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Doughnut Economics: New Model for 21st Century Economics —--The Case Study of Delhi

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1. Abstract

The word *Economics* was coined by philosopher Xenophon in ancient Greece. Combining the terms ‘Oikos’ meaning household and with ‘Nomos’ meaning rules or norms. In the 1870s, a handful of aspiring economists hoped to make economics a science as reputable as physics. However, people and money are not as obedient as gravity, so we cannot study Economics like we study Physics.

The "circular flow of the economy," which forms the foundation of economic theory, focuses narrowly on the interactions between households and firms. However, it largely ignores two critical elements: the environment that sustains us and the unpaid labor of millions, particularly women in rural areas, who work tirelessly to ensure the survival of their families.

This labor, dismissed as "unpaid," is overlooked in favor of metrics like GDP and monetary flows. It is time to return to the roots of economics, which stems from the Greek word "oikonomia," meaning the management of the household. Today, that household is our planet, and our challenge is to create a "safe and just space" for all of humanity. This is where the concept of Doughnut Economics offers a transformative approach—an inclusive framework that integrates the well-being of people and the planet at its core.This research explores the potential application of Doughnut Economics in Delhi, a metropolitan economy facing unique socio-ecological challenges. The study aims to evaluate its adaptability, assess gaps in current policies, and propose actionable recommendations. Using a mixed-methods approach, it combines interviews with stakeholders, surveys to gauge local readiness, and case studies from cities like Amsterdam and Mumbai.By aligning Delhi’s development strategies with Doughnut Economics, this research seeks to contribute a scalable model for sustainable urban planning and policymaking in emerging economies.

2. Research Questions

Why do we need the new approach of Doughnut Economics?
How have other economies that adopted Doughnut Economics performed in terms of social well-being and environmental sustainability?
How can Doughnut Economics principles be adapted to address the unique socio-economic and environmental challenges faced by Delhi?

3.Research Methodology

This study employed a mixed-methods approach, integrating both qualitative and quantitative research techniques.

Phase 1-Qualitative Research:

The base of the research was formed on the book ‘Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist ‘ written by Kate Raworth.
Interview with Kate Raworth, founder of this concept and Manas Rath, Founder of Donut CoLab formed my practical understanding of downscaling doughnut to cities
Secondary data collection involved an extensive review of academic literature, case studies, and reports that explore the theoretical foundations and real-world applications of Doughnut Economics. To contextualize the study within India, government and non-governmental reports on environmental, social, and economic challenges in urban localities were examined.

Primary data collection was conducted through an online survey, engaging 50 respondents to assess public awareness of Doughnut Economics, the state of sustainability in their communities, and key challenges that require intervention. The survey design incorporated both closed-ended and open-ended questions to capture a holistic perspective.
The study adopted a convenience sampling strategy to ensure broad participation while striving for diversity in socio-economic representation. This approach enabled the collection of varied perspectives, enriching the dataset with insights from different backgrounds and lived experiences

4.Literature Review
In Ancient Greece, Xenophon introduced the term "economics" to describe the art of managing a household. Aristotle later refined this concept, distinguishing economics from *chrematistics*—the pursuit of wealth—a distinction that has largely faded in modern times. For Xenophon and Aristotle, economics was inherently artistic, fitting their era’s context. However, centuries later, Newton’s discovery of the laws of motion shifted intellectual priorities, and science became the dominant framework.

By 1767, Scottish lawyer James Steuart embraced this shift, redefining "political economy" as "the science of domestic policy in free nations." Yet, Steuart retained a focus on purpose: providing subsistence for all, reducing societal risks, meeting collective needs, and fostering interdependence within communities. His vision—a secure livelihood and mutual prosperity—was progressive for its time, though it excluded women and slaves.
Adam Smith, a decade later, echoed this goal-oriented approach, defining political economy as a science with two key objectives: enabling individuals to secure their own livelihoods and ensuring the state could support public services. This framing challenges modern caricatures of Smith as a free-market purist, emphasizing instead his concern for societal well-being. However, such purpose-driven definitions soon began to fade.

By the mid-19th century, John Stuart Mill shifted the focus, defining political economy as "a science which traces the laws of such phenomena of society as arise from the combined operations of mankind for the production of wealth." This marked a turning point, steering economics away from defining its goals toward identifying its laws. By the early 20th

century, definitions grew more ambiguous, prompting Chicago School economist Jacob Viner to quip, "Economics is what economists do."

In 1932, Lionel Robbins sought to resolve this ambiguity, defining economics as "the science which studies human behavior as a relationship between ends and scarce means which have alternative uses." While precise, Robbins' definition glossed over the nature of these ends and the scarcity of means. Later, Gregory Mankiw's influential textbook further narrowed the scope, reducing economics to "the study of how society manages its scarce resources," erasing any reference to goals or societal purpose.

Ironically, while economics positioned itself as a science of human behavior, it adopted a reductive view of rationality that ignored the complexities of real human actions. More importantly, the discipline gradually abandoned discussions of its broader goals. Proponents like Milton Friedman championed this shift, framing economics as a value-free "positive" science concerned only with describing reality. However, this detachment from purpose left economics adrift, severed from the goals it once sought to achieve.
Kate, in her book, believes that Doughnut Economics should be the image which we every economics Student or any citizen for that matter have in the conscious mind to ensure social equity and ecological harmony. Erik Schokkaert,, while acknowledging that Raworth's book is an important contribution to the ongoing ideological discussions about what constitutes a good economy, the author believes that her work could have been more empirically grounded and analytical, rather than primarily based on beliefs and convictions.

Agreeing with Erik on this aspect, I think through the book, Raworth tried to create an image of the Economic model to transform the 'Tabula rasa' of economics students. Many of the founding fathers of economics used imagery to express their seminal ideas. Paul Samuelson, decisively placed imagery at the heart of economic thought in the second half of the twentieth century.

