressure on water resources and the safe disposal of waste water. Most cities are facing water stress and are reaching the limits of accessing drinking water from all available sources and a grave crisis of untreated waste water. The total urban population of India, as per Census of India (2011), was 377 million, spread across 7935 urban centres - 4041 statutory towns and 3894 census towns. Statutory towns are administered by Urban Local Bodies responsible for delivery of infrastructure services and 38% of the towns are administered via rural administration; provision of urban services is not mandatory in these areas. Through the number of census towns has trebled over a decade, the increase in number of statutory towns has been much slower.

Table 1. Urban Centres in India

<table>
<thead>
<tr>
<th>Types of Urban Centres</th>
<th>Census 2001</th>
<th>Census 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statutory towns</td>
<td>3,799</td>
<td>4,041</td>
</tr>
<tr>
<td>Census towns</td>
<td>332</td>
<td>1,054</td>
</tr>
<tr>
<td>Urban agglomerations</td>
<td>384</td>
<td>475</td>
</tr>
<tr>
<td>Out growths</td>
<td>962</td>
<td>981</td>
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As per the 2011 census, only 32.7% of urban households are connected to the sewer systems. The Central Pollution Control Board (CPCB), 2015 report stated that the sewage generated nationally is 62,000 MLD, whereas, the developed sewage treatment capacity is only of 22,940 MLD. Due to this hiatus in sewage treatment capacity about 38,791 MLD of untreated sewage (62% of the total sewage) is discharged into the nearby water bodies.

CPCB reported that there are 920 Sewage Treatment Plants in different States/UT, out of which, 615 were operational, 80 non-operational, 154 under construction and 71 in the planning stage.

Recently, there is a conspicuous movement to use treated wastewater from STPs to fill lakes or to recharge ground water if it entails huge pumping and transportation cost of treated wastewater many miles away. Use of treated wastewater in industrial sector has been prevalent for many years. Now the practice has started gaining momentum in the urban areas for using treated wastewater for filling up lakes and water bodies in peri-urban areas (being planned for Bengaluru and other towns).

Drying cities: Managing Water Demand India: While population of world is 7.3 billion and have only 4% of world’s renewable fresh water resources (Ministry of Water, Mandate). The World Bank anticipates 50% increase in urban water demand in the next 30 years. For India, its timeline may be even shorter. Water Demand Projections by the International Water Management Institute show that India has an underestimates water withdrawals by 3-14%. Globally, the total domestic water use already exceeds the forecasts for 2053 and expansion of water use for irrigation is much higher than expected.

From open wells under Scheme 1 to bone wells, the need is for a permanent pump in ground water withdrawal from deeper aquifers. We are at a stage where only demand management (through regulation, normalisation of groundwater) can expand the available water to meet our needs. It raises the need to identify new technologies that can:

- Adequacy and frequency of water supply in the required quality and pricing
- Water quality
- Institutional sustainability of the water utilities

There is a large dependence on ground water for meeting urban households’ water requirements. Overall, 50% of urban water requirement and 85% per cent of rural domestic need are watered by groundwater.”

Some of the challenges faced are:

- Drying and polluted aquifers, competing and increasing demand from agriculture is reducing the quality for expanding water supply.
- Dumping of untreated waste in rivers and water bodies, is creating a public health hazard due to the loss to biodiversity.
- Unequal access to drinking water supply within a city, competing demand with industrial and agriculture needs, is creating water conflicts at many levels - urban, agri-culture industry, intra-urban conflicts over water supply and disposal of waste water.

Climate change is also going to impact the availability of water supply for Indian cities; due to increasing variability in temperature, leading to dramatic changes in resources (floods and droughts) and water supply to cities.

As we reach the limits to groundwater withdrawal and exploit all available surface and ground water resources (Ministry of Water, Mandate) it will be needed to manage water resources. Figure 1 shows the limits to water supply attained with every technological advancement.

Fig-1 - Limit to water supply with every technological advancement

Source: UNDP Report

Supply, Demand & Availability

<table>
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<tr>
<th>Location</th>
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Source: NSS Training Brochure on Odisha FSSM

The state of Odisha has taken a leading role in promoting NSS schemes as a pioneer for committing to scaling up of faecal sludge and Septage management systems to all the 114 Urban Local Bodies in the state. Faecal Sludge and Septage Management Plants has already been installed and are operational in 11 towns, already in phase 1 (mentioned in table 2). In smaller towns, where enough septage is not generated on a daily basis, Deep Flow Enrichment (DFE) is being implemented as a temporary measure in 84 towns of Odisha. In this method, a small tank is dug underground which ground water tables are low, trucks carrying septage from septic tanks dump their load in these trenches and they are covered with soil. Over a period of time, the sludge decomposes.

Table 2: List of towns in Odisha operating with FSSM Plants Phase 1

Odisha has shown that a combination of political and administrative will, with the active leadership of the Chief Minister and Sarpanch most officials of Urban and Rural Ministries of the state can bring a paradigm shift away from centralized sanitation systems.

Conclusion
The 2017 national Faecal Sludge and Septage Management Policy provides guidance for NSS systems for India. 19 out of the 36 Indian states have adopted the FSSM Policy. 442 towns have announced or tendered the construction of FSSM systems. 355 towns are using the NSS technologies most to ensure use of minimum water for waste treatment. States like Odisha, AP and Tamil Nadu are showing us a possibility.

Depinder Kapur
Senior Domain Expert & Team Leader
SCBDM NUA

All this requires community/social engagement, institutional and legal backing.

