OCAD University Open Research Repository

Faculty of Design

2021

Plastic Wave – Plastic pollution is a result of who we are

Bakshi, Kunal, Yeutkar, Swapnil, Chauhan, Abhimanyu and Shankar, S

Suggested citation:

Bakshi, Kunal, Yeutkar, Swapnil, Chauhan, Abhimanyu and Shankar, S (2021) Plastic Wave – Plastic pollution is a result of who we are. In: Proceedings of Relating Systems Thinking and Design (RSD10) 2021 Symposium, 2-6 Nov 2021, Delft, The Netherlands. Available at http://openresearch.ocadu.ca/id/eprint/3899/

Open Research is a publicly accessible, curated repository for the preservation and dissemination of scholarly and creative output of the OCAD University community. Material in Open Research is open access and made available via the consent of the author and/or rights holder on a non-exclusive basis.

The OCAD University Library is committed to accessibility as outlined in the Ontario Human Rights Code and the Accessibility for Ontarians with Disabilities Act (AODA) and is working to improve accessibility of the Open Research Repository collection. If you require an accessible version of a repository item contact us at repository@ocadu.ca.

The Plastic Wave

Plastic pollution is not a material problem, it is a result of who we are.

The enormity of plastic pollution is not only a threat to the wildlife and the environment but it is a fight between social construct and giant economies. With the pace of events that we create to disturb the natural ecosystems, our footprint might be the last of all. Linearity of mind and models have deeply influenced our behavior, habits and our relationship with the planet. Use of plastic has become so integral in our daily lives, such that we are addicted to the throwaway lifestyle. Consciousness and reflection, either from a choice perspective or a responsible managerial point is what withholds closing the tap of hazardous plastic flow down the river, but it's our values that feeds the loop. In the name of convenience we have exploited our limited resources and pushed boundaries beyond ethics of all kinds, so much so that we have been made numb to the disaster that is a result of our daily choices.Plastic has revolutionized the modern age but it's very nature allows it to penetrate into our food chains, that talks about the failure of events and pushes us to change our patterns. A wave has begun to conquer the plastic mountain but will our efforts be enough?

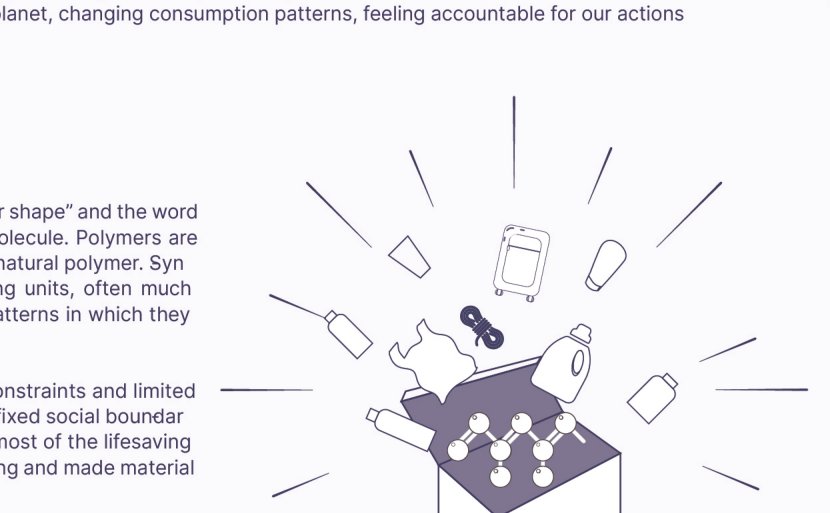
Why are we doing this

The Plastic tide has started forming an unavoidable loop from the depths of our oceans, to island beaches, ingested by fishes and back to our plates in forms we can't see. Such is the invisible nature of the problem. The entire system is complex to apprehend and poses challenges at multiple touch points. There lies a great opportunity in drawing connections from psychology, society, technology, values and many more fields to make sense of the nature of this problem. As plastic pollution is a result of all things working simultaneously, resolving it also requires conjunction of different efforts to face this adversity. We believe that the solution lies in restoring our relationship with the planet, changing consumption patterns, feeling accountable for our actions and finding congruence between our needs and desires.

Plastic - the wonder material

The word "Plastic" comes from a Greek verb plassein, which means "to mold or shape" and the word "Polymer" means of many parts" and polymers are made of long chain of molecule. Polymers are abundant in nature - cellulose present in the cell wall of plants, is a common natural polymer. Synthetic polymers are made up of long chains of atoms, arranged in repeating units, often much longer than those found in nature. It is the length of these chains, and the patterns in which they are arrayed, that make polymers strong, lightweight, and flexible.

Plastics freed us from the confines of the natural world, from the material constraints and limited supplies that had long bounded human activity. That new found elasticity unfixed social boundaries. Plastics made possible the development of computers, cell phones, and most of the lifesaving advances of modern medicine. Inexpensive plastics raised the standard of living and made material abundance more readily available.

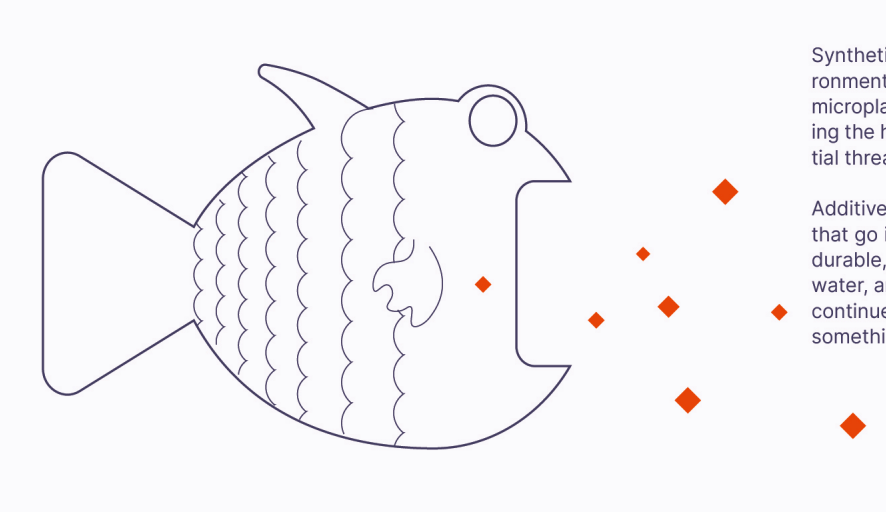


The types of plastics

Polyethlene terephthalate (PET)	Water bottles, dispensing, Containers, biscuit trays	Polystyrene (PS)	Cutlery, Plates, cups
High-density polyethylene (HDPE)	Shampoo bottles, milk bottles, freezer bags, ice cream containers	Expanded polystyrene (EPS)	Protective packaging hot drink cups
Low- density polyethylene (LDPE)	Bags, trays,containers, food packaging film	Bioplastic	can be disintegrated by bacteria, fungi, or some other biological process under control enviornment
Polypropylene (PP)	Potato chip bags, microwave dishes, Ice cream tubs,bottle ccaps, single use face masks	Compostable Plastic	decompose under control enviornment which then creates fertilizer for your soil
Polycarbonate (PC)	Helmets, Luggage bags Dash boards, Electronics, Safety goggles		

Waste crops + Chemical additives

Why is plastic toxic?