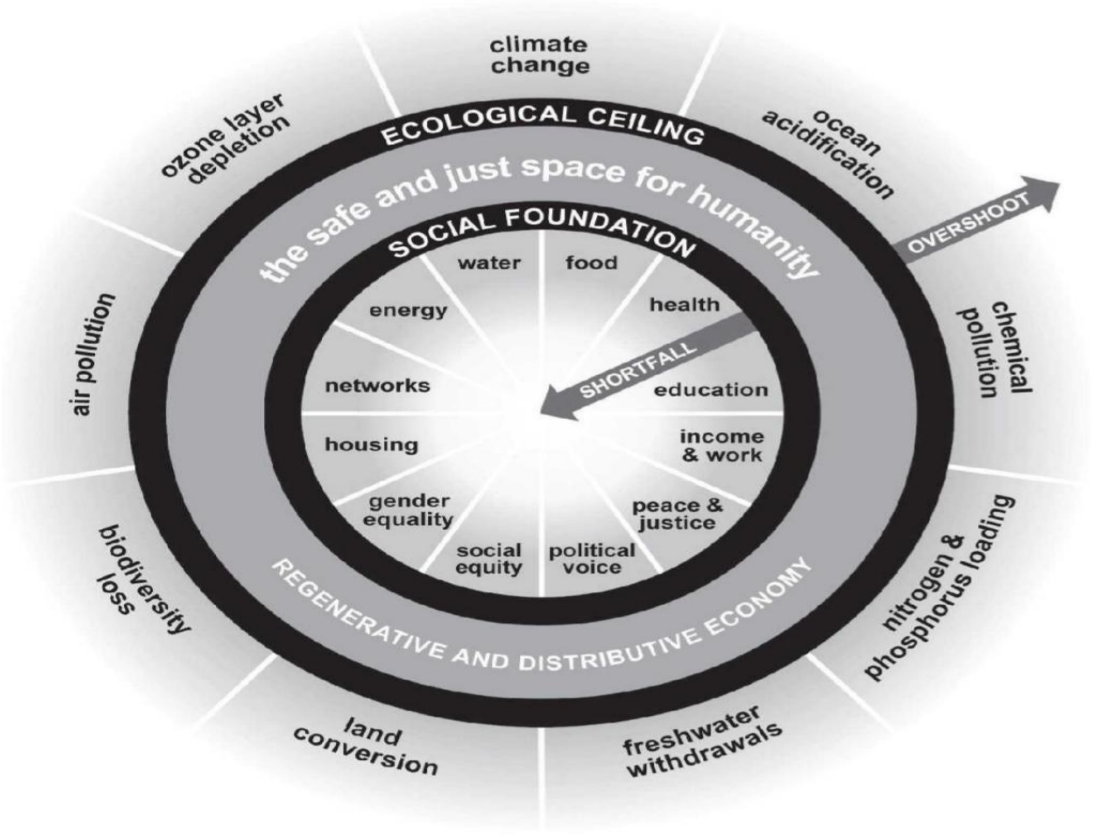
4. Introduction:
In the past 70 years, There have been extraordinary strides in human well being. A baby who was expected live for 48 years in 1950 is expected to live 71 years today 1
The total population earning below 3.65 dollars a day has been reduced more than half from 2000 to 2019 2

Twenty first century had a chaotic start with a financial crash in 2008 and a global pandemic in 2020 and multiple wars among countries. add to that the extreme deprivation of people. Even though neoclassical economics was a hit in the 20th century, 21st century economics needs a change. In Doughnut Economics, Raworth (2017) argues that
Key models of neoclassical economics have permitted economic policy to put growth at the top of the agenda by separating the market from social and environmental systems. To provide a model that better explains the actual costs and dependencies of the economic system, she uses an image of the economy's embeddedness in social and environmental systems divided into four sections: commons, household, state, and market (Raworth 2017, 71). This model differs from neoclassical economic theory in three ways.

First, Doughnut economics highlights that the economy is dependent on commons, that is, free and open resources such as environmental goods and services and knowledge.
Second, the embedded economy model highlights that reproductive and unpaid work in the household are essential to human well-being and that productivity in the paid economy is dependent on these care activities. Third, it demonstrates the central role of the state in enabling economic development and the need to strengthen its role in the face of current challenges.

Doughnut Economics was developed by Oxford University economist Kate Raworth.The premise is that economies, and societies, should be designed to thrive, not just to grow. This requires fundamental shifts in how economists and policymakers set goals. She identified
12 Social Foundations: The basic needs to live healthy and happy lives; and
9 Ecological Ceilings: Boundaries we must not breach in order to avoid ecological destruction and collapse. The doughnut-shaped framework addresses the urgent crises of our time by advocating for a balanced development that considers the planet's well-being while securing our social needs. Since the introduction of the framework, several European cities have started to implement Raworth's ideas within their policies. However, there is a lack of

previous studies that critically engage with this new economic model. To fill this gap in the literature, my research aims to examine how we can incorporate the Doughnut Approach into Policy making. I, specifically, aim to develop a framework on how can doughnut economics be incorporated with policy making in Delhi.



The Doughnut: a twenty-first-century compass. Between its social foundation of human well-being and ecological ceiling of planetary pressure lies safe and just space for humanity.

5. Amsterdam's Approach

Overview

In 2020, Amsterdam announced it will become a 100% circular Economy which it aims to achieve by 2050.The municipality embraced Doughnut Economics as a strategy to promote transformative sustainable development. Amsterdam then joined the Thriving Cities Initiative, which is a collaboration between Doughnut Economics Action Lab (DEAL), the nonprofit organization Circle Economy, and the global climate action network C40 Cities to apply the Doughnut on a city level. In 2022, the municipality created a Circular Economy Monitor, which is a tool that measures the material resource flows in and out of the city.

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The most prominent academic group working with Doughnut Economics is the Center for Economic Transformation (CET) at the Amsterdam University of Applied Sciences (AUAS). The CET is using Doughnut Economics alongside various other alternative economic theories to promote sustainable business models. They initiated and led a project called "When Business Meets the Doughnut" that consisted of collaborative workshops with business leaders to envision and implement business models that support a regenerative and distributive local economy.

The Amsterdam Doughnut Coalition is an open network of people enthusiastic about the Doughnut Economy and working together to put it into practice. They connect people and initiatives working with the Doughnut model by hosting events and showcasing projects on their website. The coalition is coordinated by university researchers and staff (institutional stakeholders), yet works closely with several members of grassroots community groups. There are 100 projects listed on their website; the majority of which are grassroots (engaging with Amsterdam neighborhood residents and communities), while the rest are academic projects led by researchers and professors.

An example of a project involved with the Amsterdam Doughnut Coalition that does not directly engaged with the model is the "*Community Land Trust*" in the Bijlmer neighborhood of Amsterdam. They are promoting permanent affordable land ownership in their neighborhood,which will contribute to the social foundation goals of the Doughnut and thus the overall vision of the doughnut economy.

SAIL Amsterdam occurs once every five years and is one of the city's largest events. The tenth edition is set to commence in August 2025. A massive fleet of large ships and various other special vessels sail across the IJ and dock near the city center. The city is aspiring to conduct the event within the doughnut.

