

THEME 2 CASE STUDY

Plastic Waste Management "Ecosys"



THEME 2: SHOWCASE A NEW INNOVATION

**Profile of Stakeholder: Sumit Goyal (Co-founder)
and Prachi Bansal (Co-founder)**

Sumit Goyal is a chartered accountant by profession and Prachi Bansal had completed her fashion management course in Italy. Apart from Ecosys Cleaner, they both are co-founders of DearCows startup too. They both reside in Mumbai, Maharashtra.

TEAM MEMBERS:

1. [Lakshya Jain](#)
2. [Hatim Mustafa Merchant](#)
3. [Shrish](#)

SCHOOL: BITS Pilani, Pilani

(Abstract) Describe the Plastic Waste Problem and The Proposed Innovation

Problem: Plastic has found an extensive place in the packaging industry due to its commendable properties like it is light in weight, has great strength, is inexpensive, and does not readily react with the surroundings. The problem begins when the plastic packaging is discarded by the end consumer after its use. Most of it gets ended up in landfills. And according to various reports (<https://www.voanews.com/>) and articles (<https://www.nationalgeographic.org/>) Less than 9 per cent of the total plastic waste in these landfills actually gets recycled. A fraction of the remaining plastic is sent to incineration, which produces high carbon footprints, and the remaining plastic is left in landfills which ultimately litters the waterbodies.

Innovation: Packaging industry should shift to materials that have properties similar to plastics but are cleaner and greener. One such material is PVA (polyvinyl alcohol). It has no odor, is non-toxic, and is grease, oil, and solvent resistant. It is ductile but robust, flexible, and acts as an excellent oxygen and odor barrier, and most importantly, it is water-soluble. We have taken the example of one such initiative, Ecosys Cleaner, that uses PVA film to package their concentrated cleaning solution, which can be directly dropped into a bottle containing water to make the cleaner.



The impacts of plastic packaging used in household cleaners



25,940 tonnes per day of plastic waste--equivalent to 1,030 truckloads at 25 tonnes per truck--is generated in the country



60% of this total waste generated comes from plastic packaging



Single-use plastic spray bottles and other household cleaning products alone accounts for about 40%

PLASTICS



Indians throw away as many as 35 billion plastic water bottles each year



Just by recycling one ton of plastic, we can save 5,774 Kwh of energy



The world consistently produces around 300 million tons of plastic each year



Line up the plastic thrown away each year and we could take a trip around the Earth 4 times!

The Unique Solution Offered:



Using pre-dosed concentrated cleaning solution wrapped inside a water soluble PVA film

Polyvinyl alcohol (PVA) film is a water soluble biodegradable film which dissolves without leaving any harmful residue



PVA films does not affect the environmental health negatively. The material can be easily broken down by microbes naturally present in environment

The refills can be as small as 6cm in height and upto 200 such refills can fit in a single drawer!



I. DEFINING THE PROBLEM

What problem are you solving? Specifically, why does it persist in India? What are its causes. Be as narrow as possible –the narrower the problem, the better opportunity your innovative solution will attract users. Provide quantitative support, if possible.

We are trying to solve the plastic packaging waste problem by trying to reduce the use of plastics in packaging and using some cleaner alternatives instead. Because plastics are lightweight, durable, decay-resistant, affordable, and moldable, they are a product of human creativity. Unfortunately, this advancement comes at a cost.

Plastic packaging is incredibly wasteful and has a negative influence on the earth's ecosystems, which we all rely on. The majority of plastic garbage is transferred to landfills or disposed of into the environment due to poor product design and a lack of political infrastructure. Only 9% of the 9.2 billion tons of plastic that has been manufactured has been adequately recycled. Since plastic is not biodegradable, every single piece of it has remained on the globe. Plastic that is discarded or washed into the oceans is ingested by marine species, whether it breaks down into microplastics or not.

In India, the plastic packaging sector is at boom as India proves to be a large producer and a large marketplace as well for many commodities due to its large population. Hence plastic waste is also increasing. According to data compiled by the Central Pollution Control Board (CPCB) published in the NDTV's article (<https://www.ndtv.com/india-news/indias-plastic-waste-generation-more-than-doubled-in-5-years-centre-2639773>) India's plastic waste generation has more than doubled in the last five years with an average annual increase of 21.8 per cent as in 2015-16, 15.89 lakh tons of plastic waste was generated which grew to 30.59 lakh tons in 2018-19 and it further increased to 34 lakh tons of plastic in 2019-2020.