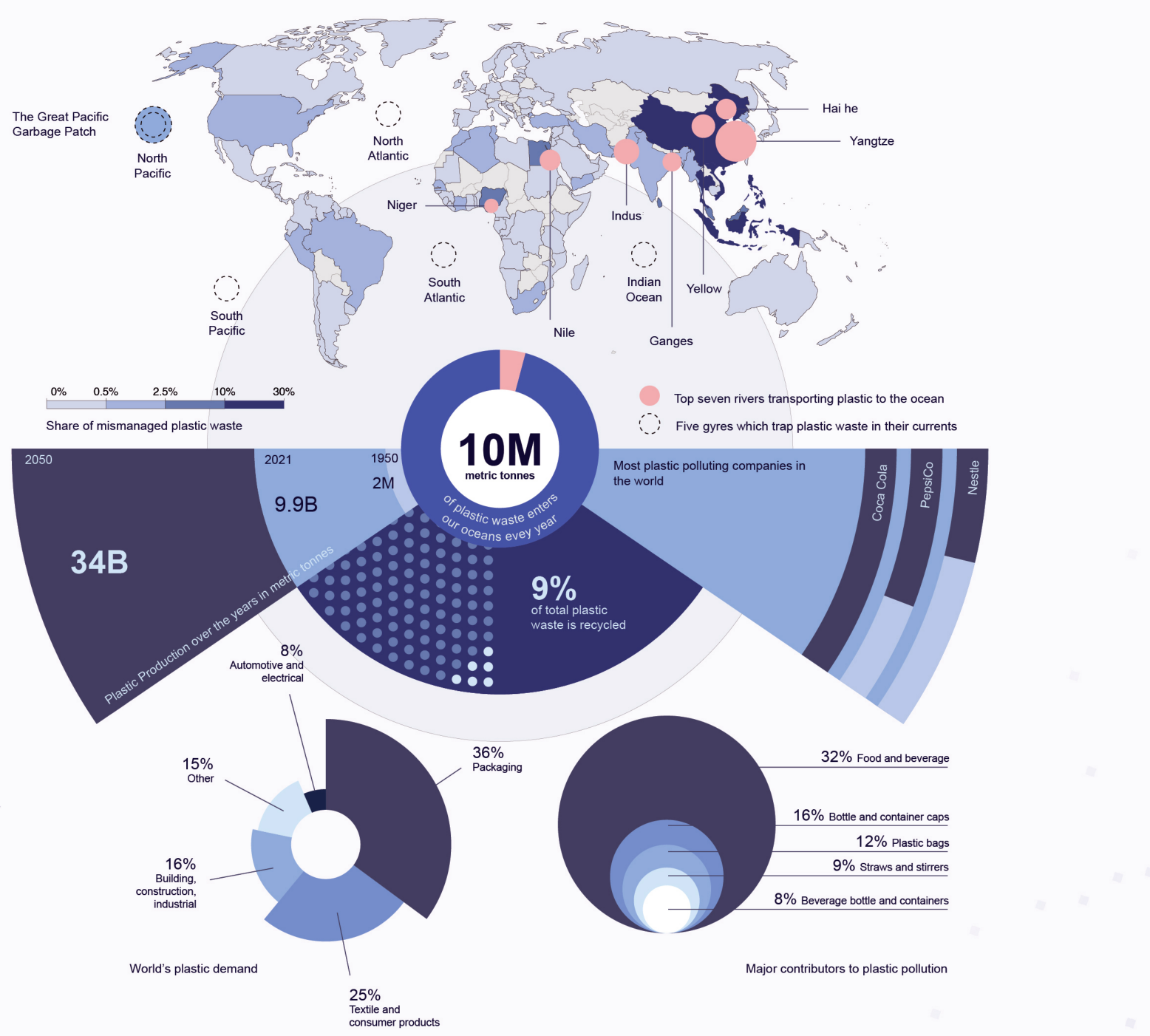
Synthetic plastics are largely nonbiodegradable, they tend to persist in the environment. Sunlight and seawater embrittle plastic, and gradually break it down into microplastics on which zooplankton and other small marine animals feed, disturbing the health of marine ecosystems. There is a growing concern about the potential threat they pose to human health.

Additives (such as bisphenol A [BPA] and a class of chemicals called phthalates) that go into plastics during the manufacturing process, makes them more flexible, durable, and transparent. These chemicals leach out of plastics and into our food, water, and bodies, eventually disrupting the endocrine (or hormonal) system. What continued accumulation means for our evolution and future generations is not something that we can ignore.

Why do we need to act now?

Marine species see plastic as food. They either get entangled or ingest plastic in debris both equally fatal conditions. We have lost hundreds of species to plastic pollution and by this account we will have more plastic in the oceans than fish by 2050. Over exploitation of non-renewable energy to derive fuel and plastic produces ginormous amounts of carbon in the process of extraction, hugely impacting our climate. We choose profit over empathy due to which we have lost the connect with our natural ecosystems.

Disposable living is deeply ingrained in our culture which is a far deeper concern. This problem was created by humans, and only humans can fix it. Our future is in our hands and it is never too late to turn the tide against plastic pollution.



15% of endangered marine species have ingested marine debris

79% of plastic waste enters our land, water and environment

45kg of plastic is consumed by average person globally

95% of value of plastic packaging material is lost to the economy

0.82gt annual carbon emission from the plastic life cycle

Microplastics - the invisible killer

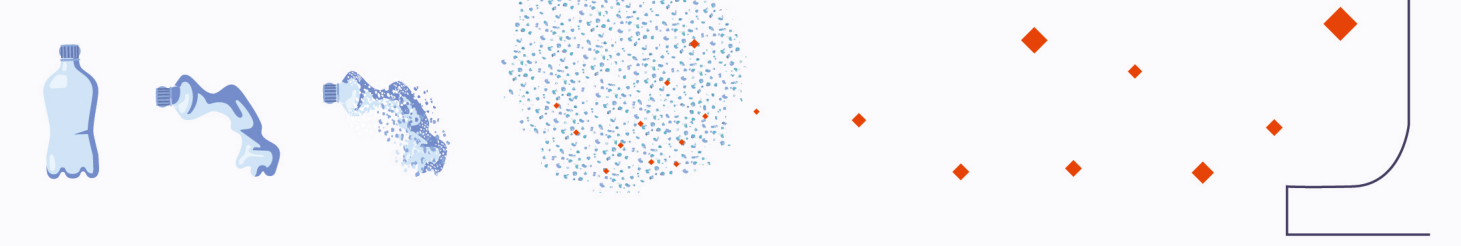
<5mm

The plastic that is ashore breaks down due to constant smashing against abrasive surfaces, the ones that float is chaurned by waves and other elements like UV rays and wind act as a tool to break down these macro plastics to micro ones. Micro beads and nurdles are designed plastic materials that are less than 5mm making them the reeady made micro plastics.

