

### "Make the Case" Entry



#### Profile of Stakeholder: Dr. MAHESH KASTURE

Experienced Chief Research Development Manager with a demonstrated history of working in the oil & energy industry. Skilled in Research and Development (R&D), Materials Science, Management, Leadership, and Product Development.

#### TEAM MEMBERS:

1. Mridul Khanna
2. Anmol Malhotra
3. Ankush Koundal
4. Pritish Jain

#### Initiative Overview

As chaos theory states, even a butterfly flapping its wings can cause a tornado in the long run i.e., even small changes/events can have a big impact on the future. The initiative that our team selected is one of those small events that can have a big impact on the future.

The initiative revolves around the fact that some plastics cannot be recycled and for those plastics it isn't economical to clean, segregate/ separate and then perform heat-pressure treatment on the waste plastic so as to recycle them. So, they came up with a model that incorporates plastic waste in the pre-existing road manufacturing techniques. They proposed that the plastic waste can be converted to modules that can be placed in sub-base and base layer of the road while construction. The plan was to make roads out of plastic waste that could contain any type of plastic in any proportion but first it's always necessary to perform a small-scale test before going all out. So, they started out by making a sample road for experiment purposes in front of their BPCL Noida branch office and then slowly started building small test sites in other cities like Mumbai, Kochi and Kolkata.

## PART I: PROVIDE BACKGROUND INFORMATION

### Describe the city where the Initiative takes place?

The plastic roads were constructed in Mumbai, Noida, Kochi and Kolkata. All these cities except Noida have poor waste disposal and management systems as well as poor roads that are in desperate need of repairs. It's estimated that 96% of roads in Mumbai have pothole problem. Noida has hot and somewhat dry weather conditions whereas Mumbai and Kochi have a very hot and humid environment due to heavy rainfalls and nearness to the sea. Kolkata has balanced tropical weather conditions due to its geographical location. The plastic roads built in these locations and are still in working condition.

### Provide the scale of the problem of plastic waste in this city?

Waste disposal and management is a big problem in almost all the cities across India. There isn't a single city that can be reported as plastic litter free. Mumbai and Kolkata are responsible for major plastic waste production and according to municipal corporation they are among sixty cities that generate more than one sixth of the total plastic wastes generated by the country. They also produce much more litter and plastic debris as compared to Noida and Kochi.

Numerous animal deaths were reported due to consumption of plastic in some of these cities which is a cause of major concern.

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#### Why did the Initiative start in this city?

The first road was constructed near BPCL Noida office. This place was selected so as to test the road's strength under the load of various vehicles that commute to the office. This helped to determine whether the plastic roads could still stand after experiencing frequent fatigue cycles. Since Noida has a less moisture rich environment and low annual rainfall, we would not be able to tell the effect coastal cities, which have relatively cool and moisture filled environmental conditions.

## PART II: THE INITIATIVE'S IMPACT

#### What are the benefits to society? What has been accomplished? Have the societal benefits outweighed the amount of resources expended to generate the results?

- Construction of plastic roads can indirectly reduce the amount of unintended litter produced. Since waste can be collected from nearby area, less transportation steps are required, which leads to decrease in air pollution occur during transportation.
- Plastic scraps can be consumed by animals which may leads to their death. Also, accumulation of waste around the roads can have a negative impact on the people living in the region, which reduces the overall gross happiness product of the country leading to the migration of people.
- It was seen that 60-metric ton of plastic was consumed to make 1Km of road. The initiative is the first process globally which is able to use such extraordinary amounts of plastic to make roads. This will greatly decrease the amount of waste lying around in unsanitary landfill.
- Yes, the benefits are more than the amount of resources expended. As this process of module manufacturing generates jobs locally and can make use of waste generated in that particular area, even it also decreases the amount of tar used. This decreases the overall transport cost of the process.

#### What are the benefits for the environment? Has the Initiative reduced or eliminated the amount of plastic in the streets or waterways? What has been accomplished?