Did your team research the problem? Talk with potential target customers

Yes, the team went through various articles published in relation to the Plastic Packaging waste. Plastic Packaging is extremely wasteful. Majority of these plastic wastes end up in landfills or are disposed of in the environment due to the lack of a proper waste management infrastructure. The increase in supply is constantly challenging the waste management system. Various organizations as well as industries have taken up initiatives to provide a cost-effective method to efficiently recycle the plastic waste like the Nepra industries, Mura Technology, Ecosys, etc. The team found the innovative idea of Ecosys very intriguing and decided to contact them to know more about their project. We were successful in getting touch with them and completed the rest of our case study on that basis.

Describe the stakeholders impacted by the problem?

Everyone is negatively impacted by plastic waste as it contaminates the air and water. However, people who have homes near to landfills are the worst affected as most of the plastic packaging waste gets piled up over there. According to a report published in Firstpost, "As Over 140 lakh tons of waste collected since 1984 lie in the Ghazipur landfill leading to hazardous living conditions with toxic air, contaminated water for people living in nearby areas like Kaushambi, Khoda, Gharoli, Kalyanpuri, Ghazipur and Kondli." (Source: <https://www.firstpost.com/india/delhis-waste-mountain-in-ghazipur-ruins-environment-and-health-politicians-look-to-settle-political-scores-not-solution-9097081.html#:~:text=Over%20140%20lakh%20tonnes%20of,%2C%20Kalyanpuri%2C%20Ghazipur%20and%20Kondli.>)

Who are the stakeholders most harmed and impacted by the problem (and how)?

The majority of Plastic Package produced are of one-time use. General public prefer this since it is cheaper as well as easy to use. A significant portion comes from the packages of cleaning products viz. spray bottles, medical products as well as the storage of goods in plastic packages in warehouses, etc. The temporary dumping of these wastes near hospitals, warehouses, etc affect the population living in the area. The commuters using these streets are too affected by the constant dumping of wastes near such areas. The parasites that grow near this temporary dumping grounds also affect the general population. The plastic waste management programme adopted by Ecosys creates an excellent opportunity to recycle these plastic waste in a cost-effective and an efficient way.

Who are the stakeholders that could be engaged/invested to help bring the solution to fruition?

Our solution is based on the usage of cleaner alternatives to plastic, and in our case, it is the use of PVA (Polyvinyl Alcohol). This would require the customers and producers to switch from conventional plastic packaging to this new biodegradable type of packaging. Hence the prime task is to make people aware of the concept of sustainability. For this, the major stakeholders who can take part are the influencers & activists to promote/market the idea using digital media, government officials to form favorable policies and good corporate mentors to drive the decision of big firms keeping sustainability as one of their priorities.

Who are the stakeholders that could do their best to prevent the solution from coming to fruition. Explain why these stakeholders benefit from status quo?

Ms. Prachi had an optimistic view when we asked her this question. According to her, it is fortunate enough that the consumers and the firms are becoming more aware of their actions and have a common positive take on adopting sustainable methods, and there is no 'suppressing' factor. Instead, even existing plastic packaging firms support such new sustainable ideas. The only gap lies on the part of taking the initiative. Like the existing plastic packaging, firms are trying to make a switch but they cannot completely stop their current operations. Similarly, the consumers cannot make a sudden switch either because of a lack of awareness or simply because it falls out of their comfort zone.

What current options already exist to solve the problem thus far? Are you reinventing the wheel? Are there any unintended consequences from the different approaches that have been tried that may happen again with your innovation?

There are many developments taking place in the field of plastic waste management. Use of PVA is one of them, and it targets primarily on 'reducing' of 5 R's. Other products have introduced the idea of fully recyclable packaging; they have eliminated stickers, oils and colors in their product packaging. Color and glue act as impurities and must be removed before recycling. This idea is the best solution available in packaging personal grooming items like hair care products, creams, etc. However, in the case of many other products, like cleaners in our case, we can go with an even better solution, that is, the use of soluble compounds as 'reducing' is less energy exhausting process than the 'recycling' and hence has lesser chances of unintended consequences.