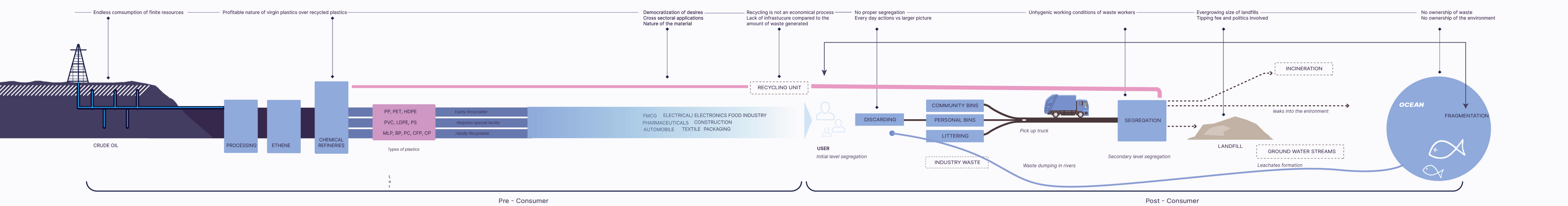
Australia's University of Newcastle, commissioned by the World Wildlife Fund, suggests that on average people could be ingesting approximately 5 grams of plastic every week, which is the equivalent weight of a credit card'

From the top of Mount Everest to the deepest oceans, we know that plastic trash is everywhere on Earth. Now it's in us, too. its in the food we eat, water we drink and the air we breathe

BREAKDOWN



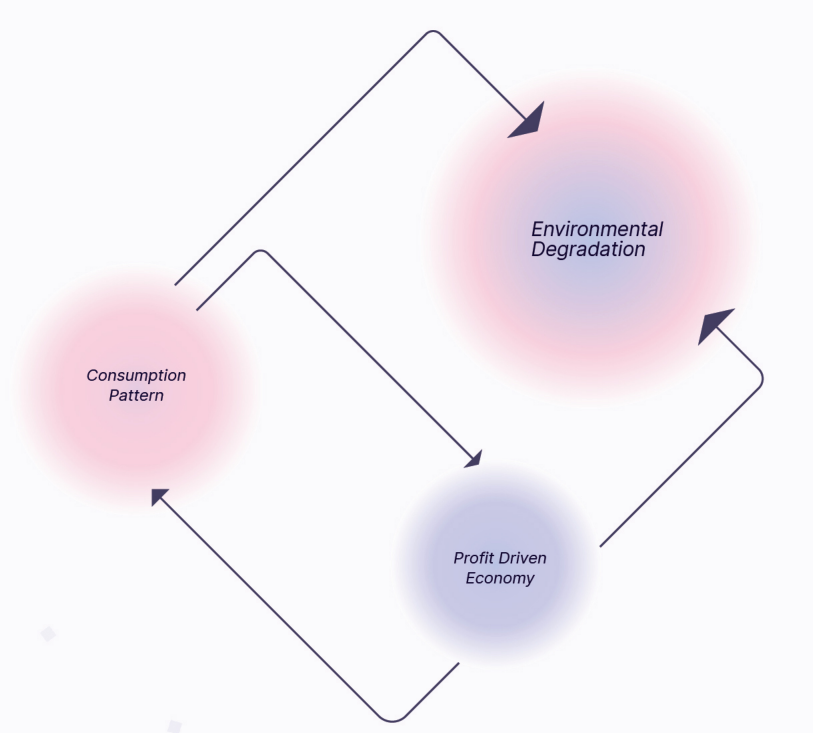
The journey of Plastic



Endless comsumption of finite resources
Profitable nature of virgin plastics over recycled plastics
Democratization of desires
Recycling is not an economical process
No proper segregation
Unhygenic working conditions of waste workers
Evergrowing size of landfills
Tipping fee and politics involved
No ownership of waste
No ownership of the environment
CRUDE OIL
PROCESSING
ETHENE
REFINERIES
Types of plastics
USER
Initial level segregation
INDUSTRY WASTE
Waste dumping in rivers
Secondary level segregation
INCINERATION
LANDFILL
GROUND WATER STREAMS
Leachates formation
OCEAN
Pre - Consumer
Post - Consumer

The wicked loop

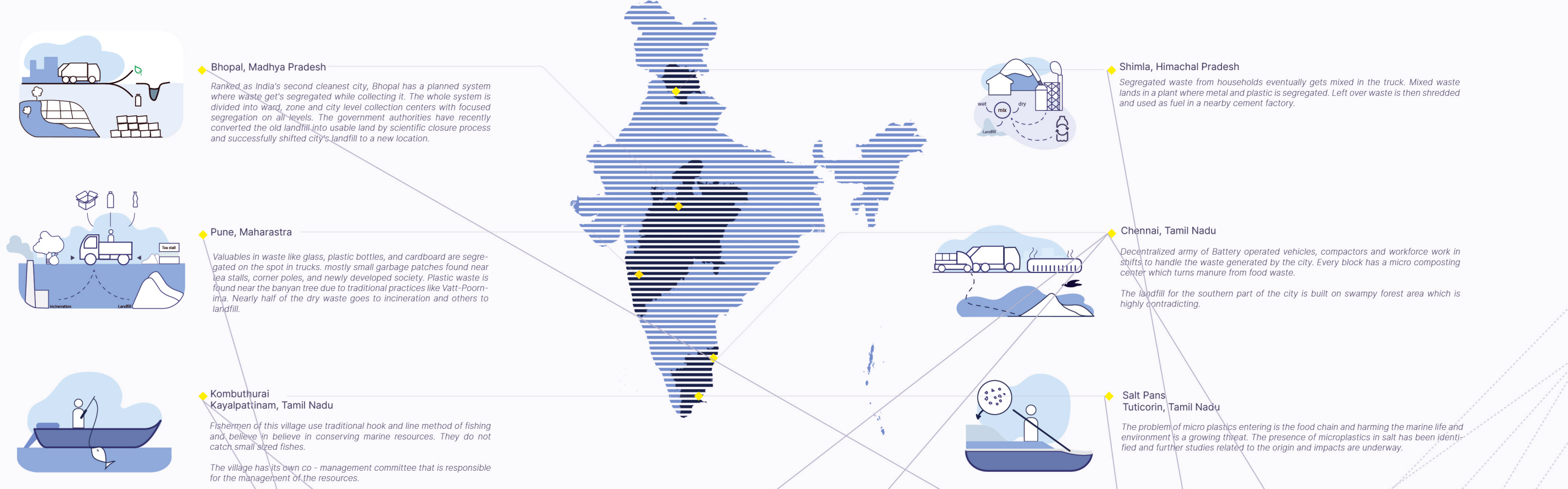
With the only planet and it's limited resource, we come closer to exploit and degrade the natural ecosystems that are rudimentary in our existence along with other harmless species. The system is built on a strong foundation of profit driven economies and it feeds on people's consumption, buying capacity, needs and desires. Such power models have largely benefited businesses and are key in shaping the modern idea of development but with a large consequence we pay for harming our natural environment. It is an invisible, vicious loop that will continue to churn endlessly if we do not act and rebuild the entire system starting today.