- The initiative utilizes a large amount of plastic waste which will surely decrease the amount of waste going into landfills and incinerators. This will decrease the greenhouse gases evolved from these processes, which can decrease the effects of climate change in the future.
- During recycling, waste plastic is washed multiple times before processing, which can create microparticles. These can leach into water bodies when the chemical reaction tanks are cleaned or water used in the washing step is discharged. Hence the initiative can decrease marine life pollution.
- More than 77.5 metric tons of plastic waste has been utilized to make 8,632-meter square of plastic roads across four different cities in India. This has considerably decreased the amount of waste going unused and increased the quality of roads.

#### What are the benefits for the economy? Has the Initiative created new business? Can it create new jobs?

- The initiative affects mainly two industries, namely, Petro-chemical industry and the plastic waste treatment industry. As plastic waste is mainly required for construction of roads than tar, which will decrease the amount of waste going to incinerators and reduce the energy required there.

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- It is similar to the conventional road construction business but the only difference is that it involves the plastic waste industry. It also involves filling up tenders and hiring employees for different reasons, hence the initiative does generate jobs and works as a business.
- As, we have to remove various metallic contaminants from the plastic waste to increase the quality of modules. If demand for plastic roads increases, the demand for plastic waste also increases and more treatment and waste collection facilities have to be built. This will create jobs in different fields.

### Which SDGs will the initiative impact through its social, economic and environmental contribution?

1. Climate action: this initiative reduces GHG emissions due to accidental or intentional fires by decreasing waste in landfills. Hence the initiative can reduce the effect of climate change due to plastic waste.
2. Clean water and sanitation: If we commercialize the initiative, the plastic waste modules will be present below the bitumen layer, this will prevent microplastics formation. Reduction in plastic waste present in landfills also reduces bugs and microorganism present in the society and hence can improve sanitation.
3. No poverty and zero hunger: The selected initiative create job opportunity for local workers, since they are required for various processes. The plastic waste produced locally can be used to make roads which boosts the economy of the area. This initiative also requires removal of contaminants from plastic waste which can generate a demand for plastic waste segregation industry and can generate jobs.

## PART II: WHAT IS POSSIBLE IF THE INITIATIVE HAD MORE RESOURCES IN ITS CURRENT LOCATION

### Are the Initiative's operations sustainable "as they are?" Will it be in operation for next five years? If yes, why? If no, why not and what can be improved?

India is a developing country, there are villages that are being organized and urbanization of the rural areas is taking place at an exponential level. To connect these villages with towns and cities, it is essential to construct roads. There are numerous roads that require lot of repair. Since they are subjected to long service periods.

Plastic waste production can reduce after a few years but it can never reduce to zero since the world is highly dependent on plastics. This tells us that there will be a constant requirement of road construction all over the country. Hence the plastic road business model is sustainable. The plastic roads that were built at different sites around the country are still in working conditions and there was no requirement for performing maintenance of the plastic roads during the past years. This tells us that the plastic roads are durable.

### Assume your team had the funds to increase the budget to maximize social impact. How would the team spend this additional funding, and what would be the incremental results/benefits?

#### SPEND MONEY/WHY:

1. Hazmat suits and gas mask; 2,000 rupee per piece - This would keep the workers safe
2. Better sorted waste; 2 lakhs per ton approx. - Plastic Waste without metallic and organic waste contamination.
3. Pavers; 9 lakhs- used to automate the process.
4. Solar panels;1-2 lakhs, decrease energy consumption cost.
5. Skilled labor; 1000 rupees per day per person - To improve the quality of workers managing machines.
6. Research and development; 2-3 lakhs per annum -This will help develop new techniques to improve the initiative as a whole.

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#### INCREMENTAL RESULTS/BENEFITS

1. There were various gases and chemicals being released from landfills which can adversely affect the health of unprotected labors. Using hazmat suits can help protect the worker's health.
2. Skilled labor will decrease the chances of accidents and even also, we can invest in making unskilled labor skilled during the time they are working for the company.
3. It is important to remove metallic waste from plastic waste so as to prevent various machines that are used to shred the waste and make modules from being damaged.
4. Our initiative requires machines that works either on oil or electricity. So, the cost of electricity can be reduced by using solar panels.
5. Machines like Pavers can be used to decrease the number of workers required in the process which will decrease the cost of the process.