The focus in this study has been put on three value chains which largely determine the wellbeing of the city.

Value Chain	Development Direction
Food and Organic waste streams	Create circular food production in urban areas. - Encourage healthy, sustainable and plant-based food consumption by all inhabitants. - Minimise food waste by retail, hotels & restaurants, and households. - Scale up the separate collection of organic waste from households and businesses for high-quality processing.
Consumer Goods	Reduce consumption and avoid overconsumption. - Stimulate high-quality recycling of complex consumer goods. - Aim for shared and long-term use of products. - Increase the number of local craft centres for repair and restoration of products. - Use and design standardised and modular products that are suitable for reuse, repair, and recycling.
Built environment	Stimulate circular area development with an urban design, an integrated approach and climate-proof construction, with special attention paid to closing cycles. - Use circular criteria in land allocation and tendering of all construction and infrastructural projects and in the public space. - Develop buildings with adaptable functions and systems. - Scaling up circular disassembly and separate collection for the purpose of high-quality applications. - Use renewable and secondary building materials. - Stimulate circular renovation in private and social housing.

Short food Chains:

Food wastage is the biggest problem in Amsterdam. The environmental cost of food wastage of around 1 Billion Euros per year. Majority of food waste is incinerated which is a concern. In 2022, only 5% of the organic waste was collected. City aims to grow this figure to 30% by 2026.

To achieve this '*Collection Centres'* have been established where organic food is turned into compost and further used to fertilise community gardens.

An average meal in Amsterdam travels 30,000 KM from production to plate, hence by promoting locally sourced food emissions associated with transportation will reduce while promoting local businesses.

Consumer Goods:

The strength of Amsterdam as a city, lies in its purchasing power. A top down approach is being followed. The Municipality has set themselves a target of 100% circular procurement by 2030 meaning, anything purchased by the city will have to be used, recycled or refurbished.

Stadspas, which is a city card reserved for people with lower income which offers a discount for clothes and appliances. The city has a refugee run textile repair centre and numerous other repair café all across the city where appliances can be fixed.

Ownership to Usership

Another incentive is to shift from ownership to usership. Snappcar is a peer-to-peer car sharing platform. Peerby is a platform where people can easily share the products in their neighborhood from party lights to power tools.

'Yes Yes Sticker'

A huge low-cost but effective scheme has been the 'Yes Yes Sticker'.
Previously, the people in Amsterdam could opt out of the unaddressed mail to their mailbox.
With the new scheme, posting of unaddressed mail is prohibited unless the sticker is used.
This simple switch has resulted in 10% reduction in paper waste.

Reverse Logistics

It refers to the process in which products at the end of their lives are returned back into the supply chain for refurbishment or disposal, which makes the supplier more responsible for the goods it produces.

Built Environment

It accounts for city's 60% of total material use by weight. As 80% of land is owned by the city it is one of the most effective tools at disposal. They are in the way of constructing 30 new buildings in line with circular thinking.
Principle of "Reuse Unless" is being used in construction of public spaces.
Where materials can't be reused timber construction or other bio-based construction materials are promoted.

Case Study: Cityplot Buiksloterham

Introduction

Urban redevelopment often follows a top-down approach, where large-scale master plans dictate land use and infrastructure. However, this rigid model struggles to accommodate rapid socio-economic and environmental changes. Cityplot Buiksloterham in Amsterdam presents an alternative—an adaptive, mixed-use development that integrates sustainability, community participation, and circular economy principles. This case study examines how Cityplot Buiksloterham challenges conventional urban planning by employing a decentralized, flexible model to regenerate a post-industrial district.

Methodology and Planning Approach

The Cityplot model, implemented by De Alliantie and Synchroon, is based on small, modular plots (typically 100×100 meters) rather than large, predefined blocks. This method allows for phased development, accommodating self-build projects, social housing, and commercial spaces while maintaining design diversity. Unlike fixed masterplans, Cityplot Buiksloterham functions as a "living lab," evolving through continuous dialogue between residents, developers, and urban planners.

The old industrial district is being continuously redeveloped into a circular economy, which is to be used as a pilot project for the city. On its completion it is expected to provide housing to 6,500 residents and by 2034 the city aims to be close to zero waste with complete dependence on renewable energy and houses made with recycled and circular materials

A core feature of this approach is its participatory framework. The project encourages co-creation, where individuals, collectives, and businesses contribute to shaping their environment. Public spaces, semi-private courtyards, and work-home units are interwoven to create an urban ecosystem that promotes interaction and adaptability. The mixed-use nature of Cityplot supports economic resilience, ensuring that residential and commercial activities complement each other rather than being zoned separately.

Sustainability and Circularity Strategies

Sustainability is embedded into Cityplot Buiksloterham's design, with a particular focus on water management. Instead of channeling rainwater underground, the development incorporates it into the urban fabric through visible retention systems in rooftops, courtyards, and streetscapes. This large-scale urban water strategy mitigates flooding risks, stabilizes the microclimate, and enhances ecological resilience.

A double sewage system separates black and grey water, facilitating resource recovery through an innovative floating sanitation facility. Buildings are designed with modularity in mind, allowing future adaptability and minimizing material waste. The project also

prioritizes circular construction practices, ensuring that materials can be reused and repurposed within the district. These strategies position Cityplot Buiksloterham as a model for integrating circular economy principles into urban development.