Environmental Degradation
Consumption Pattern
Profit Driven Economy

What happens to my trash?

A regional level primary study covering Shimla, Pune, Bhopal and Chennai, informs about the current systems in place. In search of knowing exactly what happens to our waste, we traced it's path and observed different management systems that come in affect everyday to collect, segregate and treat the plastic. A deeper understanding was developed as part of this field study where we observed live activities and interacted with people who are behind such operations.



Bhopal, Madhya Pradesh

Ranked as India's second cleanest city, Bhopal has a planned system where waste get's segregated while collecting it. The whole system is divided into ward, zone and city level collection centers with focused segregation on all levels. The government authorities have recently converted the old landfill into usable land by scientific closure process and successfully shifted city's landfill to a new location.

Pune, Maharastra

Valuables in waste like glass, plastic bottles, and cardboard are segregated on the spot in trucks. mostly small garbage patches found near tea stalls, corner poles, and newly developed society. Plastic waste is found near the banyan tree due to traditional practices like Vatt-Poornima. Nearly half of the dry waste goes to incineration and others to landfill.

Kombuthurai Kayalpattinam, Tamil Nadu

Fishermen of this village use traditional hook and line method of fishing and believe in believe in conserving marine resources. They do not catch small sized fishes.

The village has its own co - management committee that is responsible for the management of the resources.

Shimla, Himachal Pradesh

Segregated waste from households eventually gets mixed in the truck. Mixed waste lands in a plant where metal and plastic is segregated. Left over waste is then shredded and used as fuel in a nearby cement factory.

Chennai, Tamil Nadu

Decentralized army of Battery operated vehicles, compactors and workforce work in shifts to handle the waste generated by the city. Every block has a micro composting center which turns manure from food waste.

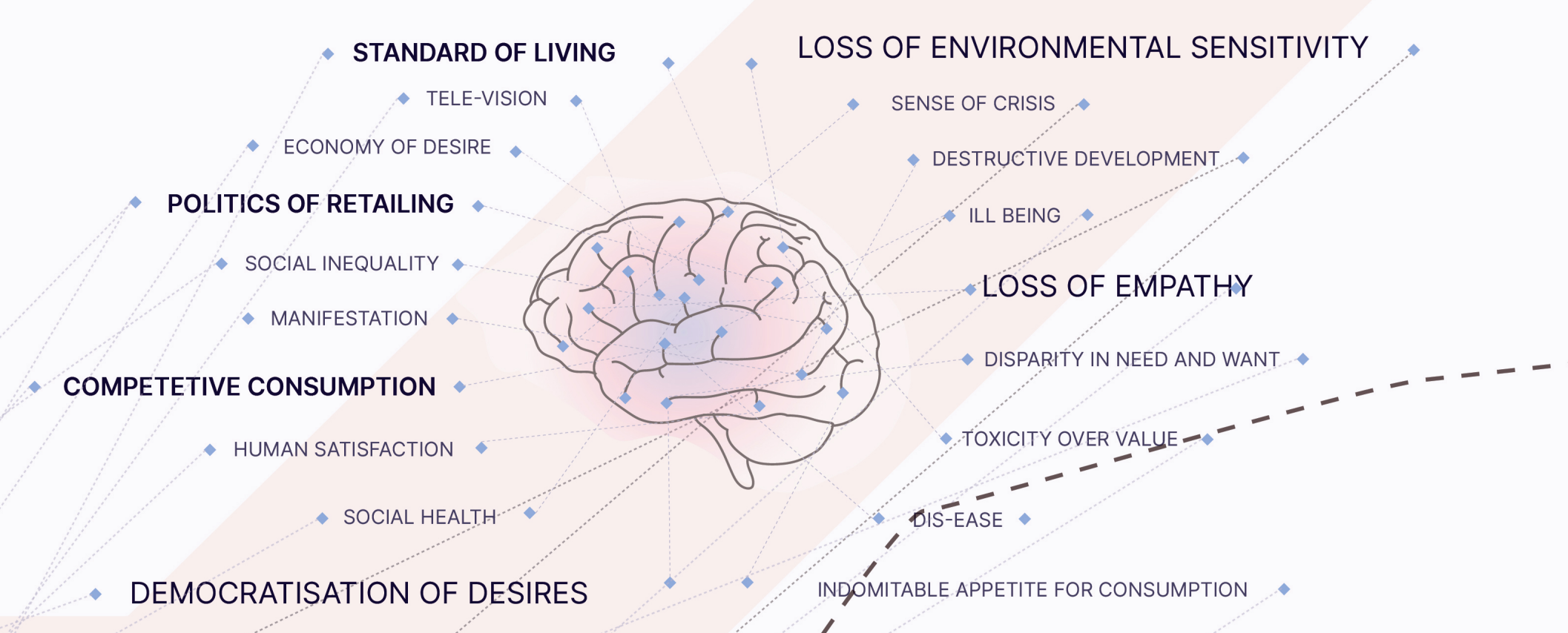
The landfill for the southern part of the city is built on swampy forest area which is highly contradicting.