## PART III: "MAKE THE CASE" TO REPLICATE THIS INITIATIVE IN FIVE OTHER LOCATIONS IN INDIA (OR WORLD)

### How can this Initiative be replicated in other cities in India?

To replicate the initiative, first we need to buy plastic waste. The second step is to dry and shred the plastic waste. Then a concrete mould is made in which the plastic waste can be heat and pressure treated to get the modules. For construction of roads, an area is to be digged and flattened with the help of a roller, water is sprinkled and the area is allowed to dry for three days. Then a layer of stone of size ranging from 2-3 inches is laid over the flattened area and evenly distributed with the help of a roller. The top layer is cleaned and then stone chips of size ranging from 0.50 to 0.75 inches and later sand and clay is spread to fill the minor gaps. The surface is rolled and cleaned again. This layer is called the sub-base, on which base is prepared by spraying hot bitumen, then applying one inches of concrete on which plastic modules should be placed. Then the modules are covered with an even layer of bitumen and then the surface is worked upon by a roller. This process can be implemented in any city, with minor changes.

### What kind of resources will be required to replicate current innovation? Money? People? Change in regulation/policies?

The main resources include mixed plastic waste that is free from any contamination and tar. You would also require sand and gravel of different sizes. The machines include shredder, compression moulding apparatus, mold based on the dimensions of modules, road construction machines like motor grader, road roller, paver, bitumen mixing machine and other road construction machines. You require laborer's who will make use of the machine and follow your instructions to help build roads. You also require equipment's for the safety of the workers, assets to look after the needs of the laborer's and provide them food, shelter and salary.

### Why would these new Initiatives be worth the time, resources and effort?

These initiatives are worth the time, effort and resources since it can create a big impact on the environment, economy, ecosystem and happiness of people. As, it is very important to control the release of GHG like CO<sub>2</sub>, CO, CH<sub>4</sub>, etc. which are responsible for increase in the average global temperature. This can lead to melting of ice caps and submersion of coastal area due to rise in sea levels. If the initiatives like the plastic roads are rigorously practiced, the GHG emissions can be reduced and in the long run decreases the problem of climate change to some extent.

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#### What challenges need to be overcome for replication?

One of the major challenges faced during the process described in the initiative is the collection and separation of plastic waste from other kinds of waste. It is hazardous to collect plastic waste from landfills without proper equipment such as gas masks and full body cover/suit which is generally not available or unaffordable in India. Other challenge includes deciding the dimensions of the modules to be produced. Generally, the height of the modules is kept negligible but the length and breadth can be varied according to the required dimensions of road or ease of placement on the base layer.

#### Which cities of India will you choose and why?

We selected Delhi to construct plastic roads because of two main reasons. First reason, that Delhi is the city that has the highest plastic waste generation per annum and the second reason is that, it is the capital of the country. If we construct plastic roads in Delhi it will not only reduce the amount plastic waste going to treatment facilities and landfills but also help to gain political support. It will draw attention of central as well as the state governments towards an alternative way of plastic disposal. This can help publicize the initiative and help create environmental awareness.

#### What type of stakeholder and partnerships will be needed to replicate the current initiative?

Offering partnerships means collaborating with higher authorities and working with them in a combined way. Partnering with state authority is the best way to start. Individuals and organizations that are currently working towards achieving a similar goal will be the best pick as partners as they might have a better understanding about each and every aspect of the initiative's development. Ideal stakeholders for this initiative would be the municipal corporation, NHA and Central Public Works Department. This is because even if the project aims to cover shorter distances for road construction at first, the scaling up might be rather quicker under these authorities.

## TEAM PROFILES

**TEAM LEADER:** Mridul Khanna, <https://www.linkedin.com/in/mridul-khanna-2a5982171>

I've always been focused towards the world's issues and try my best to come up with most unique & innovative solutions to resolve them. I never give up on my efforts and will do whatever it takes to complete the tasks I'm provided with. I consider myself capable of handling any situation with ease, no matter how stressful it may be. I've worked on a few research projects. One of them being with The University of Birmingham.