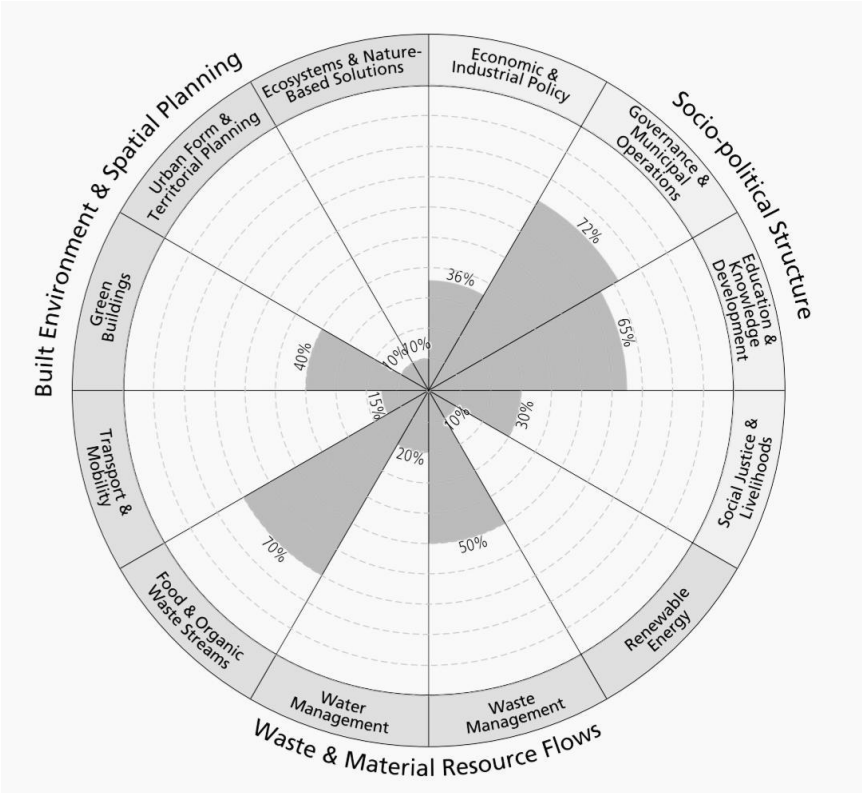
Findings and Implications

The phased, decentralized development approach has yielded several key insights:

1. Unlike rigid masterplans, Cityplot's flexible structure allows for gradual adjustments in response to changing social and environmental conditions.
2. Participatory Planning : By involving residents and small-scale developers, the project fosters a sense of ownership and collective responsibility.

Conclusion

Cityplot Buiksloterham redefines urban development by prioritizing adaptability, sustainability, and participatory governance. Its experimental approach challenges the limitations of traditional planning, offering a replicable framework for post-industrial urban regeneration. As cities worldwide grapple with climate change and socio-economic shifts, the insights from Cityplot Buiksloterham provide valuable lessons for future urban development models.



Policy area addressed in Amsterdam's circular Economy strategy

Strongest actions are taken in the policy areas of governance and municipal operations (72%), education, and knowledge development (65%), food and organic waste streams (70%), and waste management (50%). On the contrary, there is a lack of consideration for nature-based solutions (10%),
urban form and territorial planning (10%), renewable energy (10%), and transport and mobility (15%)

Source: https://doi.org/10.1080/13549839.2023.2206643

Multi-Stakeholders engagement is one of the key points for success in Amsterdam
Stakeholders in Amsterdam's Doughnut Economics framework can be categorized into two main groups:

Grassroots Stakeholders: These include community-led initiatives that engage directly with residents to promote sustainability and social equity. For example, the "Doughnut Coalition" in Amsterdam consists of various grassroots organizations that focus on local sustainability projects, such as community gardens and cooperative housing.

Institutional Stakeholders: This group comprises city government employees, businesses, academia, and think tanks that promote urban sustainability through formal pathways. The Amsterdam municipality has integrated Doughnut Economics into its policy framework, aiming to align urban development with ecological and social goals.

Challenges in Implementation

Despite these successes, several challenges hinder the effective implementation of Doughnut Economics in Amsterdam:
Accessibility and Understanding: The academic language surrounding Doughnut Economics is often inaccessible to residents, limiting effective communication and engagement with the community. Many grassroots stakeholders have reported difficulties in translating the theoretical concepts into practical actions that resonate with local communities

Power Imbalance: A power disparity exists between institutional and grassroots stakeholders, with institutional actors dominating the narrative and implementation processes. For example, while the municipality has the resources to promote its initiatives widely, grassroots organizations often struggle to gain visibility and support for their projects.

Insufficient Support for Grassroots Initiatives: Grassroots stakeholders have expressed concerns about the lack of institutional support for their projects. Many initiatives, such as local community gardens, have not received adequate funding or recognition from the city, which can hinder their effectiveness and perpetuate feelings of exclusion among community members.

Conclusion

Amsterdam's adoption of Doughnut Economics has led to significant advancements in sustainable urban practices, but the success of its implementation is tempered by challenges related to accessibility, power dynamics, and support for grassroots initiatives. Addressing these challenges is crucial for ensuring that Doughnut Economics can fulfill its potential as a transformative model for a just and sustainable economy in Amsterdam.

6.How to downscale doughnut into City level?

City Portrait

	Social	Ecological
Local	What would it mean for the people of the city to thrive?	What would it mean for the people of the city to thrive in its natural habitat?
Global	What would it mean for the city to respect the well being of people worldwide?	What would it mean to respect the health of the whole planet?

The key principles for implementing the Doughnut framework in urban policy, as outlined in the document, include:

1. **Holistic Perspective**: The Doughnut framework encourages a comprehensive view of urban life by considering both social and ecological boundaries. This means assessing the city's performance not just in economic terms but also in relation to social equity and environmental sustainability .

2. **Cross-Departmental Collaboration**: The framework promotes collaboration across different city departments and stakeholders. This collaborative approach is essential for integrating diverse perspectives and expertise, which can lead to more effective and inclusive urban policies .

3. **Community Engagement**: Engaging with residents and local communities is crucial. The City Doughnut Workshops, for example, gathered insights from various neighborhoods to understand their visions and priorities, ensuring that policies reflect the lived experiences of all citizens .

4. **Iterative Process of Change**: The implementation of the Doughnut framework is seen as an ongoing process that requires continuous feedback and adaptation. This iterative approach allows for adjustments based on real-world outcomes and

community needs .

5. **Focus on Social Cohesion and Wellbeing**: Policies should prioritize affordable housing and social networks to maintain community cohesion, especially in diverse urban settings. This focus helps to mitigate the negative impacts of rapid urbanization and rising living costs .

6. **Integration with Existing Initiatives**: The Doughnut framework should complement and enhance existing city initiatives, such as the Circular Roadmap and climate neutrality goals. This integration helps to align various efforts towards a common vision of sustainability and resilience .

7. How to apply Doughnut in Delhi?

Introduction

The NCT of Delhi is the largest city in the country in terms of area, spread across approximately 1486.5 sq.km. It comprises 367 villages, most of which are declared as urbanThere are 11 districts, 33 tehsils/sub-divisions, 272 wards and five local bodies handling civic administration viz. North DMC, South DMC, East DMC, New Delhi Municipal Council and the Cantonment Board. Delhi is divided into 18 Planning Zones for ease of planning and management.Close to 30% of Delhi's population comprises children and young people of 0-18 years age group. In 2021, the population stood at 20.6 million and expected to grow to approximately 30 million by 2041. Delhi is one of the fastest growing urban centres of the world. It is the sixth largest contributor to the national GDP (7.1%) with a GDP growth rate that is 4% higher than the national average.Delhi also serves as a major industrial centre with 33 planned industrial estates, four flatted factory clusters, 1.75 lakh MSMEs (more than 90% micro enterprises) and 23 notified non-conforming industrial clusters. These industries along with household industries continue to generate employment for both skilled and unskilled workforce.
The scale of industry has undergone fragmentation and a large proportion of the workforce is employed in small and micro enterprises and household industries. Over the past two decades, Delhi has experienced a shift towards the tertiary sector. Close to 83% of Delhi's income is from the tertiary sector and about 15% is from the secondary sector (NSS 2015- 16, PLFS (Periodic Labour ForceSurvey) 2017-18). However, despite these strides in economy, people of Delhi are struggling to breathe fresh air and consume clean water.