Salt Pans Tuticorin, Tamil Nadu

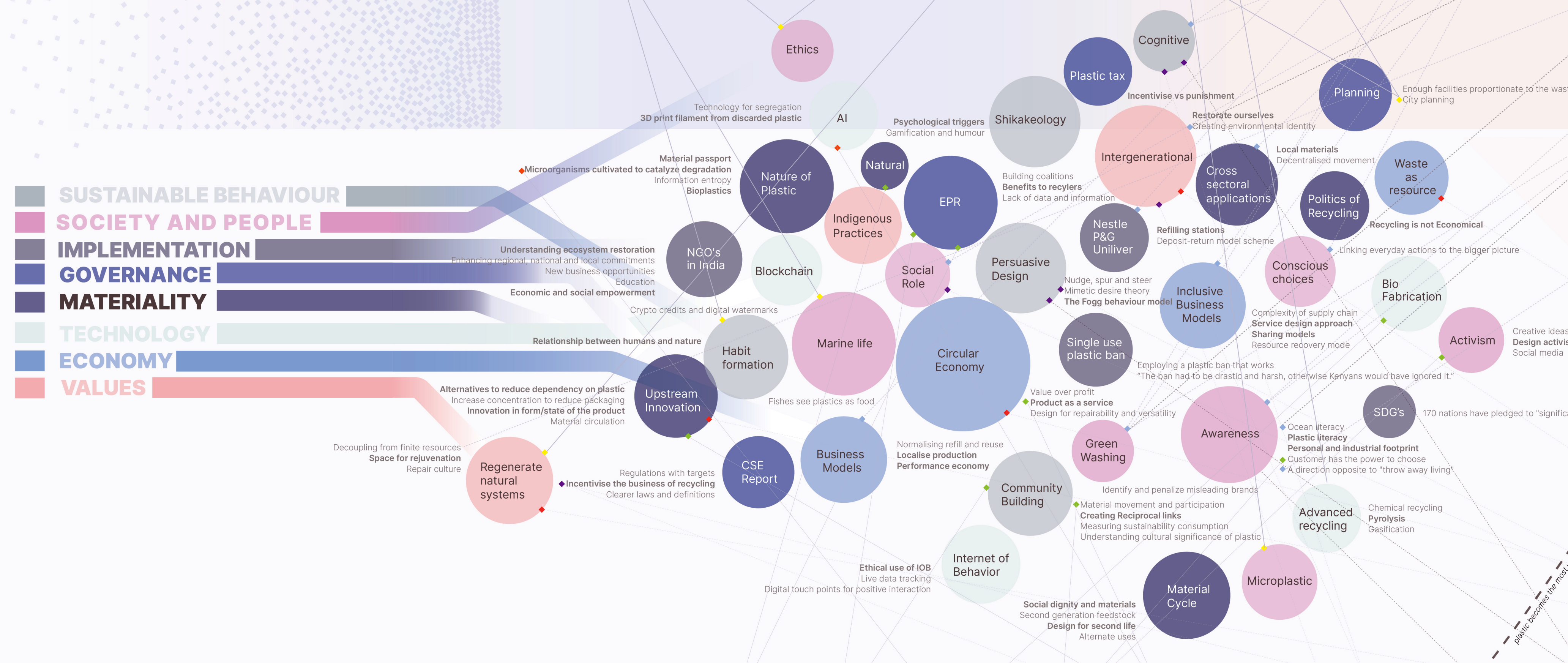
The problem of micro plastics entering is the food chain and harming the marine life and environment is a growing threat. The presence of microplastics in salt has been identified and further studies related to the origin and impacts are underway.

Mapping

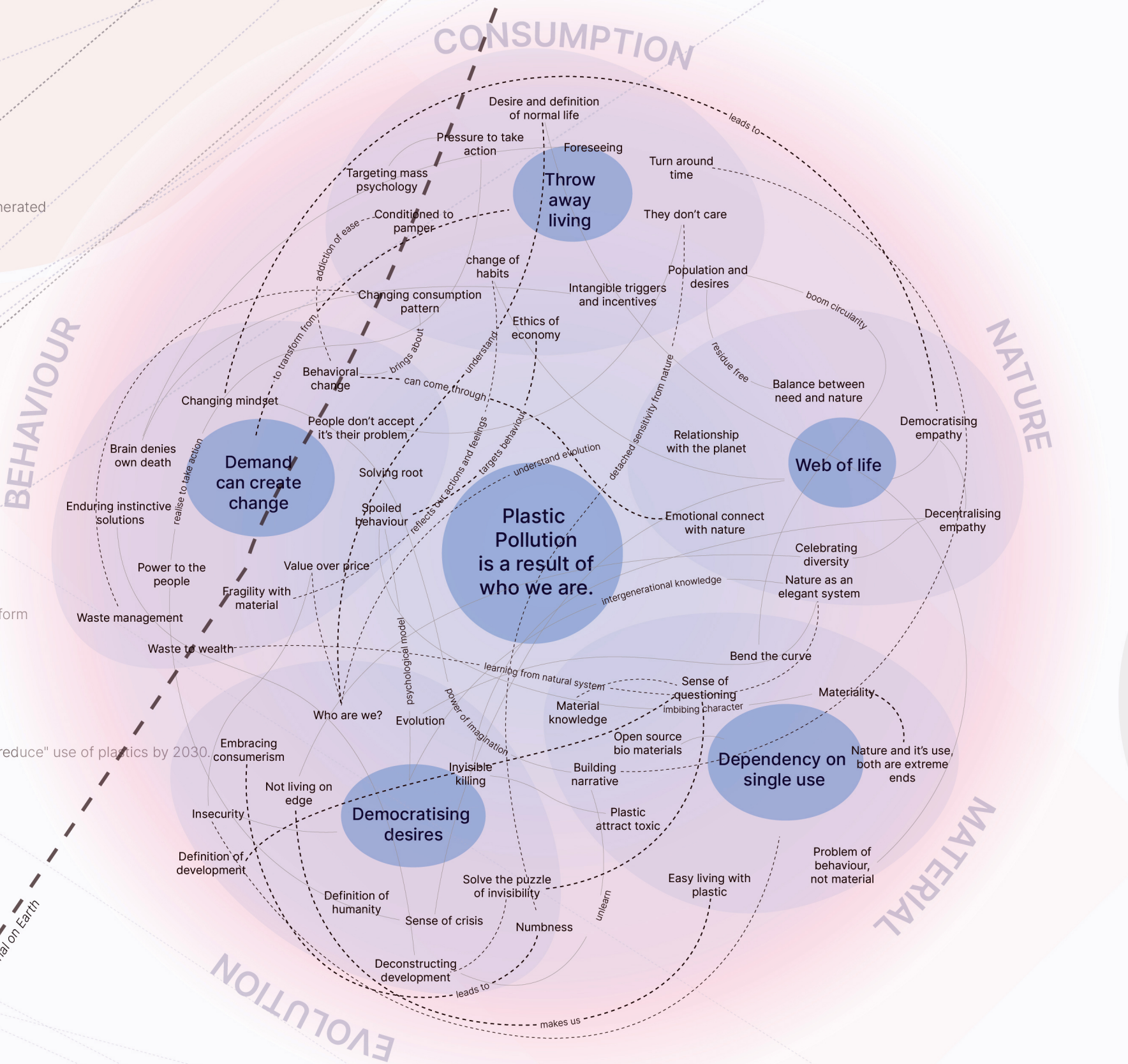
Our decisions are highly influenced by the nature of system that exists. This socio cultural phenomenon has evolved and we have become accustomed to how we perceive, behave, react and act to fit into the system. This effects our nature on a cognitive level and we become a part of the artificial events that we create for our convenience and development at the cost of not just the planet but social health too. Democratization of desires affects our natural, emotional and empathetic state of being and proves detrimental to the future we wish for ourselves on this only planet with limited resources.