II. MAKE THE "BUSINESS" CASE

What is the innovation? Why is it innovative?

Polyvinyl alcohol is a water-soluble synthetic polymer. It works well for film formation, emulsification, and adhesion. It has no odor, is non-toxic, and is grease, oil, and solvent resistant. It is ductile but robust, flexible, and acts as an excellent oxygen and odor barrier. PVA is already being used in many countries. Ecosys Cleaner conducted many experiments to find the ideal shape, size and thickness of the film that must be used for packaging their cleaners and found the ideal length to be 6cm. This 6cm refill is further packed in biodegradable water-resistant packaging to prevent leakage of cleaner as PVA is water-soluble. As Ecosys refills can be dissolved in any reusable plastic bottle to make the 1 Liter of solution, they eliminate the need to buy new bottles. Thereby promoting 'refill and reuse'.

Is there a stakeholder group, if it showed significant interest, that your team would want to get on board? What would be required of them?

Some of the existing firms involved in plastic packaging had shown interest in the Ecosys Cleaner's idea. Though the main product line of Ecosys Cleaners includes cleaning products but Ecosys can collaborate with such firms for mutual benefits. Like these firms can outsource the packaging to Ecosys. Giants in this field can invest in Ecosys's idea to scale this to other products' packaging to convert them into sustainable products. Also, a good mentor and a brand strategist will help the brand to grow and scale from the current position.

Who is the target customer and why would they be interested in adopting and implementing this innovation?

Ecosys aims to bring together big corporations. Like Reliance has many offices, plants, retail stores etc., in India, and if the higher management team decides to make use of only sustainable goods during their operations and for their employees, then this alone can create significant impact as these corporations deal in high volumes, and it would motivate other relatively small corporations to follow. Also, the employees at these corporations would get used to sustainable products and are expected to eventually start using the same at their homes as these products are almost equal in terms of cost. Hence sustainable products will reach retail consumers as well.

Does this innovation solution address the cause(s) of the problem?

Since this innovation is targeted at reducing packaging plastic waste generation by providing a viable biodegradable packaging alternative, it indeed solves the root problem. As there would be no plastic used in packaging, there would be no question of plastic waste generation. However, in order to extend this type of packaging for other commodities in the market, more research and experiments need to be carried out regarding the perfect alternative material; its inertness to the main content inside the packaging, the size and thickness of the packaging and its viability for end consumers.

What key occurrences have to happen in India and the Indian subcontinent to drive its adoption/use?

Government can form policies that make it compulsory for the packaging industry to shift to a biodegradable alternative for plastic. Until they adapt to the new policies, the EPR (Extended Producer Responsibility) should be strictly imposed to make the discarded plastic packaging a part of the circular economy rather than leaving it to contribute to increasing wastage.

Since India is a cost-sensitive market, sustainable products should be priced a bit lesser, at least in the beginning. Like if the raw material of packaging is being imported, then it could be made cheaper by decreasing the import duty if it. Sustainable products must get green tax benefits.

Describe a pilot program that your team would design to showcase your innovation

Firstly, the idea must be made familiar to the consumers using social advertising. Since Ecosys Cleaners is based in Mumbai, Maharashtra, for physical demonstration, some malls in the metropolitan area can be selected to open a stall selling the Ecosys Cleaner product. The cleaning products should be given to the cleaning team of the mall for free or minimal cost for cleaning purposes.

The consumers will already have a fair idea of the product due to social advertising, and so they are likely to visit the stall out of curiosity to try something new and eco-friendly. And they will also be able to see the results live in the mall itself as the cleaning team would be in a continuous cleaning process.

Describe the human capital and financial resources necessary to build and implement this innovation in one city to demonstrate success? (100 words)

Since the innovation is related to the manufacturing of the cleaner and packing it in a soluble PVA film, it can be done in a city with adequate financial and human resources for setting up industry; the one which has good connectivity for transportation, land and labor availability, access to electricity and water supply, and big markets in nearby locations. The current plant of Ecosys Cleaner is situated in Swastik Industrial Estate, Mumbai, Maharashtra, which has almost all the mentioned factors. For expansion, their in-house R&D department can get great human resource in the form of chemical engineers from top engineering schools in India and receive funding from investors in India and abroad.

