

SUSTAINABLE URBAN LIVING – ROLE OF ECO-FRIENDLY PRACTICES AND PEOPLE'S PARTICIPATION

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ABSTRACT: According to the United Nations, 68% of global population will reside in urban areas by 2050. In the past few decades the urban growth in many parts of the world has lacked sustainable practices and hence, contributed to a myriad of global problems. Sustainable urbanization on the other hand meets the needs of the present and future generations. People's participation is key for adopting a sustainable lifestyle, which happens when people consciously choose to reduce, reuse and recycle, thereby reducing their ecological footprint. This study showcases the smart sustainable practices adopted by an urban community in Bengaluru, the 'Silicon Valley of India'. Though situated in a busy metropolis, characterized by high foot traffic and a large floating population of approximately 30,000 visitors per month apart from more than 2000 residents, this community has lush green covers, extremely rich biodiversity and better air quality. A few sustainable practices adopted here include preservation (conservation of rich species diversity of flora and fauna), natural farming and permaculture, natural fuel production from waste plastic, handmade paper from waste paper and cotton, cooked waste conversion to create briquettes and LPG that are reused as fuel, etc. Through people's participation, this unique community characterized by floating and resident populations, exemplifies the possibility to create an 'Oasis of sustainability' in the arid desert of urbanization.

KEYWORDS: Urbanization, sustainable practices, people's participation

I. INTRODUCTION

Urbanization is an inevitable yet important aspect of development. According to the United Nations, the urban population is expected to increase to 68% by 2050. Human influenced activities in the past few decades have caused widespread effects in the environment, many of which are irreversible and exceeding the self-purification capacity of the environment. Therefore, a crucial aspect of urbanization is that it is based on eco-friendly and sustainable practices, for it to be a boon; else it may become a bane. In the past few decades the urban growth witnessed in many parts of the world focused on economic development and seldom incorporated the ecological aspects. Such urban growth with unsustainable practices has contributed to a myriad of global problems including skewed urban population growth, unplanned management and rapid depletion of non-renewable natural resources. Sustainable development on the other hand caters to the needs of the present generation without compromising the needs of the future generations. This kind of development depends on how

well urban growth is managed, especially in nations where the phenomenon of urbanization is taking place at a rapid pace.

This study showcases the smart sustainable practices adopted by an urban community right in the heart of one of the biggest metropolises in India – Bengaluru. This IT hub popularly known as the ‘Silicon Valley of India’ has an urban population of 12.34 million (2017). This population explosion and increase in pollution has led to deterioration of environment. Though situated in a busy metropolis and characterized by high foot traffic and a large floating population of approximately 30,000 visitors per month apart from more than 2000 residents, this community has lush green covers, extremely rich biodiversity and better air quality.

Some of the key sustainable practices followed include conversion of waste plastic into fuel, waste paper and cotton for making handmade paper, compost production from uncooked vegetable waste, cooked food waste to ‘Biogas’, solar energy, rainwater harvesting to recharge ground water, use of recycled water from sewage treatment plant for gardening, natural farming and Permaculture as sustainable agricultural practices. Such practices are scalable and replicable owing to their sustainable nature. Through this it is possible to create an ‘Oasis of sustainability’ in the arid desert of urbanization.

APPROACH TO THE ENVIRONMENT

From being a barren land to a lush green lung space, the Art of Living International Center in Bengaluru, has come a long way in terms of being an environmentally sustainable model worth emulating. The Center could well be termed as a ‘Mega Permaculture Site’ – nothing goes waste as produce from one process is used as raw material for another process. (The Art of Living International Center – A case study in sustainability) (Sustainable Campus - Art of Living).

The Art of Living International Center is located on the Old Mysore-Kanakapura Road. Spread over 65 acres, it was once a barren land that is now a haven for flowering foliage spread along winding paths, a peaceful lake and the exquisitely beautiful buildings. The centre has 81 departments that are volunteer driven. Various programs ranging from 3-45 days, both residential and non-residential are conducted throughout the year. The uniqueness of the community is that it is characterized by high foot traffic and floating population apart from a residential community.

People are now aware and accepting of the benefits of embracing a more sustainable and eco-friendly lifestyle. An underlying factor as Rau et al. (Rau, et al. 2018) report is how practicing ancient breathing techniques like the Sudarshan Kriya Yoga (SKY™) and associated meditation techniques make people more connected and sensitive to nature. The uniqueness of the community is that it is characterized by high foot traffic, has a high proportion of floating population apart from a residential community, and still able to maintain eco-friendly practices in a sustainable manner.. Such practices are scalable and replicable owing to their sustainable nature.