A major cause of concern for Delhi is the poor air quality index throughout the year. large fraction of air pollution in Delhi comes from outside its geographic boundaries, implying that regional level action would be necessary. Indigenous (within city) PM2.5 pollution is 26% and 36% during the summer and winter, respectively, out of which 45% is because of dust (Ministry of Heavy Industries and Public Enterprises). This highlights the need for dust management during construction activities and enhancing dense forest cover. 20% of the total air pollution in Delhi is from the transportation

sector. Rest is emissions from households, waste burning, industry and diesel generator sets.
Water pollution in the Yamuna and other water bodies, has resulted in disappearance of aquatic life and disturbed the water ecology. The 22 km stretch of Yamuna from Wazirabad to Okhla in Delhi, which is less than 2% of the river length, accounts for about 70% of the pollution load in the river. Despite being a perennial river, the Yamuna has no fresh water flow downstream of Wazirabad in the dry season. The flow in the river comprises of treated and untreated wastewater flowing through drains that fall into the river.24 major drains including Sahibabad, Shahdara, Indrapuri, and Tehkhand drains that are responsible for most of the polluted outflow in the river, are monitored by DPCC. The strategies for preventing pollution of the river have to consider the floodplains, as encroachment or polluting activity in the flood plains increases the ecological damage and the potential flood hazards.
Noise quality levels are beyond the prescribed limit at all locations monitored by DPCC, both during the day and night. Delhi was ranked the third-noisiest city in the world in 2017 by the Worldwide Hearing Index

Air Pollution

Air quality index (AQI), according to the Central Pollution Control Board (CPCB), is a measure of the concentration of eight pollutants

1. particulate matter (PM)10,
2. PM2.5,
3. nitrogen dioxide (NO2),
4. sulphur dioxide (SO2),
5. carbon monoxide (CO),
6. ozone (O3),
7. ammonia (NH3)
8. Lead (Pb)

PM2.5 is a type of airborne fine particulate matter that is less than or equal to 2.5 microns in diameter. The U.S. The Environmental Protection Agency (EPA) uses PM2.5 as a standard to compare air quality in the United States, it is also dominant in determining the air quality index of Delhi. The prescribed level in India is 0-60µg/m³which is 4 times the standard of WHO which is at 15µg/m³.
As of January 18, 2025, the PM2.5 level in Delhi was 125 µg/m³, which is 8.47 times higher than the World Health Organization.3

Major Cause for Air pollution are:
Stubble Burning: During October-November, the contribution of Stubble burning to pollution is nearly 32%.

This is because, by the end of October farmers have to harvest their summer crops to prepare the fields for winter crop. Due to time constraints they seek the easiest step of burning the crop.
Earlier the burning used to happen during September, during September monsoon and hence Direction of winds led to removal of pollutants.
In 2009, Punjab government passed 'Preservation of subsoil Act' which prohibits paddy transplantation before June 15th owing to water shortage in the region. In April, the minimum requirement of water is 4500 litres/hectare. But in June with the advent of monsoon the figure dips down to 3000 litres/hectare.
Before 2009, the stubble was burned in September, during that time the direction of wind doesn't allow the pollutants to enter the Indo-gangetic Plain hence reducing the pollution levels.
Status quo is that every year, Northern plains become a poisonous environment to breathe in. Dust contributes 38% to the pollution in Delhi, whereas,vehicular contribution is 20%. Out of which, 46% comes from trucks and 33% comes from two-wheelers.
Burning: Solid waste and biomass burning together account for around 30% of pollution. In Sukhdev Vihar, a huge plant burns waste to generate electricity, which is an innovative step, however due to non-compliance with the standards this pollution goes into the city adding to the plight.

Water Pollution

Once the lifeline, which spawned the many civilisations and Cities that grew in the area of the present NCT of Delhi, the River Yamuna today suffers from inadequate flow and quantum of water and an extremely high degree of pollution. The length of the river in the NCT of Delhi is 48 kms from Palla in the North to Okhla in the South, with a total river bed/floodplain area of around 97 sq.kms. which is about 7 percent of the total area of Delhi. A little over 50 percent of the river lies North of Wazirabad and the rest, around 22 kms., to its South, in the Urban area of Delhi, which is most polluted. Apart from being the main sources of water supply for Delhi, it is one of the major sources of ground water recharge.
Over the years, rapid urbanisation,encroachments on the river banks, over exploitation of natural resources/water, and serious deficiencies and backlog in sanitation and waste water management services, have resulted in the dwindling of water flow in the river and extremely high levels of pollution in the form of BOD and Coliforms, etc.BOD(Biochemical oxygen demand) is the minimum oxygen required by the river to break down the organic matter in the water. The acceptable standard should be 1 mg/L and not exceed 3 mg/L According to the DPCC report June 2022, when river entered at Palla however by the time it reaches Asgarpur, high level of affluents polluted the river.

The major source of pollution in the river to the extent of about 80%, is the discharge of treated and untreated wastewater through the 22 major drains, which flow into the river. The CPCB data shows that six of these drains viz. *the Najafgarh and the Supplementary Drain, the Shahdara Drain, the Drain near Sarita Vihar, the Maharani Bagh Drain, the Barapulla drain and the Sen Nursing Home Drain* contribute almost 90 percent of the flow and 80 percent BOD load levels respectively.

Noise Pollution:

The prescribed noise level measured in decibels is 55 db during daytime and 45 db during night in residential areas. In Delhi, we exceed this threshold in every region.
The major sources are industrial, aircraft, transportation and diesel generator sets.
During Diwali 2024,Karol Bagh recorded the highest noise level in the city, with an average of 88.7 dB, up from 84.5 dB in 2023.https://search.app/pErqnbDpzrRHqWwH6

Freshwater Withdrawals

The report on the Dynamic Ground Water Resources of NCT Delhi provides a detailed assessment of the ground water situation as of March 2022 4
The tool used to categorise is Stage of ground water withdrawal, which is calculated as,

$$\frac{\textit{Existing gross ground water extraction for all use}\ \ X100}{\textit{Annual extractable groundwater resources}}$$

The existing gross ground water extraction for all uses refers to the total of existing gross ground water extraction for irrigation and all other purposes. The stage of groundwater extraction should be obtained separately for command areas, non-command areas and poor ground water quality areas.