III. "MAKE THE CASE" TO REPLICATE THIS INITIATIVE IN OTHER LOCATIONS IN INDIA (OR WORLD)

How can this innovative solution be replicated in other cities in India -with a similar problem to solve?

PVA packaging units can be opened in other metropolitan cities like Bangalore, Chennai, Kolkata, and Delhi. Also, Delhi has one of the worst landfills in the world, the Ghazipur landfill. People in Delhi are negatively impacted, and they, therefore, are more concerned about using eco-friendly products. Hence there is a tremendous market opportunity for sustainable packaging in Delhi, and it is the need of the hour to lessen the carbon footprints. Additionally, the opening of firms that produce sustainable products may start a chain reaction that is even other manufacturing units are expected to shift to ecofriendly packaging contributing to the process of decarbonization. Also, it is necessary to have a fine team in the research and development department to discover biodegradable packaging solutions for other commodities in the market. This will help the organization grow while reducing carbon footprints. Since setting up such plants will require large financial capital, a phased-out investment plan is required so that the organization does not have to shut down because of running out of cash or losing viability because of inflated costs incurred due to unplanned expansion. Parallely, they need to spread awareness amongst the retail consumers to make them adapt to the new change.

What challenges need to be overcome for replication?

The technical challenge is to find a suitable packaging design. Like in the case of Ecosys Cleaners, the cleaner would leak from the PVA packaging and only after conducting several experiments were they able to find the perfect shape and size of PVA refill.

The challenge related to the consumer mindset was that the audience was not aware of the importance of sustainable products. Like in the case of Ecosys Cleaner, the domestic helpers employed for cleaning used the product, but the product was to be purchased by the house owner. The owner did not want to take the burden of explaining the new product to their helpers. Hence it becomes a bit difficult to make people transit from their current methods due to lack of awareness.

What circumstances must be present in order for this solution to be implemented elsewhere in India and its subcontinent?

For smooth pan-India administration of operations of an organization like Ecosys Cleaner, the prime condition is good connectivity in terms of communication and transportation. Like, Bangalore has many IT-related firms and startups and has a pool of highly skilled engineers in IT. It is a perfect place to set up office and customer support for the same reason. Being the capital of the country, Delhi has seen high growth in the setting up of industries, which makes it easy to procure raw material; hence Delhi is ideal for setting up a manufacturing plant.

IV. DESCRIBE THE ACTION PLAN TO SECURE ENGAGEMENT AND IMPLEMENT THE INNOVATION (OPTIONAL)

Please layout, step by step, what your team would need to do to convince the responsible stakeholder(s) to solve the problem, including the steps that would need to be taken to make the innovation into a success:

1. Research and Development (Phase-1)

Technology push methods should be employed to innovate new packaging ways to reduce plastic waste. Like the PVA was Discovered in 1924 by a Nobel Laureate, polyvinyl alcohol (PVOH) resin was developed and commercialized three decades later by Japanese chemical manufacturer Kuraray (Source: <https://www.bpf.co.uk/plastipedia/polymers/polyvinyl-alcohol-pvoh.aspx>). Ecosys Cleaners attempt to introduce this to Indian markets by making changes in it to make it adaptable for the Indian consumers.

2. Fund Raising (Phase-1)

Financial capital will be required to carry out research and conduct experiments to develop the final packaging design for a particular product. Like in the case of Ecosys Cleaner, they focused on cleaners' packaging. Hence angel investors need to be approached to get the seed funding.

3. Spreading Awareness and Marketing the Product (Phase-1)

To make people aware of the concept of sustainability as well as for advertising of the products, social media must be used, as initially, the organization does not have much funds to spend on marketing. Hence social advertising, being one of the least expensive ways of marketing, will be fit for showcasing the idea to the masses.

4. Fund Raising (Phase-2)

As consumers adapt to the innovation, demand is expected to rise. Hence to meet the demands, mass production of the product will have to be done. And for that, a manufacturing plant will be required. Like in Ecosys Cleaner's case, they opened a plant in Swastik Industrial Estate, Mumbai-400098, Maharashtra, India. For this, large capital is required, and hence venture capitalists are to be approached.