II. PROPOSED METHODOLOGY

The data presented in the study was collected by documentation of the various eco-friendly processes followed by the departments and by in person interviews with the management and staff. The methodology reported in this study is based on the processes followed by different

departments as mentioned in the subsequent sections below. Excerpts from one-on-one interviews have also been incorporated in this study.

Production –

Agriculture activities – As mentioned earlier, the Art of Living has given prime importance to protection of the environment. We are well aware of the environmental degradation across the world mainly due to the intensification of agricultural activities involving use of increased rates of chemical pesticides and fertilizers that are not only polluting the soil and groundwater sources, but also affecting ecosystem services such as natural pest control, pollination, nutrient cycling and the food chain on the whole. It is now time to go in for agricultural practices such as natural farming and permaculture that grow crops in accordance with nature, on a very large scale. This is feasible with widespread awareness campaigns for farmers and civil society. We also need to clear the misconception that crop yields are low when grown using the principles of natural farming. 1, 50,000 kg quantity vegetables are produced on a monthly basis.

Natural/Organic farming – As one takes the narrow bypass lined with coconut palms replete with tender coconuts, from the International Center's main reception leading to the Cafè, one can see the earth freshly ploughed, naturally fertilized with cow dung and elsewhere some fresh vegetable produce ready for harvest – this is just the tip of the natural farming lands under cultivation at the Center.

During festive seasons, where requirement for vegetables is approximately 3 lakh kilograms, much of the produce is supplied in-house and that which is purchased, is from farmers who practice natural and organic farming.

Permaculture (Permanent Agriculture) – Growing food in accordance with nature.

What was once a barren six-acre rocky piece of land is now a full-fledged permaculture site. Designed based on the three-ethics and 12-design principles of permaculture, this piece of land abounds with vegetation and many bird species.

Waste Management – 100% waste management: All waste is segregated into dry and wet waste – To segregate waste at the source, separate bins have been put up for dry and wet waste in the entire campus that are collected on a daily basis. Garbage from nearby villages is also collected and brought to the Waste Management Plant near the Art of Living International Center. The waste plastic is converted into fuel, paper into handmade paper, metal scrap is sold-off, uncooked vegetable waste is sent to be used as manure in the Permaculture farm and food waste is used in the generation of biogas.

Waste plastic is converted into fuel – Plastic is gold if you have a full-blown pyrolysis plant that converts plastic into fuel. The Biourja plant that is functional since 13 May 2015, uses the process of Pyrolysis (decomposing at high temperature in an inert atmosphere) to convert waste plastic into industrial grade crude oil (fuel). This is subjected to distillation to yield Pyrolysis oil which is used for the boilers of the kitchen as well as running generators in the International Center. Apart from this, part of the crude oil is also used to run the plastic-to-fuel plant.

Waste paper mixed with waste cotton is recycled into handmade paper – Another interesting machine in the vast serene campus is the papermaking machine. Waste paper and cotton are converted into handmade paper. This is used to make stationary for several departments in the campus.

Food waste is converted into fuel – Although there are practices in place to reduce the wastage, the food waste is used for a better purpose. The 1 ton capacity biogas plant converts the food waste mixed with cow dung into cooking gas for the kitchen. When the plant is run to full capacity of 1 ton, 70 kg biogas is produced that is used to light the burners in the kitchen.

Dry and green waste is turned into black gold – All the uncooked food waste from the Center's kitchen is turned into compost at the permaculture site. The compost is used in the agricultural activities of the center.

Cow dung is used to grow food and generate energy – The uniqueness of this gaushala which houses hundreds of cows is that they are indigenous Indian cows. The cow dung is used to make fertilizers for the center's agricultural activities and in the gobar gas generator to produce energy for the gaushala.

Clean Energy:

Solar energy – In this vast center where countless visitors arrive to take a deep dive into the silent corner of their heart, the energy needs are high too. These needs are also taken care of in the most sustainable manner. The several residential blocks are provided with solar energy. The Center has an ambitious plan to harness wind energy too in the future. Art of Living launched the International Interfaith Solar Alliance (IISA) during the World Culture Festival (WCF) in March 2016, to extend support to the International Solar Alliance.

Fuel from environmentally friendly briquettes used in kitchen boilers – The Center's kitchen uses steam generated from boilers using fuel in the form of environmentally friendly briquettes made from sawdust, groundnut and coffee shells.

Sustainable kitchen – 105 tons of fruits and vegetables are consumed during the lean season and 165 tons during the peak season (annual festivals of Navaratri and Shivaratri). During the lean season when average number of people is around 15169, 105 tons of vegetables and fruits are used which goes upto 165 tons during the peak season when the number of people is around 22,000. During some events the number of people touches 1 lakh.

