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"A Design Thinking Approach to Improve Implementation of National Clean Air Programme (NCAP) in Telangana"

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Design Thinking Approach to Improve Implementation of National Clean Air Programme (NCAP) in Telangana

Abstract

This paper explores the integration of the Design Thinking approach within India's National Clean Air Programme (NCAP), focusing on Telangana's efforts to combat air pollution. Rapid urbanization and industrialization have led to deteriorating air quality in cities like Hyderabad and Patancheru, prompting the implementation of NCAP strategies, including enhanced monitoring, clean energy adoption, and pollution control. Design Thinking, a human-centric methodology, is integrated to ensure that air pollution control measures are practical, inclusive, and responsive to local needs. This approach involves framing the problem, understanding stakeholder perspectives, defining a point of view, ideating creative solutions, prototyping, and continuous testing for adaptive and sustainable outcomes. The NCAP, launched in 2019, aims to reduce PM2.5 and PM10 levels by 20-30% by 2025-26, aligning with the Air (Prevention and Control of Pollution) Act, 1981. In Telangana, NCAP focuses on reducing emissions, improving waste management, and increasing green cover. A case study of Patancheru highlights the challenges in achieving sustained air quality improvements despite allocated funds and initiatives. By employing Design Thinking, the aim is to foster a more adaptive and innovation-driven approach to air quality management, ensuring that policies are grounded in real-world experiences and address the diverse needs of the population.

Keywords: National Clean Air Programme (NCAP), Air Pollution, Telangana, Design Thinking, Stakeholder Engagement

Introduction

In India Air pollution is leading to environmental and public health challenges, due to rapid urbanization and industrialization many states are facing problems like deteriorating air quality and one of those states is Telangana. To address these issues, the National Clean Air Programme (NCAP) was launched as a strategic step aiming to achieve a 20 - 30 % reduction in PM 2.5 and PM 10 levels by the Ministry of Environment, Forest & Climate Change (MoEFCC).

Major cities in Telangana like Hyderabad, Patancheru, Nalgonda etc. have witnessed rise in the pollution levels because of the infrastructural development, industrial emissions and increase in vehicular density.

The implementation of NCAP is structured around key steps in Telangana, including the increase of air quality monitoring infrastructure, adoption of clean energy solutions, enhancement of green cover and enforcement of pollution control regulations. The Telangana state pollution control board also plays a vital role in monitoring the air quality and ensuring compliance with regulatory standards. To provide the real time data on the pollution, continuous ambient air quality monitoring stations have been located across major cities which enables data-driven policy decisions.

In Telangana to enhance the effectiveness of NCAP, the Design Thinking Approach has been integrated into policy planning and implementation. Design Thinking is a human-centric, solution-oriented methodology that emphasizes innovation, collaboration, and continuous improvement. To ensure that the air pollution control measures can be practically implemented, inclusive and are responsive to local needs, the design thinking approach is used. The approach facilitates the development of adaptive and sustainable solutions by delving into the problems and engaging with various stakeholders, industries, also including government bodies and the public.

The Approach of design thinking in the air quality management of Telangana includes several key principles. The first step is framing the problem which involves the identification of air pollution as a critical problem and defining major sources. Then comes the second step understanding which mainly focuses on the collection of data from monitoring stations and involving stakeholders to assess the impact of pollution. Step three is Point of view where we do analyses to identify specific areas for Telangana's environment. The fourth step is ideation in which we explore and design creative solutions for the problem. Then in the fifth step Prototype we arrive at the final outcome of this process and map out ideas to make projects. The sixth step is Testing which ensures continuous monitoring, feedback and refining before full scale implementation.

With the integration of design thinking with NCAP, the aim is to create a more adaptive, inclusive and innovation driven approach for the management of the air quality in Telangana.

Policy Overview

The National Clean Air Programme (NCAP) was launched by the Ministry of Environment, Forest and Climate Change (MoEFCC) in January 2019 to enhance air quality in 131 cities, including non-attainment cities and Million Plus Cities, across 24 States and Union Territories. The program seeks to engage all stakeholders in achieving air quality improvements, targeting up to a 40% reduction in PM10 concentrations or compliance with the National Ambient Air Quality Standards by 2025–26. Under NCAP, 82 cities have been assigned annual reduction targets of 3–15% for PM10 levels, contributing to the overall goal of a 40% reduction. Additionally, 49 cities supported by the XVth Finance Commission air quality grant are required to achieve an annual 15% reduction in PM10 concentrations and increase the number of good air quality days, where the Air Quality Index remains below 200 (Press Release: Press Information Bureau, 2023).