The total annual ground water recharge is estimated at 41,051.17 ham, with an annual extractable resource of 36,946.51 ham. The overall stage of ground water extraction is approximately 98%, indicating a critical reliance on groundwater. Out of 34 assessment units in NCT Delhi, 4 are categorized as Safe, 8 as Semi-Critical, 7 as Critical, and 15 as Over-Exploited.The report identifies five key challenges contributing to the ground water crisis, high demand due to urbanization, inefficient water management, contamination of surface water, climate variability and over-extraction for agricultural purposes.

Land Conversion

As per the URDPFI guidelines5 , the land under green cover there should be 10-12 sqm of per-capita green space in urban areas and 1.2 to 1.4 Ha of green space per 1,000 population. This is in line with WHO standards which recommends 9 square metres of urban green space for each person. WHO guidelines also suggest that an ideal amount of urban green space can be provided as much as 50 sqm per person.

Waste management

The current status of waste management in Delhi reveals significant challenges, as the city generates approximately 11328 TPD (tons per day) of Municipal Solid Waste (MSW). However, the existing processing capacity of MSW facilities stands at only 8228.875 TPD, accounting for about 72.64% of the total waste generated. This results in a processing gap of

approximately 3099.125 TPD (27.36%), indicating that a considerable amount of waste is not being effectively managed.
The processing capacity is calculated by summing the total MSW generation and the capacities of all operational waste processing facilities.

The Municipal Corporation of Delhi continues to dump around 3,400 tonnes of fresh waste daily at the two landfills in Ghazipur and Bhalswa.Of the 11,300 tonnes of municipal solid waste (MSW) generated daily in the city, around 7,300 tonnes are processed at the four waste-to-energy plants and 800-1,000 tonnes at the composting units, with the rest ending up in the landfills.However, the Waste-to-energy plant in Okhla is under scrutiny investigation shows that from 2019 to 2023, 150 samples from around the plant and dumping site contained hazardous metals and persistent organic pollutants like dioxins at levels 10x permissible limits.6

Chemical Pollution

In Delhi, the total annual Greenhouse gas emission was estimated to be 37.91 million tonnes of tCO2e. The fossil fuel consumption of coal and natural gas for electricity generation and fuels used in vehicles accounted for the major emissions in the city (82%). The per capita emission of Delhi city is 2.26 tonne per year tCO2e,

Methodology

The methods consist of the following:
Input: Ten social and seven environmental indicators published by existing peer-reviewed data, government reports, or international organizations for Delhi
Time frame: The most recent information from official sources has been published.
Process:
Step 1: Identify the most reliable and updated indicators based on the doughnut economics parameters, contextualised for Delhi.
Step 2: Identify an estimated sustainable target for each indicator.
Step 3: Identify general interrelationships between parameters.
Step 4: Visualize those indicators in a doughnut economics model.
Output:
Delhi's doughnut economics model

TABLE 1: Delhi's Dimension

Sector	Indicator	units	unsustainable	marginally sustainable	moderately sustainable	sustainable	Delhi	Ref
Social Indicators								
Health	Life	Years	<65	65-70	70-75	>75	74	A1

	expectancy							
	Infant mortality rate	Ratio	>7	7-6	6-4	<4	23	A
Education	Literacy Rate	%age	<75	75-85	85-95	>95	88.70	B
Income	Unemployment rate	%age	>5	5-4	4-3	<3%	1.90	C
	Multidimensional poverty rate	%age	>20	20-12	12-5	<5	3.43	D
Sanitation	Population with access to safe sewage systems	%age	<80	80-89	89-95	>95	56	E
Housing	People living in unauthorised colonies	%age	>20	20-12	12-5	<5	30	F
Gender Equality	Sex ratio	Ratio	<900	900-950	950-999	1000-1050	922	G
	Gender pay Gap	%age	>25%	25-15%	15-5	<5	5	H
social equality	Income inequality (Gini index)	%age	>60	60-40	40-20	<20	40.20	I
Political Voice	Voter turnout	%age	<45	45-55	55-65	>65	<45	J
	Good governance Index	rank	>7	4-7	2-4	<2	1	K
Networks	Average download internet speed	mbps	<25	25-60	60-100	>100	122.0	L
Energy	The proportion of the population with access to electricity metres (Accessibility)	%age	>20	20-50	50-95	>95	95	M

Environmental Dimensions								
Air pollution	Air Quality Index	AQI	>150	150-100	100-50	50-0	202	N
water pollution	BOD level	mg/L				<3	2(in)/85(out)	O
Noise Pollution	Level of decibels	dB	>55	50-55	45-50	<45	63	P
Freshwater Withdrawals	Groundwater Extraction	%age	>100	100-90	90-70	<70	98.16	Q
Land Use	Green Cover	%age	>20	20-25	25-33	33	23.06	R
Waste Management	Processing Capacity	%age	<50	50-75	75-95	>95	72.64	S
Climate Change	Per capita energy-related carbon dioxide emissions	annual per capita tCO2e emission	>9	9-6	6-2.3	<2.3	2.26	T

Social Indicators

Health

The indicator consists of two parameters: life expectancy and infant mortality rate each with the weightage of 50%. Life expectancy refers to the average number of years a person is expected to live at birth. NCT Delhi and kerala are among the states with highest life expectancy where Delhi stands at 74.7 years.A1

However, in the case of infant mortality rate, which refers to the number of deaths of infants under one year of age per 1,000 live births in a given year, Delhi has an alarming figure of 23 which is far beyond sustainable levels.

Education

It is measured by literacy rate, which refers to the percentage of people aged 7 years and above who can read and write in any language with understanding. It stands at a moderately sustainable figure of 88.7% as per the 75th NSS report. In Delhi, Male literacy rate is 93.7% and Female literacy rate is 82.4%.6

Income

To calculate this indicator two parameters with equal weighting are used.
Unemployment rate:The unemployment rate is the percentage of the labor force that is willing and able to work but unable to find employment during a specific period.
As of January–March 2024, Delhi's unemployment rate was 1.8%, a significant drop from 3.3% in the previous quarter. However, the rate increased to 2.5% in the next quarter (April–June 2024). So the fluctuations have been inside the sustainable level.