Water Management

Rainwater harvesting – Rainwater run-off is efficiently harvested, based on 'tap-it-where-it-falls'.

Sewage Treatment Plant – There are nine Sewage Treatment Plants (STPs) in and around the Art of Living International Center at various locations. The total treatment capacity is 18 lakh liters per day.

Biodiversity – The Art of Living International Center that now looks like a forested area was once a barren piece of land. It forms an excellent case study of using native plant species to restore a rocky terrain into a mini ecosystem. Due to the growth of vegetation, water levels have also risen in the ground and a host of birds, butterflies, reptiles and small mammals have also been found here. Someone rightly said referring to this beautiful campus that, "not only humans, but life grows here"

III. DISCUSSION

Impact of our Sustainable Initiatives in Reducing the Ecological Footprint

The Art of Living International Center is characterized by resident as well as floating population. Even with a high footfall round the year, the Center has adopted and incorporated sustainable living choices, right from the lush green cover to recycling and reuse of sewage water.

When every aspect of human life including food consumption and developmental activities are aligned in accordance with the environment, the resulting ecological footprint (measure of the ecological assets that a given population requires to produce the natural resources it consumes) would represent meeting everyone's need at present without compromising needs of future generations.

Like in this study where people's participation in creating sustainable communities has been touched-upon, Raufirad et al., 2017 too stressed on the importance of Local People's Participation (LPP) in successful Sustainable Natural Resource Management (SNRM) in Central Iran.

Biodiversity

The biodiversity at the Art of Living International Center comprises both flora and fauna. Over a period of 35 years, the once barren land has blossomed in to a natural as well as a nurtured landscape.

Permaculture can be defined as 'Consciously designed landscapes which mimic the patterns and relationships found in nature, while yielding an abundance of food, fiber and energy for provision of local needs' (Bill Mollison, 1979).

Agricultural practices based on living a life without polluting the air, water and earth, are what help meet the expectations of the principles of permaculture. This was exactly how agriculture was practiced by the Indians in ancient times – respecting nature and well in accordance with her – Rishi-Krishi (pure farming).

Permaculture is emerging as a system of food-production that can not only help us grow chemical-free food, but also save the planet from further degradation by addressing concerns of soil (and topsoil) health, water-availability, ecological problems, and climate change.

This system of agriculture was pioneered by co-workers Bill Morrison and David Holmgren in the 1970s in Australia. It was conceived at a time when we were just beginning to recognise that our local actions could have a far greater impact on the biosphere than those which we had originally intended (Bambrey, 2006). There are **three ethics** and **twelve design principles** of Permaculture as elucidated by Bill Mollison (1979).

Designing a permaculture farm involves bringing maximum benefits to both humans and to ecology and draws from allied fields like organic farming, integrated farming, agro-forestry and so on. Permaculture opens an individual to new realms and makes one realize that it is the need of the hour because it brings ecology and agriculture together, but with a different approach than natural farming or organic farming.

A hard-hitting fact was given by Bambrey (2006) who said, "If agriculture fails, civilization falls! That is why a permanent/sustainable agriculture is of paramount importance." What makes Permaculture sustainable is that it operates in a 'closed system' where the wastes output from one part of the system are used as inputs for other parts of the designed system.

Energy consumption by humans has escalated manifold globally due to urbanization and industrialization. Most of these energy demands are dependent on the non-renewable sources that are limited in nature. Their exploitation not only affects their availability but also negative

impacts the climate (Zafar, et al. 2018). Turning to renewable sources of energy like solar and wind is thus gaining momentum. But to make this sustainable, is the need of the hour. In addition to this, tapping into the renewable energy sources on a large scale will help mitigate climate change as well as be sustainable for the present and future generations (Owusu and Asumadu-Sarkodie, 2016). Apart from this converting waste into fuel has also come into use.

Waste Management – Waste is a global issue. If not properly dealt with, waste poses a threat to public health and the environment (UNEP, 2015).

According to the United Nations Statistics Division, waste management characterizes activities which not only include collection, transportation, treatment and disposal of wastes but also controlling, monitoring and regulation of production, collection, transport, treatment and disposal of waste along with prevention of waste through modification, reuse and recycling (Dondapati, et al. 2018). In various states and Union Territories of the Indian sub-continent, the amount of solid waste generated has increased manifold (Sharma and Jain 2019). With special reference to the state of Karnataka (where the Art of Living International Center is situated), the waste generated has increased and so has the amount of waste collected.