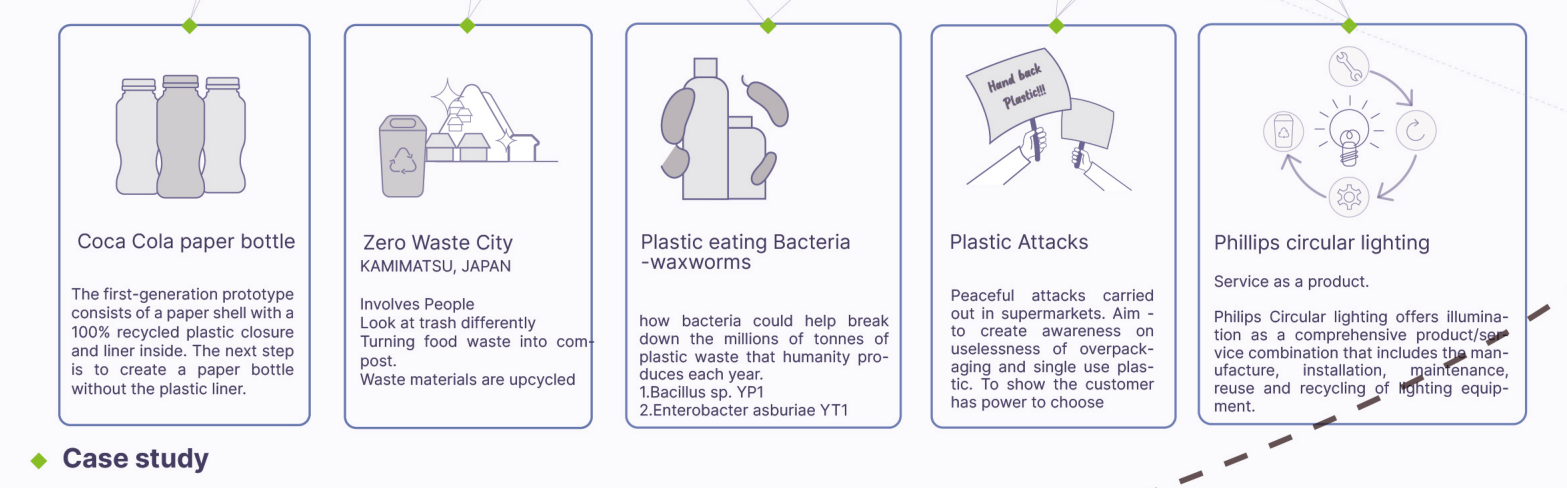
STANDARD OF LIVING
TELE-VISION
ECONOMY OF DESIRE
POLITICS OF RETAILING
SOCIAL INEQUALITY
MANIFESTATION
COMPETETIVE CONSUMPTION
HUMAN SATISFACTION
SOCIAL HEALTH
DEMOCRATISATION OF DESIRES
LOSS OF ENVIRONMENTAL SENSITIVITY
SENSE OF CRISIS
DESTRUCTIVE DEVELOPMENT
ILL BEING
LOSS OF EMPATHY
DISPARITY IN NEED AND WANT
TOXICITY OVER VALUE
DIS-EASE
INDOMITABLE APPETITE FOR CONSUMPTION



SUSTAINABLE BEHAVIOUR
SOCIETY AND PEOPLE
IMPLEMENTATION
GOVERNANCE
MATERIALITY
TECHNOLOGY
ECONOMY
VALUES
Ethics
AI
Technology for segregation
3D print filament from discarded plastic
Nature of Plastic
Material passport
Microorganisms cultivated to catalyze degradation
Information entropy
Bioplastics
Natural
Indigenous Practices
EPR
Psychological triggers
Gamification and humour
Shikakeology
Building coalitions
Benefits to recylers
Lack of data and information
Plastic tax
Cognitive
Incentivise vs punishment
Intergenerational
Restorate ourselves
Creating environmental identity
Cross sectoral applications
Local materials
Decentralised movement
Planning
Enough facilities proportionate to the waste generated
City planning
Waste as resource
Politics of Recycling
Recycling is not Economical
Linking everyday actions to the bigger picture
NGO's in India
Understanding ecosystem restoration
Enhancing regional, national and local commitments
New business opportunities
Education
Economic and social empowerment
Blockchain
Crypto credits and digital watermarks
Social Role
Persuasive Design
Nestle P&G Uniliver
Refilling stations
Deposit-return model scheme
Nudge, spur and steer
Mimetic desire theory
The Fogg behaviour model
Inclusive Business Models
Conscious choices
Complexity of supply chain
Service design approach
Sharing models
Resource recovery mode
Bio Fabrication
Activism
Creative ideas to inform
Design activism
Social media
Relationship between humans and nature
Habit formation
Marine life
Fishes see plastics as food
Circular Economy
Single use plastic ban
Employing a plastic ban that works
"The ban had to be drastic and harsh, otherwise Kenyans would have ignored it."
Upstream Innovation
Alternatives to reduce dependency on plastic
Increase concentration to reduce packaging
Innovation in form/state of the product
Material circulation
Value over profit
Product as a service
Design for repairability and versatility
SDG's
170 nations have pledged to "significantly reduce" use of plastics by 2030
Awareness
Ocean literacy
Plastic literacy
Personal and industrial footprint
Customer has the power to choose
A direction opposite to "throw away living"
Green Washing
Identify and penalize misleading brands
Regenerate natural systems
Decoupling from finite resources
Space for rejuvenation
Repair culture
CSE Report
Regulations with targets
Incentivise the business of recycling
Clearer laws and definitions
Business Models
Normalising refill and reuse
Localise production
Performance economy
Community Building
Material movement and participation
Creating Reciprocal links
Measuring sustainability consumption
Understanding cultural significance of plastic
Advanced recycling
Chemical recycling
Pyrolysis
Gasification
Internet of Behavior
Ethical use of IOB
Live data tracking
Digital touch points for positive interaction
Material Cycle
Social dignity and materials
Second generation feedstock
Design for second life
Alternate uses
Microplastic
plastic becomes the most used material on Earth