While NCAP functions as an independent initiative, it is aligned with the Air (Prevention and Control of Pollution) Act, 1981, which serves as the primary legal framework for air pollution control in India. The program also integrates with various environmental regulations and policies to strengthen its implementation (Ministry of Environment, Forest & Climate Change Government of India, 2019).

The programme represents India's comprehensive regulatory framework to address air pollution through targeted mitigation strategies. While primarily rooted in regulatory policy due to its enforcement mechanisms under the Air Act, NCAP incorporates distributive elements through its funding model, which allocates ₹11541.88 crore (as of 2025) to non-attainment cities for pollution control projects (*NCAP*, n.d.).

The implementation model aligns with the elite model, where decision-making is centralized under the MoEFCC and other high-level committees like the Central Pollution Control Board (CPCB) whereas, ground level realities, unofficial stakeholders are not taken into consideration. Elite theory is a theory of state that seeks to describe and explain power relations in contemporary society. The theory posits that a small minority, constituting members of the political - economic elite and policy planning networks hold the most power and that this power is independent of democratic election. The core doctrine of the elite theory is that it is a minority that makes decisions that affect the general public and that the minority ruling gap is composed of those who occupy – commanding political positions. It over time changes in different ways (Salawu, 2023, p.3).

The program also reflects the punctuated equilibrium theory, which explains how significant policy changes occur after long periods of stability due to external pressures like public health crises or international environmental commitments. The punctuated equilibrium model aims to explain why public policies tend to be characterized by long periods of stability punctuated by short periods of radical change (Jolicoeur, 2018, p.1). It depicts governance systems as subject to influence from new ideas and from appeals for change from discontented actors and, once influenced, able to generate new policies (Jolicoeur, 2018, p.8).

Official actors include the Ministry of Environment, Forest & Climate Change (MoEFCC), Central Pollution Control Board (CPCB), State Pollution Control Board (SPCB), NITI Aayog, Urban Local Bodies (Municipalities), while unofficial actors encompass Academic institutions (IITs, IISc), International organizations (World Bank, UNEP), Civil society groups (NGOs), Technical experts (Ministry of Environment, Forest & Climate Change Government of India, 2019).

In Telangana, NCAP has identified three non-attainment cities: Hyderabad, Nalgonda and Patancheru (Ministry of Environment, Forest & Climate Change Government of India, 2019). The state has implemented city-specific action plans focusing on reducing vehicular emissions, improving waste management systems, and enhancing green cover through plantation drives. Hyderabad has 13 Continuous Ambient Air Quality Monitoring (CAAQM) stations, while Sangareddy has one station (*National Air Quality Index*, n.d.). These stations monitor pollutants like PM2.5 and PM10 to provide real-time data for assessing air quality trends. Other initiatives under NCAP in Telangana include public awareness campaigns and stricter enforcement of industrial emission norms.

Focusing on Patancheru, an industrial hub within Sangareddy district, air quality monitoring has been a priority due to its history of high pollution levels from industrial activities. However, as per the latest data from the CAAQM dashboard, no specific AQI data for Patancheru is available for April 2025 (*PRANA*, n.d.). Previous reports indicate that PM10 levels have consistently exceeded permissible limits over the years due to emissions from factories and vehicular traffic. While funds amounting to INR 3.74 crores have been allocated under NCAP for improving air quality in Sangareddy district from FY 2020-21 to FY 2023-24, specific details regarding the spending of funds are not publicly disclosed (*PRANA*, n.d.).

A Public Grievance Redressal Portal App has been developed, a Graded Response Action Plan has also been prepared in line with that of CPCB action plan for Delhi, only the Source Apportionment / Emission Inventory Studies is still not complete under the City Action Plan which has been approved (*PRANA*, n.d.). Initiatives such as stricter industrial compliance checks and plantation drives have been undertaken in the area. However, significant challenges remain in achieving sustained improvements in air quality due to ongoing industrial activities.