Non-Sewered Sanitation Systems in Odisha
Non-Sewered Sanitation (NSS) systems by definition are sanitation systems that treat human faecal waste without the need of traditional pipes and water supply gravity flow based conveyance systems connected with Sewage Treatment Plants(STPs). These are usually smaller sized natural or mechanical/membrane based decentralised treatment with little or no centralized Sludge Treatment Plants (FSTPs). They secure faecal waste from household septic tanks through treatment processes to make it safe. The faecal waste is then treated as per standards for safe disposal of treated waste water and solids for composting or burning into heat for domestic use or for an expanded use. Faecal sludge from treatment plants and encourage waste water reuse.

Advantages of Non-Sewered Sanitation Systems
Some of the advantages of the Non-Sewered Sanitation Systems are as follows:

- Low investment and operations cost: Many small and medium towns in India cannot afford installation and operation of centralized STPs. The High-Powered Committee on Urban Sanitation and Solid Waste Management has estimated a per capita cost of sewage systems at Rs.4000. These being large capacity treatment plants treating Millions of liters per day (LPD) require a long network of underground sewers and high cost of electricity.

- Waste recycling: For an arid and semi-arid country with declining per capita water availability and urban population, waste recycling approaches such as treated wastewater flow based 153LPD (liters per person per day) water supply is not feasible. 1 Less than 10% of the population generates faecal sludge. An NSS sanitation system relies on conveyance of Septage by trucks or other means. Water for sewage flow is not required. "Lesser volumes of treated water are easy to re-use or apply for recharge of ground water close to the treatment plant."

- Lower risk of failure: NSS systems, especially those with gravity and natural treatment solutions are not dependent on the rain and its duration failures. Their electricity consumption is minimal and mechanical failures are rare. NSS using mechanical and membrane based systems are more complicated than natural (GW) systems, but being small, repairable, maintenance and repair is possible with relative ease and lower cost."

- Short gestation period, few dug out roads and repairs: Any new centralized sewage systems levels well above the ground. They have a high profile maintenance works causing massive traffic congestion.

- Waste use and compost: NSS systems are smaller, decentralized in their context and location. They have a low profile maintenance works causing massive traffic congestion.

City managers and administrators need to explore opportunities of NSS technology. Investing in small-scale decentralised and Non Sewered Sanitation systems offers the most feasible; to ensure use of minimum water for waste treatment. States like Odisha, AP and Tamil Nadu are showing us a possibility.
**Providing Accessibility to Low-Income Neighbourhoods:**

- Case Study of Metrocable in Caracas, Venezuela

**Introduction**

Accessibility talks about the ability of connecting two places physically and socially. The translation of this definition highlights various aspects of transportation systems (Bosetti, 2018; Social Exclusion Unit, 2003):  
- existence or availability  
- location  
- safety  
- reliability  
- affordability  
- adequacy (for disabled people for example)

These criteria are some good indicators for accessibility, however, they are not exhaustive (Handy, 1994). Each individual have different needs and transportation systems must be adapted to the overall context of the area or region it is being implemented in.

The most vulnerable neighbourhoods like rural, peri-urban, urban peripheral, remote and deprived areas are most impacted by lack of public transportation and accessibility (Bosetti, 2018). In most cases, the lower income groups of the population are most affected by lack of accessibility, therefore, providing accessibility is a matter of equity (Handy, 1994). Each individual have different needs and transportation systems must be adapted to the overall context of the area or region it is being implemented in.

The Metrocable Project

The San Agustín neighbourhood  

This informal neighbourhood was built on the city’s hillside without any recognition from the municipality. It is one of the poorest neighbourhoods of Caracas (Caracas Alcaldia Mayor, 2006), a city where social segregation through income level is integral (Lizarra, 2012) at the same time, unequal conditions related to urban mobility and accessibility. Demolition and privatization of the collective transport induced the emergence of self-organized and de-urbanized sector. As this “rombo” was not indicated on the city’s official maps (Moberg, 2012), no transportation system was provided either.

The municipality of Caracas decided to build a new highway crossing the heart of the neighbourhood and destroying many places of habitat. At this instance, in July 2003, Urban Think Tank, an architectural agency, protested against this project (Urban Think Tank, 2013). The coordination between architects, planners, experts and locals brought cable car system as the best solution to serve the area (Urban Think Tank, 2013). The major asset of cable-cars is that its construction is not as intrusive as other modes of transport. Only a few dwellings were destroyed during the construction of the project. Those destroyed

Habitat  

Each Metrocable station situated on the hill is integrated in the surrounding urban system and provides additional services. The objective is to create hubs for social and community activities. Each station has two levels: one for the transportation and the other for different facilities at each station for all the people living around. These facilities operate from the profits of the Metrocable (Moberg, 2012). These services have been determined in cooperation with the inhabitants and respond to local needs, for example:

- Station Parque de la República: provides security, a school, a health centre and a supermarket.
- Station La Cebal: provides numerous facilities like police station, library, information centre and supermarket. An additional sports ground in the station is linked with the surrounding gymnasium.
- Station El Monguito: the construction of the station integrated households through the “substitución rancho por casa” programme. Destroyed shacks were replaced by secure social housing structures connected with technical and hygienic facilities (Urban Think Tank, 2013).

**Conclusion**

This informal neighbourhood was built on the city’s hillside without any recognition from the municipality. It is one of the poorest neighbourhoods of Caracas (Caracas Alcaldia Mayor, 2006). The strategic strength of the Metrocable in Caracas is its integration with the rest of the neighbourhood. The infrastructure provides accessibility to the rest of the city for the locals, but also contributes in enhancing the quality of life. After its first implementation in 2010, three other cable car lines followed, allowing the neighbourhoods of Caracas to be more integrated and interconnected.

Map of the public transport system in Caracas

Source: Metro Caracas, 2019
INTRODUCTION

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