CONSUMPTION
NATURE
MATERIAL
EVOLUTION
BEHAVIOUR
Plastic Pollution is a result of who we are.
Throw away living
Demand can create change
Web of life
Democratising desires
Dependency on single use
Desire and definition of normal life
Pressure to take action
Foreseeing
Targeting mass psychology
Turn around time
Conditioned to pamper
They don't care
change of habits
Changing consumption pattern
Intangible triggers and incentives
Population and desires
Ethics of economy
Behavioral change
Changing mindset
People don't accept it's their problem
Balance between need and nature
Democratising empathy
Brain denies own death
Relationship with the planet
Solving root
Enduring instinctive solutions
Spoiled behaviour
Emotional connect with nature
Decentralising empathy
Celebrating diversity
Power to the people
Value over price
Fragility with material
Nature as an elegant system
Waste management
Waste to wealth
Bend the curve
Sense of questioning
Materiality
Who are we?
Evolution
Material knowledge
Open source bio materials
Nature and it's use, both are extreme ends
Embracing consumerism
Invisible killing
Building narrative
Not living on edge
Insecurity
Plastic attract toxic
Definition of development
Solve the puzzle of invisibility
Easy living with plastic
Problem of behaviour, not material
Definition of humanity
Sense of crisis
Numbness
Deconstructing development
leads to
makes us
addiction of ease
to transform from
brings about
can come through
understand
realise to take action
reflects our actions and feelings
targets behaviour
understand evolution
detached sensitivity from nature
residue free
boom circularity
intergenerational knowledge
learning from natural system
imbibing character
psychological model
power of imagination
unlearn



Coca Cola paper bottle

The first-generation prototype consists of a paper shell with a 100% recycled plastic closure and liner inside. The next step is to create a paper bottle without the plastic liner.

Zero Waste City

KAMIMATSU, JAPAN

Involves People

Look at trash differently

Turning food waste into compost.

Waste materials are upcycled

Plastic eating Bacteria -waxworms

how bacteria could help break down the millions of tonnes of plastic waste that humanity produces each year.

1.Bacillus sp. YP1

2.Enterobacter asburiae YT1

Plastic Attacks

Peaceful attacks carried out in supermarkets. Aim - to create awareness on uselessness of overpackaging and single use plastic. To show the customer has power to choose

Phillips circular lighting

Service as a product.

Philips Circular lighting offers illumination as a comprehensive product/service combination that includes the manufacture, installation, maintenance, reuse and recycling of lighting equipment.

Case study

Reva Malik & Ranjan Malik

Co founders at Primalise

- *Finding Congruence b/w who you are and life you lead*
- *We have been made numb - we cant sense the crisis*
- *How to create motivation at an instinctive level*

Prasad Modak

President at Environmental Management Centre

- *Inclusive business models*
- *Responsible recycling*
- *Information design as a tool for stakeholders to respond*

Biju Dominic

Chief Evangelist at Fractal

- *Design intervention at the point of action*
- *Deeper Concerns are the source of powerful insights.*
- *Design Fear as the brain denies our own death*

Abhijit Bansod

Director at Studio ABD

- *Comission future thoughts*
- *Awareness for individual consumption*
- *Tracking personal foot print*

Lorraine Gamman

Professor of Design at the Design Against Crime

- *How do we make them care by involving emotionally*
- *Design contexts to bring stakeholders in contact.*

Dr Rangaprasad R

Business Head at Packaging360

- *Zero value flexible packaging is the key problem*
- *Recycling in Indian context = technology + manpower*

Insights from interviews

UN Decade on Ecosystem Restoration 21

On World Environment Day

- *Change consumption pattern*
- *Intergenerational collaboration*
- *Making information accessible*
- *Indomitable human spirit*
- *Nature positive activities*

Ellen Mcarthur Foundation Summit 21

On Circular Economy and Transformation

- *Competing in value than price*
- *Waste = misplaced resources*
- *Link with social agenda*
- *Lack of traceability*
- *Parallel objectives do not work. Interate*