5. Marketing (Phase-2)

Now since the product with new packaging is ready to be sold, live demonstrations of the effectiveness of the product are necessary as consumers sometimes are sceptical about the quality of ecofriendly products. Also, it is essential to demonstrate to people how to dispose of the new packaging correctly. Like the correct way of using the Ecosys cleaner is: Drop the refill in any 1 Liter bottle -> Add water -> Shake before use -> Ready in 2 minutes. As the refills are wrapped in water-soluble film, they automatically dissolve when dropped in water and do not need to be cut, and this process must be demonstrated to the consumers.

6. Research and Development (Phase-2)

Platform product method must be approached that extends the use of current successful packaging to the other products as well.

For that, a further round of experiments should be carried out to find the perfect design for the product. During the scaling up of the organization, the R&D department should be expanded too. Positions like Expert in Carbon and Energy Measurement should be

introduced and the organization should try to attain net-zero emissions to ensure that the company does not produce large carbon footprints during manufacturing, or else the central vision of the organization will not be achieved.

7. Expansion of Market

The organization also has a choice to work as a packaging firm only for new products instead of doing the whole job of manufacturing the main product and selling it in the market. Like many existing companies, they showed interest in the packaging style of Ecosys. Hence, these firms may outsource their packaging part to Ecosys. This will be mutually beneficial for both parties and contribute positively to the environment.

Non-Monetary Resources Required:

- Access to research literature and laboratories for the R&D team
- Mentorship from the professional in this field
- Support from government for spreading awareness in form of slogan printing on railway tickets, in government offices etc. to reach the common masses
- Favorable policies formulation like strict implementation of EPR (Extended Producer Responsibility), ban on certain non-biodegradable products.
- Relaxation in law compliances like labor law etc. in the beginning phase of innovation
- Collaboration with MRF (Material Recovery Facility) to experiment with discarded waste, and for statistical analysis of the major types of plastic packaging waste

Monetary Resources Required

- Cash; Rs 1-5lakhs (\$1300-6600); Building basic packaging design (R&D phase-1)
- Land; Rs 50 lakhs-2 crore (\$65,000-262,000); Setting up manufacturing unit
- Machinery; Rs 5-15 lakhs (\$6600-20,000); Machinery for packaging and other auxiliary machinery
- Marketing expenditure; Rs 1-5 lakhs (\$1300-6600); Marketing in the form of live demonstrations (Marketing phase-2)

TEAM PROFILES

TEAM LEADER: [LAKSHYA JAIN](#)

I am a sophomore at BITS Pilani, Pilani campus and am pursuing manufacturing engineering. I am a part of AIChE (American Institute of Chemical Engineering), ASCM (Association of Supply Chain Management) and REC (Renewable Energy Club). I developed an interest in plastics as my family business is related to it, and we have a small LDPE and HDPE recycling unit in Udaipur, Rajasthan. I am majorly interested in plastic sorting and would like to explore it in greater depth as I discovered that it acts as a bottleneck in the recycling industry.

TEAM MEMBERS:

[HATIM MUSTAFA MERCHANT](#)

My name is Hatim Mustafa Merchant, a student at Birla Institute of Technology and Science, Pilani. I am currently in my second year pursuing an Integrated MSc in Mathematics and BE in Chemical Engineering as my Dual Degree. I have a keen interest in Plastic Waste Management and have been following several initiatives taken up by government and non-government organizations in recent times. I am also a member of the American Institute of Chemical Engineering (AIChE) where I met with the rest of my team. I hope to be a part of such innovative ideas and help the community in best way possible.

[SHRISH](#)

I am an enthusiastic and passionate chemical engineering & M.Sc. biological sciences student at BITS Pilani with a vision to apply my knowledge of chemical processing techniques to innovate and refine existing processes for chemical upcycling of plastic waste and would love to work in an internship in a similar domain. On-campus, I am a member of chemical engineering clubs such as AIChE and IChE as well as a volunteer at PARC, a social work organization for the underprivileged.

PLEASE PROVIDE THIS INFORMATION FOR THE JUDGES: REFERENCES/INTERVIEWS

INTERVIEWS (LIST PERSON, DATE OF INTERVIEW)

1. Ms. Prachi Bansal (co-founder Ecosys Cleaner), 2 March 2022 (online meet and mail)
2. (Mr. Sumit Goyal (co-founder Ecosys Cleaner) was contacted via mail only.)

REFERENCES

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