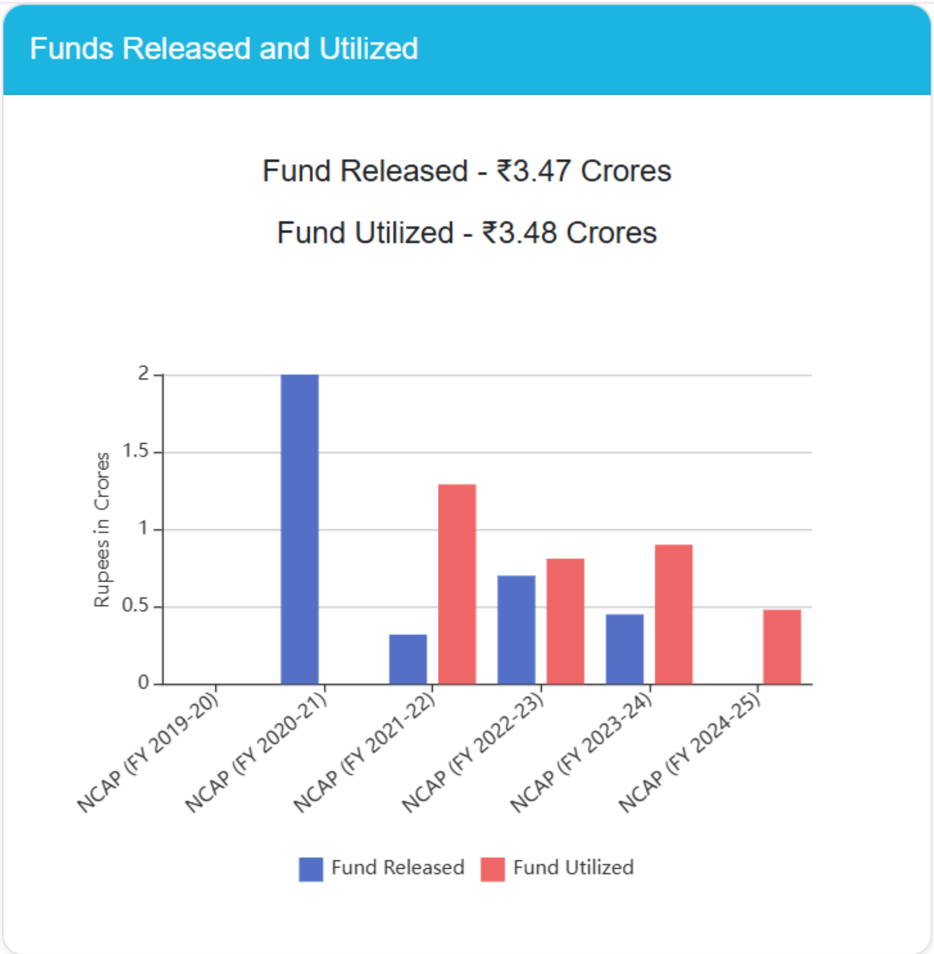

Figure 1 Fund Allocation for Sangareddy over the years (PRANA, n.d.)

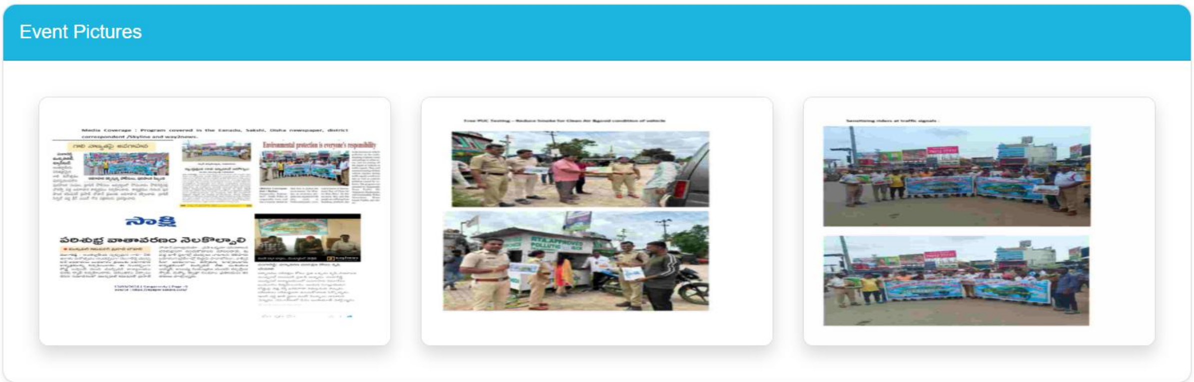

Figure 2 Updates available on the official website about the events taking place under the programme (PRANA, n.d.)

While the National Clean Air Programme (NCAP) sets a solid foundation for nationwide air pollution reduction, its implementation in Telangana, particularly in industrial zones like Patancheru, faces significant challenges. The core issue lies in balancing environmental mandates with economic realities, leading to inconsistent enforcement and monitoring. To address this complex problem, we are employing design thinking principles. This involves empathizing with all stakeholders—local communities, industries, and government agencies—to deeply understand their needs and constraints. We will then define the specific challenges in Patancheru, ideate innovative solutions that are both environmentally effective and economically feasible, prototype pilot projects to test these ideas, and rigorously evaluate their impact. The ultimate goal is to collaboratively design and implement comprehensive strategies that ensure cleaner air for Patancheru while supporting sustainable industrial growth.