Global MPI uses ten indicators covering three areas namely health, education and standard of living.MPI assesses poverty at the individual level. If a person is deprived in a third or more of ten(weighted) indicators, the global MPI identifies them as 'MPI poor'.The MPI is computed by multiplying the incidence of multidimensional poverty (H) and the intensity of poverty (A), denoted as MPI = H x A. Incidence (H) shows the percentage of people who are multidimensionally poor, and Intensity (A) shows the percentage of weighted deprivations the average multidimensionally poor person suffers from. The MPI value for a given population, therefore, is the share of weighted deprivations faced by multidimensionally poor individuals divided by the total population. Hence the MPI is known as the adjusted headcount ratio. MPI includes both the share of people in multidimensional poverty and the extent to which they are deprived.

Sanitation: Calculated the percentage of households living in houses with underground drainage systems.

Gender Equity

Two parameters of equal weightage are used namely sex Ratio and gender pay gap
Sex ratio refers to number of females per thousand males in a population
The gender pay gap refers to the difference in average earnings between men and women, often expressed as a percentage of men's earnings.

Social Equality

The Gini Index (Gini Coefficient) is a measure of income inequality within a population. It ranges from 0 to 1, where:
0 (or 0%) represents perfect equality (everyone has the same income).
1 (or 100%) represents perfect inequality (one person has all the income, while others have none)

Calculated by:

$$G = 1 - \sum_{i=1}^{n} (X_i - X_{i-1})(Y_i + Y_{i-1})$$

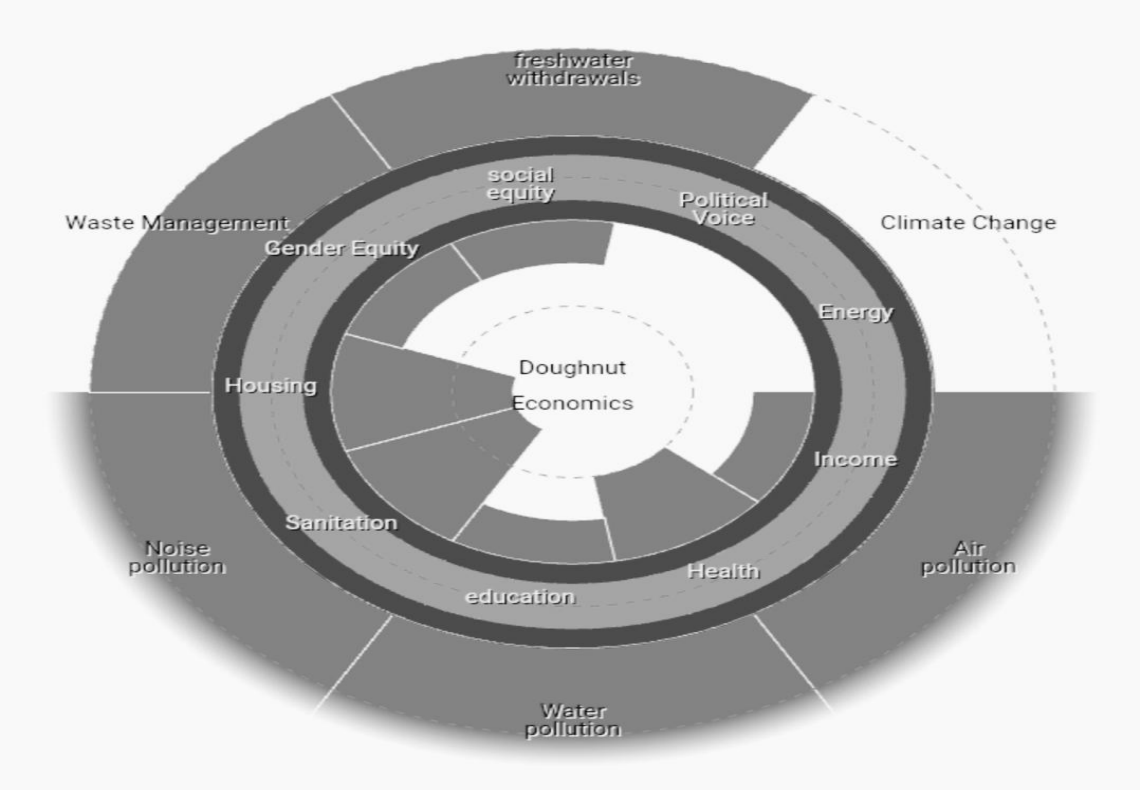
Where:
G = Gini coefficient
X = Cumulative population share (in increasing income order)
Y = Cumulative income share
n = Number of income groups

Political Voice

To calculate this indicator, two parameters were used. Average voter turnout in phase 6 of general elections 2024 by the people of Delhi. The average voter turnout in Delhi was less than the national turnout of 63.37%
Good Governance Index is a comprehensive and implementable framework to assess the State of Governance across the States and UTs which enables ranking of States/Districts. The index was prepared by the Department of Administrative Reforms and Public Grievances (DARPG), Ministry of Personnel, Public Grievances and Pensions

Housing:

The parameter used is percentage of population living in unauthorised colonies. At present around 5 million lower and middle income groups accounting to 30% of the population residing in 1731 unauthorised colonies face serious issues like inadequate infrastructure, water scarcity, unsafe electrical wiring, and lack of proper sewer systems and property registries.



Doughnut Economics for Delhi
Source:[Doughnut Creator by Cambridge Doughnut Economics]
Created using the data in Table 1.

8.Delhi Plan of Action

8.1 Policy Background

Environmental Pollution

In the survey conducted, around 74% believe that mitigating air pollution should be the top priority for the government 4. A major cause of concern for Delhi is the poor air quality index throughout the year. 20% of the total air pollution in Delhi is from the transportation sector. Rest is emissions from households, waste burning, industry and diesel generator sets.

Similarly 37% responses prioritise water management. Water pollution in the Yamuna and other water bodies, has resulted in disappearance of aquatic life and disturbed the water ecology. The 22 km stretch of Yamuna from Wazirabad to Okhla in Delhi, which is less than 2% of the river length, accounts for about 70% of the pollution load in the river. Despite being a perennial river, the Yamuna has no fresh water flow downstream of Wazirabad in the dry season. The flow in the river comprises treated and untreated wastewater flowing through drains that fall into the river. 24 major drains including Sahibabad, Shahdara, Indrapuri, and Tehkhand drains that are responsible for most of the polluted outflow in the river.