Solid waste

Solid waste also known as Municipal Solid Waste (MSW) is a major concern due to increased waste generation owing to rapid urbanization and industrialization, population growth and life-styles changes. MSW primarily comprises of waste from households, offices, hotels, shopping complexes, institutions, and from municipal services such as street cleaning and maintenance of recreational areas (UNEP 2017). Unlike in this study where solid waste is segregated at the source, Dondapati, et al. 2018 reported the segregation of 200-250 kg per day of solid waste at the dumpsite.

Food waste

A staggering 30 to 50 percent of the food produced annually for global human consumption goes waste (FAO, 2011; IMG, 2013). Infrastructure of urban food consumption and waste in Indonesia talks about how at a national level the social element of food waste plays a crucial role (Soma, 2018).

Waste plastic to fuel

The global plastics industry began in 1907 with the production of Bakelite, the first synthetic plastic. The production of plastics increased nearly 200-fold to 381 million tons in 2015 (Ritchie and Roser, 2018).

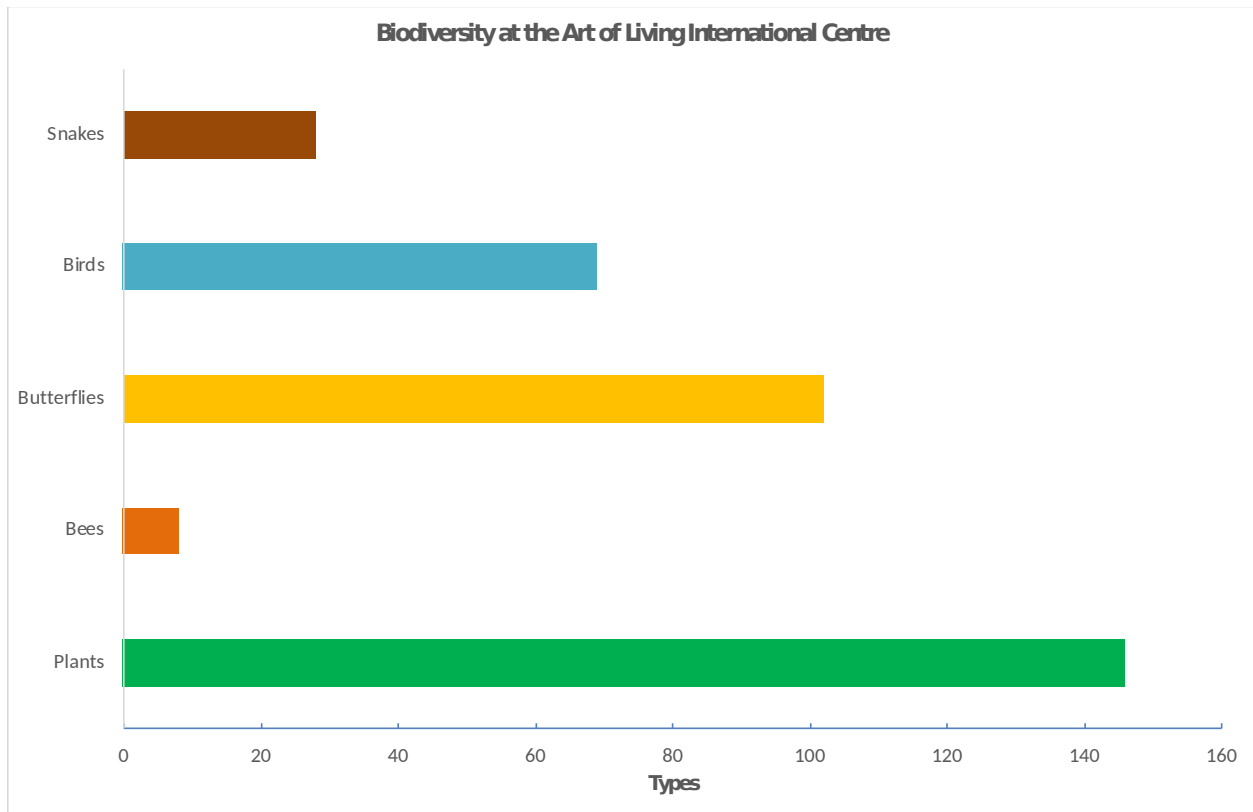
The use of plastic has become a part and parcel of everyday life. From packing food to disposing garbage, the use polythene bags have seen an unprecedented increase over the past decade. It is alarming to note that 5 trillion plastic bags would be consumed this year (The World Counts, 2019). Only nine per cent of the nine billion tonnes of plastic the world has ever produced has been recycled (UNEP, 2018). In order to reduce the plastic waste load on landfills, the Art of Living International Center has solid waste management practices in place. Fuel production from waste plastic has been reviewed (Wong et al., 2015; Miandad et al., 2016; Kalargaris et al., 2017).