Design Thinking Process

Step 1: Framing Design Challenge

An effective solution requires a well-defined problem. The first step in the design thinking process requires the user to have a clear idea of the problem that they are trying to solve. The problem or challenge that needs to be addressed has to be clearly defined. This helps the user arrive at the optimum solution. Moreover, the process of arriving at a clearly defined challenge further facilitates the design thinking process. Asking multiple and repeated questions about the problem expands the creative faculties of the thinker. A question like “why” may generate a range of ideas. A question like “how” might help narrow down to more feasible or solvable challenges. Hence, framing the design question gives a direction as well as flow to the thought process of the user.

This step strengthens the validity of the process. It illustrates the importance of the challenge that is being solved. It defines who is affected by the problem and who should benefit from the solution. It ensures that the further process is relevant to the ecosystem where it is functioning. It also gives the thinker an idea of the degree of effort and resources that the solution will require. It is an opportunity for the user to determine their priorities and make targeted efforts so that resources are used optimally.

The goal of this paper is to understand the problem of air pollution in and around Rudraram. To refine this goal and frame it definitely, the 6 Wh’s were used. This method involves answering a comprehensive set of questions about the problem. This covers all dimensions of the problem. The clarity obtained from answering these questions is useful in the upcoming steps in the design thinking process.

Figure 3 6Ws1H

What is the problem you are trying to solve?
Air Pollution in Patancheru

1. Take a stab at framing it as a design question
   How can we control the Air Pollution in Patancheru
2. Now, state the ultimate impact that you are trying to have
   Improve public health
3. What are some possible solutions to your problem?
   Regulating factories, Low emission technology
4. Context and constraints
   Regulation will cause economic problems. and people
5. Tweaked question
   How might we control pollution without excessive regulation on the factories.

Figure 4 Framing the problem

Illustrate the framing process. We asked different kinds of questions about the challenge. We found that there is a definitive air pollution problem in Patancheru. It can be due to multiple causes like factories, construction and vehicular traffic. The policy needs to focus on how to address these causes. To find the extent of the problem, there is a need to understand how this impacts the people living in the area.

Step 2: Understanding

The policy making process is complex and nuanced. It can be easy for a policymaker to forget the impact that policies have on people. This stage is crucial in mitigating such issues. It is important for the policymaker to remember that the people for whom they are making policies have many dimensions. They have concerns, worries, thoughts, and ideas. These need to be accounted for while making policies for them. The understanding stage helps the policy maker account for all perspectives and the lived experiences of people while making policy.

The most important element of the understanding stage is empathy. “Empathy is the ability and willingness to recognize and understand the thoughts, emotions, motives and personality traits of another person” (Lewrick et al., 2018, 72). In policy making, empathy helps to take stock of a situation and understand how it is impacting people. It creates new material, inputs and influences that feed into the policy making process. It bridges the gap between policy making and real experiences (Mintrom & Luetjens, 2016). Empathy lays the foundation for creativity. It enhances every stage of the design thinking process.

In the context of policy making, empathy needs to be employed to understand how the policy is interacting with the citizens and what are their experiences with it. To achieve this, we observe and engage with the citizens. To understand better, the policy maker could approach such interactions with the users with an open mind. They may go in with a loose framework and let the conversation flow according to the user (Allio & UNDP Global Centre for Public Service Excellence, 2014). For this policy, a similar approach was used. Residents of Patancheru were engaged in discussion about air pollution in the area. They belonged to two categories- Residents of Rudraram, a village and Patancheru, and residents of Gitam University

Hostel (Block C), a university adjacent to Rudraram. Insights derived from such interactions may be mapped in different ways. In this case, an empathy card was used for empathy mapping. Following Figures 4 and 5 illustrate this.