Noise quality levels are beyond the prescribed limit at all locations monitored by DPCC, both during the day and night. Delhi was ranked the third-noisiest city in the world in 2017 by the Worldwide Hearing Index.

8.2Policy Recommendations

8.2.1 River Pollution

Usage of *bubble barriers* to prevent plastics getting into the river.
Bubble barrier consists of a perforated rubber tube which is located at the end point of the river body and pressure is put through those perforations which create an upward pressure shifting the current upwards, it then lifts the plastic to the surface of water and guides it to catchments. Amsterdam already has this in place, the city consists of 90 miles of canals.

8.2.2 Air pollution

The highest Air Quality Index (AQI) ever recorded in New Delhi was 1,081 on November 18, 2024. With rising construction activities and vehicular emissions, particulate matter (PM2.5 and PM10) levels have surged, posing severe health risks. Construction dust and vehicular emissions are among the leading contributors to urban air pollution.

8.2.2a Spider-Silk Inspired Dust Containment Structures

One of the primary sources of particulate matter (PM10 and PM2.5) is airborne dust from construction sites. Traditional tarpaulin coverings often prove ineffective, allowing fine dust particles to escape into the air. A revolutionary approach involves developing spider-silk-like containment structures—lightweight yet highly efficient membranes that act as air-permeable barriers, preventing dust from dispersing while allowing airflow to maintain site ventilation.

8.2.2b Application of Dust Binding Agents

Another effective policy measure is the application of dust-binding agents on roads surrounding construction sites. *Calcium chloride and magnesium chloride* are known to absorb moisture from the air, keeping dust particles weighed down and reducing their suspension in the atmosphere. This should be followed by a *mechanized sweeping system,* ensuring that settled dust is efficiently removed rather than being resuspended by vehicular movement.

8.2.2c Stringent Monitoring and Compliance

Mandating real-time air quality monitoring at construction sites, with penalties for exceeding dust emission thresholds.

Implementing automated misting systems and air purifiers near large-scale construction zones and Encouraging green barriers (trees and vegetation) around construction perimeters to trap airborne dust.

8.3. Reducing Vehicular Pollution through Regulatory Reforms

8.3.1 Phasing Out Old Vehicles

Old vehicles, particularly those running on diesel, contribute significantly to urban pollution due to inefficient combustion and high emissions. It will not be suitable to pose a strict ban on old vehicles as people are generally looking at vehicles as a long term investment. Alternatively, incentivized vehicle exchange programs to encourage individuals to trade in old vehicles for cleaner alternatives.

8.3.2 Accelerating the Shift to Electric Vehicles (EVs)

While has made progress in electrifying public and private transport, further policy interventions are needed:

8.3.2aExpanding EV charging infrastructure, ensuring accessibility across urban and semi-urban areas.

8.3.2b Reducing GST on EVs and batteries, making electric vehicles more affordable.

8.3.2c Providing interest-free loans or direct subsidies for EV buyers.

8.3.2d Expanding EV integration in public transportation, including electric buses and rickshaws.

8.4-Strengthening Public Transport to Reduce Private Vehicle Dependency

Policies should focus on Expanding metro and bus networks to ensure last mile connectivity. Delhi Metro, DTC buses and private players like Uber and Rapido vehicles seem the most sought after way of commuting based on efficiency and cost effectiveness. However those who have the privilege to make a choice, keep DTC buses at the last option because of the excessive crowd owing to less number of buses as compared to population density and extreme delays which highlights the inefficiency in bus networks.

8.5 Stubble Burning

To produce 1 ton of rice at least 70,000 tons of water is needed. The access to water and power at nominal cost with a guaranteed MSP from the government makes it an easy crop, hence we produce in excess. Overall rice export is $6,171.35 million during April-October of the current financial year.

A lack of awareness regarding alternative solutions and the long-term negative impacts of burning has perpetuated this practice. Community Outreach, digital and Media engagement is the first step in fighting this issue.

Introduction to various technological equipment has been done like Happy seeders, however, the problem lies with inaccessibility and unaffordability of these equipment. Hence the government should provide subsidies to ease the burden of cost.

A long term solution is *crop diversification*, that not only paddy and wheat but crops like mushrooms can be grown. Mushroom cultivation offers a profitable venture for farmers exploring for an affordable cash crop. The straws and stubble needed to set up the green nurseries that ensure optimum conditions for mushroom growth, can all be derived locally from the field instead of burning.

8.6 Urban Planning:

32.2% of Delhi's population stay in single-room dwellings, according to the Delhi Statistical Handbook 2023. Subhash Camp, Badarpur is one of the many slums that was demolished but the residents were not given suitable dwelling or resettlement.

The issue of slum dwellers can be solved in two ways.

8.6.1 In-situ slum rehabilitation:Preference for in-situ rehabilitation strategies where residents can remain on-site during the reconstruction process, minimizing disruption and maintaining community ties. This involves upgrading existing infrastructure and housing without uncatered displacement.

8.6.2 Construction of Affordable Housing that is environmentally sustainable.

Vertical Housing and Built-to-rent houses can be the way to go to make the housing affordable for people of different income groups.

Built-to-rent (BTR) housing should be developed formally in Delhi because it addresses the city's growing housing demand and transient population, while also offering modern and sustainable living solutions.It provides an alternative option to buying property in Delhi, where real estate prices are high making it affordable for.middle and lower income group.

Focusing on the word formally, it means that at present Delhi's rental market is largely informal and lacks proper regulation so by developing it formally, we provide an organised alternative with tenant rights and transparent pricing.

8.6.3 Mixed Land development

The concept of '*land-pooling'* has been discussed since Delhi Development report 2021, however for proper implementation it is important for private players and different sectors to come forward and form a consortium for smooth implementation of land pooling.

8.7 Eco-Demurrage Currency

This special type of currency in parallel to the conventional currencies can highly accelerate the pace of moving towards a sustainable world.

The mechanism of money creation in this system is opposite to the conventional banking system where money is created out of thin air by banks and a money multiplier comes into effect which then keeps the money in circulation. In this scenario, money will be created when we take sustainable actions, for example planting a tree, and we get paid for it in this currency.

9.Conclusion

9.Conclusion We need a 21st century world where economies are regenerative in nature instead of degenerative, where we not only survive but thrive as a society.The exploration of Doughnut Economics as a transformative approach to urban policy and economic development has profound implications for cities like Delhi. Examples like Amsterdam and Buiksloterham, set a milestone to make this concept scalable to cities. Shifting from traditional growth metrics to a balanced model, Delhi can follow Asterdam's lead in building a resilient, equitable and sustainable future.

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