The UNEP (2018) also states that by 2050 there will be about 12 billion tons of plastic litter in landfills and the natural environment.

IV. RESULTS

Biodiversity

Apart from the floral and faunal diversity that has been documented, 28 varieties of snakes and some rare plants of medicinal value have also been reported to be growing here. 146 varieties of plants, 8 types of bees, 102 types of butterflies and 69 varieties of birds are found on the campus.



Permaculture

The Permaculture Farm at the AOL International Centre is ever busy with activity and has a stream of course participants and visitors from far and near. A one-day interactive course is conducted on a regular basis where one gets to learn transformational facts about not just permaculture, but also about the Green and the White Revolutions, about the importance of use of native Indian cows in agriculture, and a host of important facts about life, earth, and life on earth.

The varieties of flowers, fruits and vegetables and green leaves cultivated in our Permaculture farm and supplied to the Center's kitchen and also made available for sale at our Organic store are listed in the table below.

Varieties of flowers, fruits, vegetables and green leaves grown at the Art of Living Permaculture farm

Category	Botanical name	Common name
Flowers	<i>Tagetuspatala</i>	Marigold Other flowering plants
Fruits	<i>Musa spp.</i> <i>Mangifera indica</i> <i>Punicagranatum</i> <i>Carica papaya</i> <i>Passiflora edulis</i>	Banana Mango Pomegranate Papaya Passion fruit
Vegetables	<i>Raphanusraphanistrumsubsp. sativus</i> <i>Momordicacarentia</i> <i>Luffa acutangula</i> <i>Lagenariasiceraria</i> <i>Cucurbita moschata</i> <i>Benincasahispida</i> <i>Emblica officinalis</i> <i>Phaseolus vulgaris</i> <i>Abelmoschusesculentus</i> <i>Solanum lycopersicum</i> <i>Solanumlycopersicumvar. cerasiforme</i> <i>Murrayakoenigii</i> <i>Coriandrum sativum</i> <i>Mentha spicata</i> <i>Saccharumofficinarum</i> <i>Zea mays</i> <i>Averrhoa carambola</i> <i>Ipomoea batatas</i> <i>Zingiberofficinale</i> <i>Curcuma longa</i> <i>Capsicum annum</i> <i>Citrus limon</i>	Radish Bitter gourd Ridge gourd Bottle gourd Sweet pumpkin White pumpkin Indian goose berry French beans Okra Tomato Cherry Tomato Curry leaf Coriander Mint Sugarcane Maize Star Fruit Sweet potato Ginger Turmeric Green chillies Lemon
Green leafy vegetables	<i>Amaranthus retroflexus</i> <i>Spinacia oleracea</i> <i>Trigonellafoenum-graceum</i> <i>Lactuca sativa</i> <i>Erucavesicaria sp. sativa</i>	Common amaranth Spinach Fenugreek Lettuce Rocket leaf
Medicinal	<i>Aloe vera</i> <i>Trachyspermumammi</i>	Aloe Carom

Apart from the plants cultivated here, there are many plants of medicinal value that grow wildly. There are 22 different types of rare bird species that were found in the Permaculture farm. This form of agriculture also lays emphasis on the importance of recharging groundwater. This has become the guiding principle in the management of and plans for the farm. The water level has risen to unprecedented levels. More importantly, whatever is grown here is local, natural, and healthy, for humans as well as for nature and as per the sustainability norms of permaculture. The best thing about this form of agriculture is that it can be implemented across the globe given that people need to grow their food largely according to their climate and their environment.

Sewage Treatment Plant (STP)

The first Sewage Treatment Plant (STP) was functional in the year 2006. A total of 7-8 lakh liter/day domestic sewage is treated. But this quantity goes up during the annual large gatherings when lakhs of people visit the International Center. The Moving Bed Bio-film Reactor

(MBBR), Solid Immobilised Bio-Filter (SIBF) system and Sequencing Batch Reactor (SBR) types of sewage treatment plants are functional here. Monthly testing includes analyzing BOD and COD using a Test-kit. Only when required testing is done from a recognized private laboratory where colour, odour, turbidity in NTU, pH, chloride, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD; 3 days at 27 °Celsius), oil and grease, sulphates, Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and residual free chlorine are measured. The treated water is used for gardening purpose.

Waste plastic to fuel: The average monthly production of the crude oil ranges between 1500-2000 liters. The calorific value of this oil is equivalent to that of diesel.

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