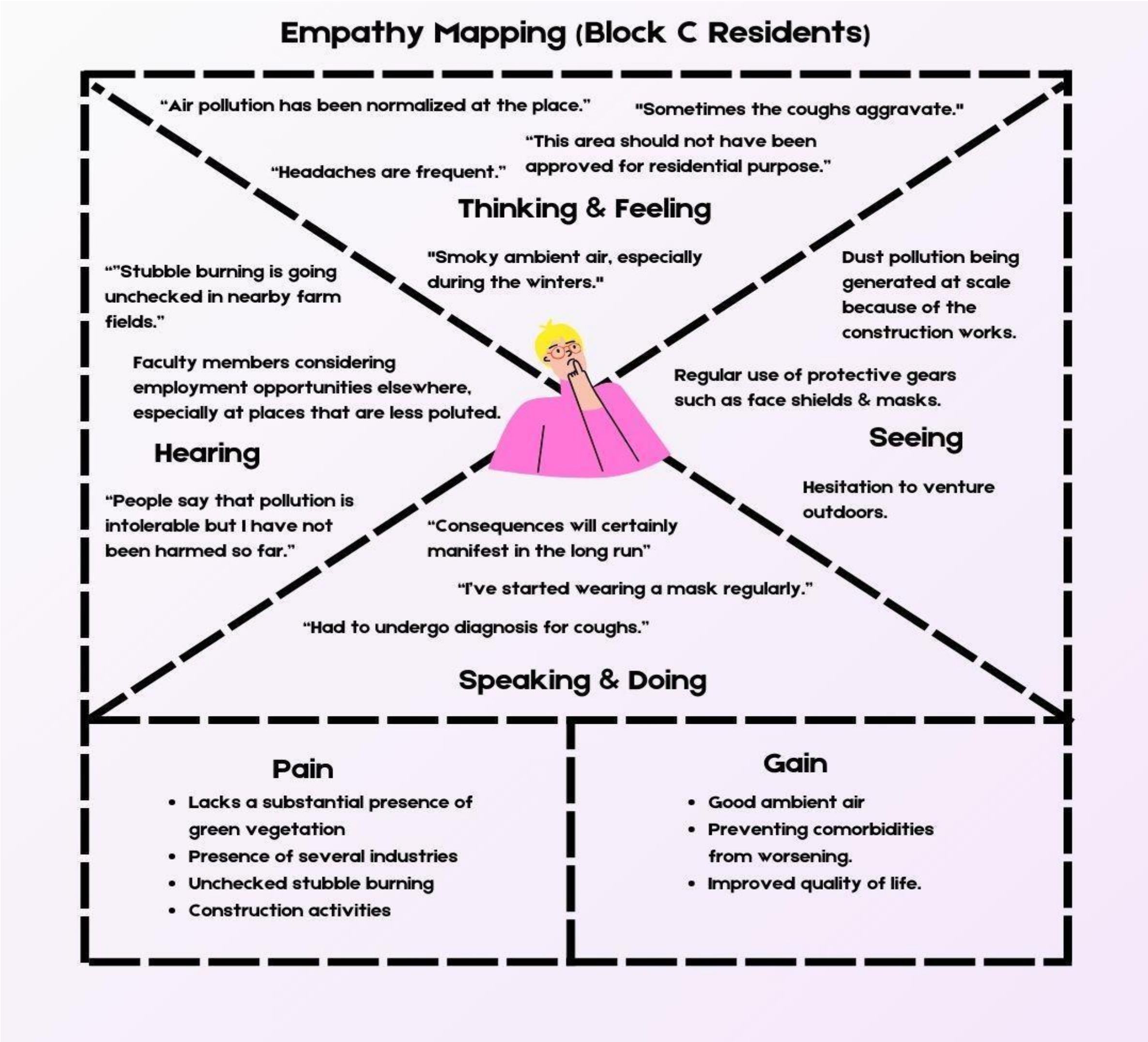

Figure 5 Empathy Mapping of Block-C Residents

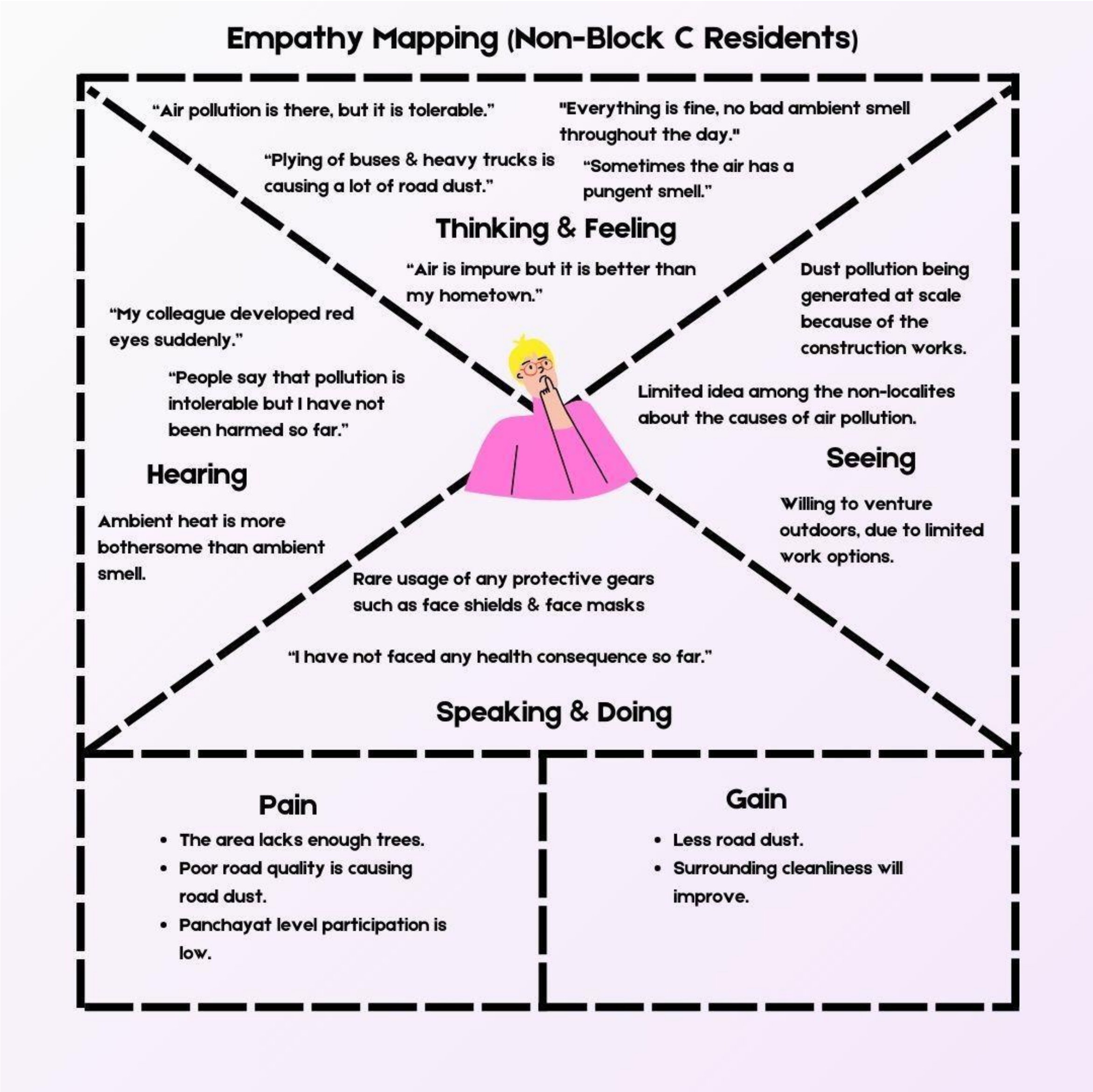

Figure 6 Empathy Mapping of Rudraram Residents

Rudraram lacks a structured policy interface. However, when asked about air pollution, there is a stark difference between the way residents of Rudram and residents of Block C perceive the problem. While air pollution frequently comes up in conversation among residents of Block C, residents of Rudraram rarely discuss it. Rudraram residents don't seem very concerned with foul smells or smog. Their issue is with dust on the roads. On the other hand, Block C residents talked about health problems and allergic reactions due to the polluted air. They attribute the air pollution to the factories around Rudraram. Residents of Rudraram seem indifferent to the problem and are more concerned about vehicular pollution that affects their daily commute on foot. Correspondingly, suggestions made by Block C residents were concerned more with the factories whereas Rudraram residents suggested more local initiatives like solutions like fixing roads, cleaning up trash, etc.

We now have a perspective outside of our existing perception of the problem. Empathizing with the users has helped us reduce our biases and pre-existing understanding of the problem. We were also able to map how different kinds of people have been impacted differently by the problem, caused by a lack of an effective solution. We now have a set of insights that we can refine further to make into practical policy ideas.

Stage 3: Define Point of View

This stage allows the thinker to frame and compile the different perspectives, insights or Point of Views that were obtained in Stage 2. We let the knowledge from stage 2 inform how we approach the solution. These definitions are more powerful because they are derived from input given by real people. This sets the context and direction for generating creative ideas. The multitude of perspectives allow us to come up with holistic solutions.

In this case we can observe that awareness about air pollution among residents of Rudraram is low. They are indifferent towards the problem. We can also observe that residents of Block C are suffering health problems that can be attributed to air pollution. Such insights may be collated into the following problem statements.

Problem Statements

1. How might we encourage village residents to take initiative for solving the air pollution problem?
2. How might we mitigate the health problems caused by the pollution?