**TEAM MEMBERS:**

### Pritish Jain

I am a boring student trying to learn more about the things that world has to offer. I am interested in all Science related stuff. I am a computer nerd and an Otaku. I like to get sleep deprived. I am interested in learning about practical and experience experimental research. I like to play table tennis, learn about different culture, listen to music, etc.

I would also like to take part in environmental protection activities.

Email id: [prishjain2001@gmail.com](mailto:prishjain2001@gmail.com)

### Ankush Koundal

I have always been fascinated by new technological advancements since childhood and with time my interest in research work flourished tremendously. Exploring new horizons in scientific advancement has always been my passion. And despite my busy academic schedule I have managed to pursue work on some research and review paper. Internships could prove an ideal tool to pursue my passion for research and development in polymer and material science.

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Anmol Malhotra, <https://www.linkedin.com/in/anmol-malhotra-76a022208>

Academics has always been my strong point. I find great interest in research and I am currently a part of research project, despite the pandemic slowing down our lives I tried my best to not let it affect my passion and used my time on writing a review article which will soon get published.

Besides academics I find great interest in movies and comics and in use my spare time to read and watch.

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#### FOR JUDGES ONLY: REFERENCES/INTERVIEWS

#### INTERVIEWS (LIST PERSON, DATE OF INTERVIEW)

1. Dr. MAHESH KASTURE, 24 February 2021
2. Dr. MAHESH KASTURE, 26 February 2021

#### REFERENCES

1. Dr. MAHESH KASTURE
2. IPI JOURNAL JUNE-JULY 2020
- 3.
- 4.
- 5.

#### MENTOR: NAME; PLEASE LIST YOUR INTERACTIONS WITH THE MENTOR HERE

1. N/A

#### DIRECTIONS FOR COMPLETING CASE STUDY

Dear Teams,

- 1) As a number of these Case Studies will be printed in the IPI Journal ([https://www.ipiindia.org/journal\\_listing](https://www.ipiindia.org/journal_listing)), we will award a small number of points for completing the Case Study by following these rules. Every team should receive the maximum points:
  - a. Please use Calibri font 10 for your answers.
  - b. Add your team's relevant information in the Header, replacing the placeholder name, location, team name, school.
  - c. Replace all "Lorem ipsum" passages throughout with your answers. These passages are placeholders for your answers.
  - d. Erase the (XXX words) and all other (Red Font directions) as these directions should not be part of your Case Study.
  - e. Replace the RED font with what is requested to add in its place, where applicable
  - f. Provide two PDF copies of your Case Study – one copy for the Reviewers that includes your case study as well as the For Judges Only and these Directions; and one copy with just your Case Study itself, ending after Part III as this would be the version that would be included in the IPI Journal.
  - g. Please adhere to the word limits.
  - h. Please keep this Case Study "template" format.
  - i. Complete the footer information with your information about your team and initiative name
- 2) Interviewing the stakeholders: As you view the Case Study Parts I, II and III, it is designed to make your team provide a detailed background about the initiative itself, in its current state, and to think what could be possible if the current initiative had more financial and other resources in its current location; and, most important, how your team could recommend replicating/scaling the initiative and what has to happen. We hope you'll reach out to the stakeholders and work with them to answer these questions. The more comprehensive your answers, the more believable your answers will be, and the more credible your Case Study becomes.

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- 3) Building the Story: In Parts II and III, there are no wrong answers. Your Case Study should "Make the Case" why and how your initiative should be replicated and scaled. The more compelling your story, the greater the possibility that there will be interest by other stakeholders in India to replicate the initiative and reach out to CAPP.Global to see how they can get involved to do so.
  
- 4) CAPP.Global would like to showcase each Case Study on both its web site (CAPP.Global) and the CAPPIndia.IN web site. Not every team secured "permissions" as had been requested in the previous round with the stakeholder, and we therefore decided not to create one page write-ups as a result. If you'd like to include your Case Study as a linked PDF document on our web site, we ABSOLUTELY need written permission from the stakeholder. If there is sensitive information they would not like included, you may omit this information for the Case Study to be published. Our intent is to provide a platform for both the stakeholder and your team, so please put together a one-page letter that the stakeholder can sign and please send it to us, along with your Case Study.