Insights from talks and events

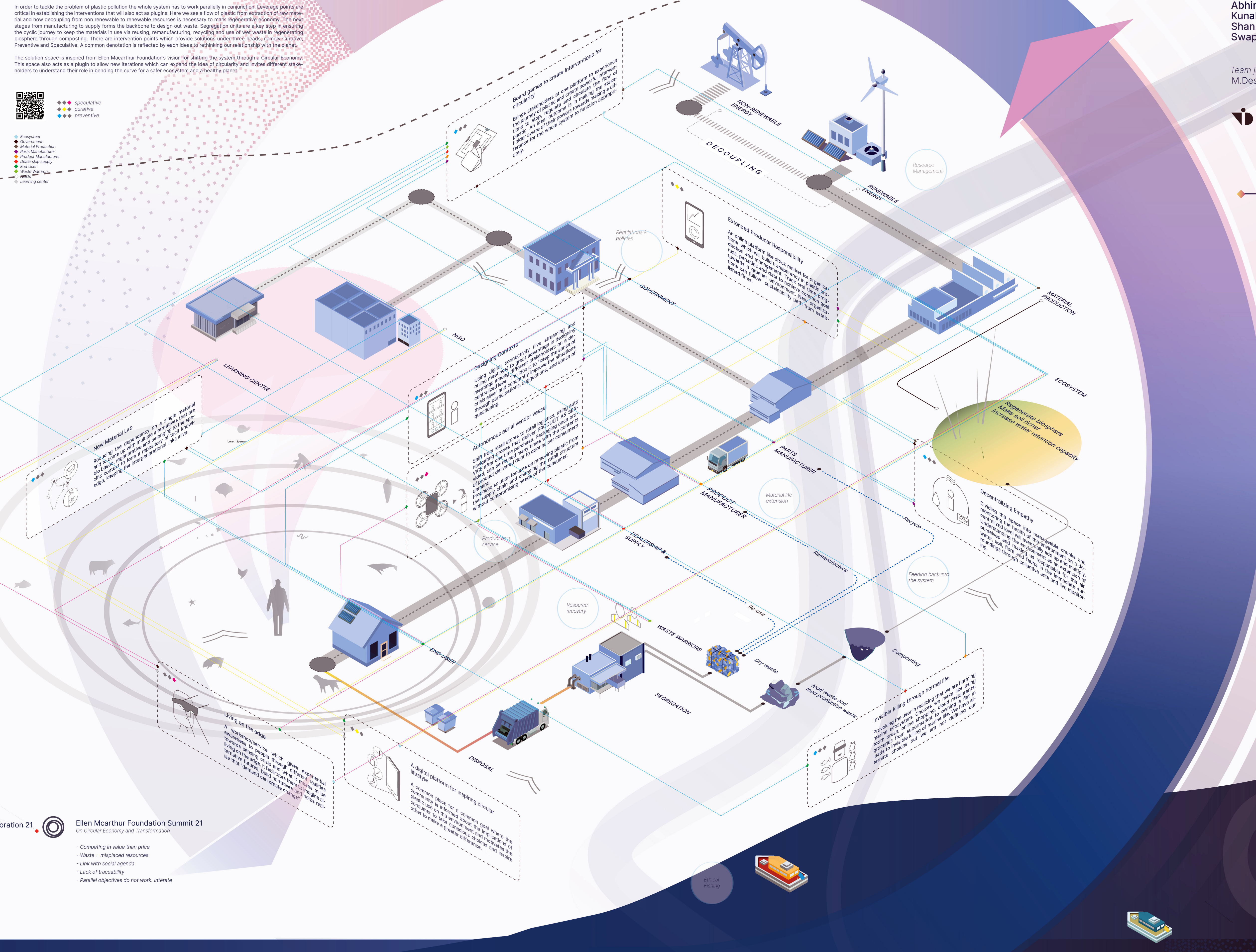
Intervention Space

In order to tackle the problem of plastic pollution the whole system has to work parallelly in conjunction. Leverage points are critical in establishing the interventions that will also act as plugins. Here we see a flow of plastic from extraction of raw material and how decoupling from non renewable to renewable resources is necessary to mark regenerative economy. The next stages from manufacturing to supply forms the backbone to design out waste. Segregation units are a key step in ensuring the cyclic journey to keep the materials in use via reusing, remanufacturing, recycling and use of wet waste in regenerating biosphere through composting. There are intervention points which provide solutions under three heads, namely Curative, Preventive and Speculative. A common denotation is reflected by each ideas to rethinking our relationship with the planet.

The solution space is inspired from Ellen Macarthur Foundation's vision for shifting the system through a Circular Economy. This space also acts as a plugin to allow new iterations which can expand the idea of circularity and invites different stakeholders to understand their role in bending the curve for a safer ecosystem and a healthy planet.

- ◆◆◆ speculative
- ◆◆◆ curative
- ◆◆◆ preventive

- ◆ Ecosystem
- ◆ Government
- ◆ Material Production
- ◆ Parts Manufacturer
- ◆ Product Manufacturer
- ◆ Dealership supply
- ◆ End User
- ◆ Waste Warriors
- ◇ NGOs
- ◆ Learning center



Board games to create interventions for circularity
Brings stakeholders at one platform to experience the journey of plastic and create powerful interventions to stop, regulate and circulate the flow of plastic. An ideal outcome is in making the stakeholder aware of their powers towards making a difference for the whole system to function appropriately.
NON-RENEWABLE ENERGY
DECOUPLING
RENEWABLE ENERGY
Resource Management
Living on the edge
A workshop/service which gives awareness to people through different towards sensing crisis and what it means living on the edge. It facilitates them to ternative futures, build narratives and what ise that "demand can create change".

a system design project

Abhimanyu Chauhan
Kunal Bakshi
Shankar S
Swapnil yeutkar

Team jalpari
M.Des Product Design 2019

Guided by

Praveen Nahar
Sahil Thappa

राष्ट्रीय डिज़ाइन संस्थान
NATIONAL INSTITUTE OF DESIGN

Are you putting your personal goals over the planet's health?

Do you coonsider yourself a good ancestor?

What are your thoughts?

The Story of Plastic

It all started with Michael Phalen, the father of American billiards looking to popularize the game of billiards through standardizing the gear. In the process of finding a suitable replacement for ivory, a newspaper ad was out offering 10,000 dollars to the one who invents one. The discovery of plastic was revolutionary as no longer was human manufacturing constrained by nature. Plastic and the idea of creating new materials helped both the people and the environment as It protected the natural world from the destructive forces of human need. World war II provided to expand the plastic industry, and the surge continued to post the war.

The optimism with plastic did not last for a longer time. Plastics could not be seen as unambiguously positive. Plastic debris spotted during 1960 made people aware of the environmental problems. The persistence of plastic waste began to be seen as trouble, and gradually, plastic became a word to describe as cheap, flimsy, and fake. During the 1980s recycling was offered as a solution which did not work well - it is far from perfect, as most of them end up in the landfill. The reputation of plastic suffers further with the growing concern about the potential threat to human health and marine life. Despite growing mistrust, plastics play a significant role. Plastics raised the standard of living and made material abundance readily available. There are attempts around making plastics safer and more sustainable. Innovations around developing bioplastic, making recycling more efficient, creating truly biodegradable plastics are in progress. The story of plastic began as an effort to 'take the pressure off our environment but went on to do more harm than good.

1850s
1869
1907
1929
1930s
1933
mid 1930s
1939
1940
1945
1953
1955
1965
1969
1976
1979
Late 1980s
1997
2002
2011
2015
2017
2018
2019
2020
2030
2050
Period of Great Depression
World War II

1850s – The Age of Billiards

For many decades, starting in the mid-19th century, billiards was the one of the most popular amusements

830 pool halls in the city of Chicago alone.

Replacement for Ivory

Growing popularity for billiards put strain on supply of Natural Ivory obtained by slaughter of Elephants.

Ivory was expensive and dangerous to obtain

1869 – First synthetic polymer invented

John Wesley Hyatt

First Plastic - Celluloid

1907 – Creation of Bakelite

Leo Baekeland

First fully synthetic plastic

1930s – The rise of Bakelite and Radio

1933 – Creation of Polyethelene

mid 1930s – Moulding Technology

New methods in plastic moulding technology

1939 – Introduction of Nylon

Invented by Wallace Carothers

WWII and the expansion of Plastic Industry

1945 – Post War Scenario

1953 – Invention of High-density polyethylene (HDPE)

Karl Ziegler and Erhard Holzkamp

House Beautiful Magazine

1955 – Life Magazine

"Throwaway Living."

1965 – Polyethylene shopping bag

1969 – Giant Leap

1979 – Introduction in the US market

Late 1980s – Growth of Plastic Bags

Plastic bags will have almost replaced paper bags around the world

1997 – Discovery of Great Pacific Garbage Patch

Sailor and researcher Charles Moore discovers the Great Pacific garbage patch

2002 – Ban on thin plastic bags

2011 – Consumption Rate

World wide one million plastic bags are consumed every minute

2015 – Plastic straw stuck in a sea turtle's nose

Marine biologist Christine Figgener

2017 – Kenya bans Plastic Bags

2018 – #BeatPlasticPollution

#BeatPlasticPollution Chosen as theme for World Environment Day

2019 – Our waste claimed the life of yet another whale

2020 – Covid - 19 and the resurge

Plastic bags saw a resurgence because of the COVID-19 pandemic.

2030 – Plastic production growth

Plastic production is expected to grow 40% by 2030.

2050 – More plastic than fish in the oceans