This is an example of how Defining Point of Views help us narrow our focus. This is the “How” part of the question that helps us reach feasible solutions. Another helpful component of this stage is defining the kind of problem that we are dealing with. For example, the problem of air pollution in Rudraram is an ill-defined problem. Even though we are aware of the problem, the exact cause or primary cause is unclear. There are also a multitude of problems and subsequently a multitude of solutions. This helps us form a creative framework within which we can work on the next stage.

Stage 4: Ideation

The ideation stage drives the design thinking process. It involves using various techniques to stimulate the creative thinking process. Brainstorming sessions about prospective solutions, formulated in the framework of these techniques, can lead to optimal solutions. It uses various visuals, graphics and sketches. Ideas may be mapped to understand how they can play out.

In this case, brainstorming resulted in ideas that addressed the issues discovered in the previous stages. Some of them were mapped for better understanding and clarity. Figure 6 is a Retrospective board to visualize the ideation process. Figure 7 maps the ideas that were generated.

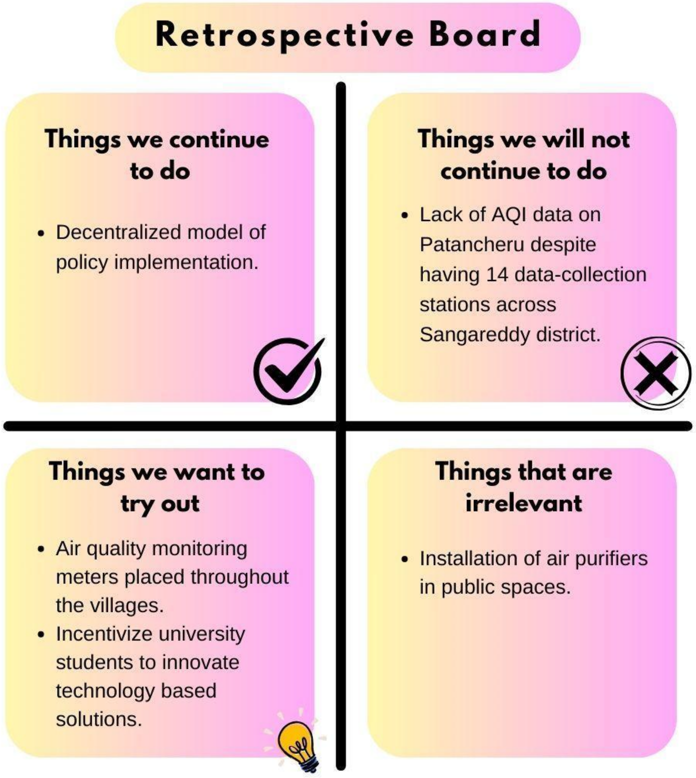

Figure 7 Retrospective Board

Figure 8 Ideas Map

Mapping the solutions is part of a larger process. Mapping them is the first stage of developing a prototype of the solution. It helps us to make the idea tangible and implementable. In this stage, volume is key. We come up with as many ideas as we can before we map them out. This provides multiple ideas for prototyping and testing, allowing us to identify the most viable solution. In this case, ideation has given us a clear range of solutions that can be considered for the next stage.

Stage 5: Prototype

This stage lets us arrive at a final outcome of the design thinking process. At this stage, we have our ideas mapped out. We now make real life replicas of the ideas to see how they would play out. Prototyping is an iterative process. It offers a controlled environment where the strengths and weaknesses of the ideas may be analysed and tweaked. The ideas can be tweaked until we arrive at an idea that works.

For this policy, program prototypes can be made to test how they can be implemented. A network of prototypes using various methods can be developed to replicate the solutions. Innovative ideas like air quality monitoring systems, waste management systems and enclosures around construction sites can have work-like prototypes to test the effectiveness. The rest of the ideas may be tested with concept level prototypes that can give a comprehensive idea of how effective they can be. The most important component of the prototyping in this case would be role play. A lot of the solutions rely on how people living in Patancheru will interact with the solutions. Policymakers can act like different kinds of residents like women, children, students, elderly people, etc. They can interact with the solutions to understand how the users will experience it. This will lead us to optimal solutions.

Stage 6: Testing

This is the stage where prototypes that were developed by us are actually tested. In this case, the replicas of the various components of the solution that were developed, are tested on a small scale. A small set of potential users test the prototypes. More importantly, this stage is expected to give final and practical insights. To achieve this, we ask the users “Why?”. We try to find out why a prototype has worked or why it has not worked. Hence the testing process is accompanied by in-depth questioning. In other cases, this stage can include testing websites and digital interface products with potential users to find problems or strengths. This will help us arrive at a set of implementable solutions.

Proposed Changes

Some of these solutions are mentioned in the policy. However, the biggest issue is that the implementation is not reaching Patancheru. The policy needs to be more decentralized. Every locality has different problems that have unique solutions. This is something that we have discovered with the help of design thinking. As we can see, the solution needs to be tailored to the unique problems of the region.

The design thinking process that was proposed, produces a number of solutions that are uniquely suitable for the Patancheru region. They are arrived at, by a long and detailed process of citizen centric empathy mapping. This can only be achieved if the implementation is decentralized.

Therefore, we propose for it to remain a combination of regulatory and distributive policy type while making sure the decentralization is maintained with robust implementation. This would provide decision making power with the local bodies allowing them to take action based on real-time situational analysis. This would also benefit in quick decision-making since the process is decentralized.

Next, we suggest changing the implementation model from elite to incremental model. This would help in maintaining the dynamic nature of changes required in the City Action Plan for each non-attainment city listed individually.

After deciding upon the implementation model, we would move forward to another integral part which is the framework. Previously, the Punctuated Equilibrium Theory (PET) framework was used. Now after applying the Design Thinking process, we believe Stage Heuristic would be a good fit. Considering the implementation involves decentralized and incremental methodology, trial and error would be a continuous process. To evaluate the changes frequently continuous evaluation needs to be done, which may be done through the Stage Heuristic Framework. In the stage heuristic model, particularly in the evaluation stage, the results and the outputs of the policies are assessed and compared with the goals set in the formulation stage. In this context, policy makers make a decision whether the policy should be redesigned or not. When compared to other public policy analysis models, in stages model every detail of the policy is more scrutinised (Kulaç (PhD) & Özgür (Prof. Dr.), 2017, p.149).

Socio-Economic & Political Impact on Society & Governance

Social Impact

Air pollution is harmful to everyone's health, but it's especially dangerous for children, the elderly, and people with existing respiratory problems. The tiny particles in the air, known as PM2.5, are so small that they can penetrate the body and cause serious health problems such as asthma, lung infections, and heart disease. The World Health Organization (WHO, 2021) states that long-term exposure to polluted air can be harmful to the heart and lungs. Hyderabad has implemented the National Clean Air Program (NCAP) to ensure clean and healthy air for all. The plan could reduce exposure to air pollution and improve the quality of life for everyone in the city. To raise awareness, the government can launch online campaigns with tips on how to clean the air, educate children in schools about air pollution, and support social initiatives such as planting trees or reducing air pollution.

Economic Impact

Air pollution not only harms people's health but also costs them a lot of money. Whenever people fall ill due to air pollution, they spend a lot of money on healthcare. Workers may be absent from work or unemployed, and tourists are reluctant to visit polluted areas, which hurts local businesses. According to the Center for Science and Education (CSE, 2022), the health costs of air pollution in rural India are estimated to be 1.7% of India's GDP. Hyderabad can be made affordable through clean transportation (electric buses and cars) and renewable energy sources (such as solar energy). These changes not only reduce environmental pollution but also help develop a green economy. Companies investing in these initiatives can generate additional revenue by contributing to a clean and healthy environment (Kaur, Rajveer, & Pandey, Puneet, 2021).

Political & Governance Impact

If implemented properly, NCAP can make the government more effective in controlling air pollution. Currently, air quality regulations are not always followed, making it difficult to clean the air (Datta, E., & Ginsart, 2021). But with real-time air monitoring and Public Air Quality Index (AQI) data, Hyderabad residents can take steps to keep their air clean. NCAP can also be linked to other city initiatives, such as promoting electric vehicles under the Telangana EV Initiative and improving public transport under the Hyderabad Metro project. This will create a better plan for the city's future, combining clean air with the development of modern cities (Ministry of Housing and Urban Development, 2022).

Conclusion

Application of the design thinking approach enabled us to critique the implementation of the National Clean Air Program (NCAP) 2019 and assisted in highlighting the stark disconnect between policy design and policy experience at the community level. The design thinking tools, especially the empathy map, enabled us to deploy an empathetic approach toward understanding the policy shortcomings. It also facilitated an understanding of the difference in perception towards pollution existing between policy beneficiaries, a major policy challenge for policymakers. This shows how policy interventions do not align with local priorities and experiences. Through the application of various design thinking tools, the effectiveness of the policy in question could be greatly improved, and optimal solutions could be drawn to address the implementation gaps. The design thinking approach offers a promising framework for policymakers to develop community-responsive policy interventions in not just Patancheru but several other cities that could be facing similar implementation gaps under the National Clean Air Program.

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