

# A behavior and economic framework to attack marine plastic pollution

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## ○ Outline:

- Background and problems
- Existing frameworks:
  - ❖ Global Instruments related to marine plastic pollution
  - ❖ Civil society and behavioral economic approaches
  - ❖ Legal frameworks and market-based instruments
- Impact pathway of marine plastic pollution (behaviour and economic framework)
- Research ideas

## ○ Background & problems:

- Since 1950s, **8.3 billion tons** of plastic produced (FAO, 2017)
- Annual plastic production **reaching 322 million tons** in 2015. (excluding synthetic fibers used in clothing, rope and other products - **61 million tons** in 2016. Plastic production is likely doubling by 2025.
- Every **one minute, 1 million of plastic bottles** are bought globally
- Only about **9% recycled, 12% burned** and the remaining **79%** => landfills or the environment (Geyer et al., 2017)



Mouth of the Los Angeles River, Long Beach, California. Photo source: ©© Bill McDonald, Algalita Foundation / Heal The Bay

- Background & problems:

- What are plastics used for?

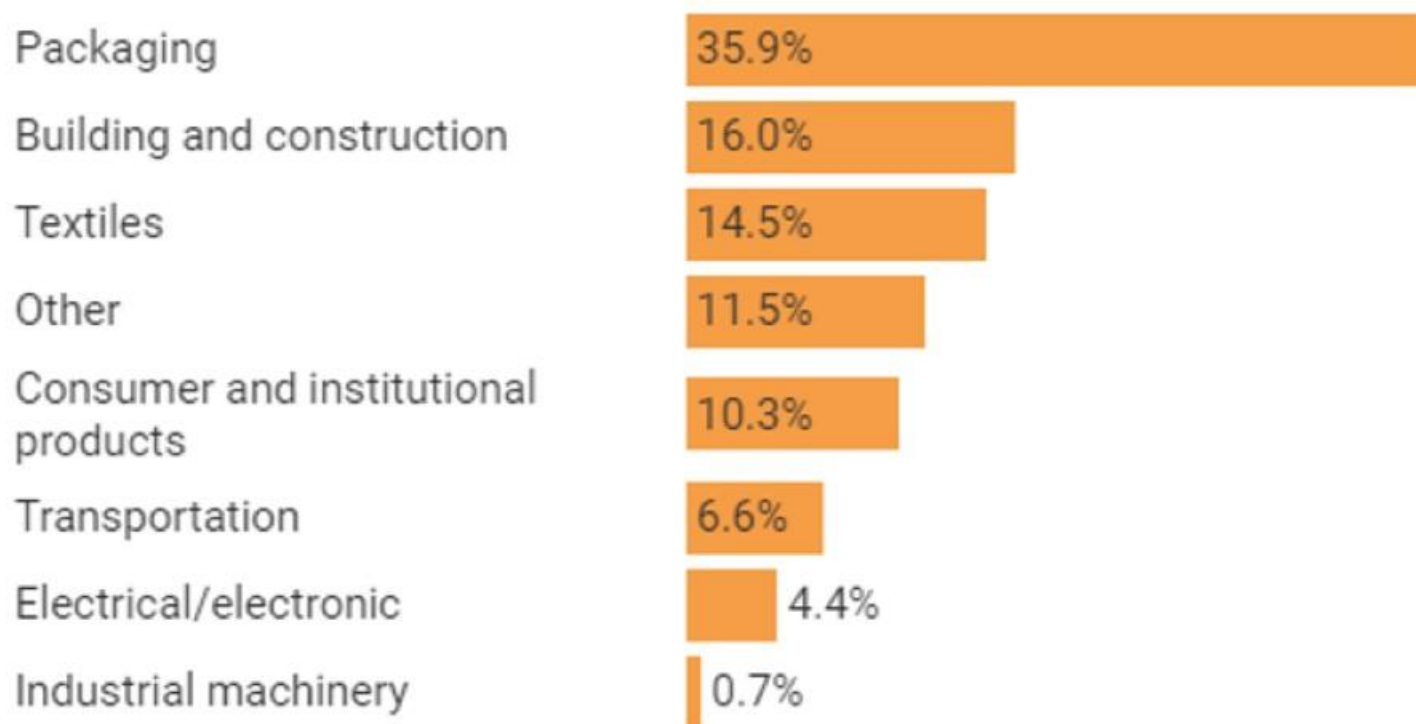
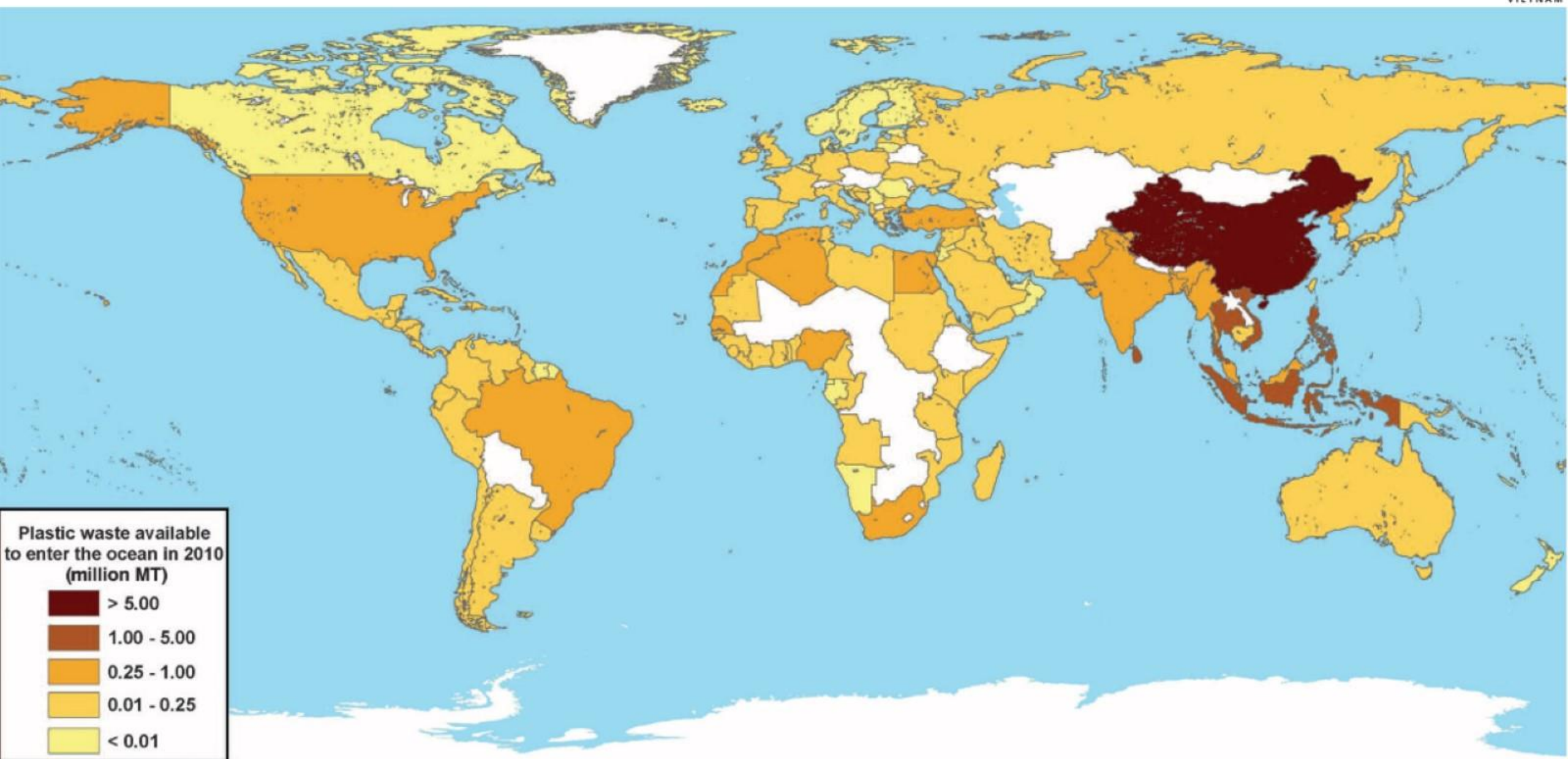


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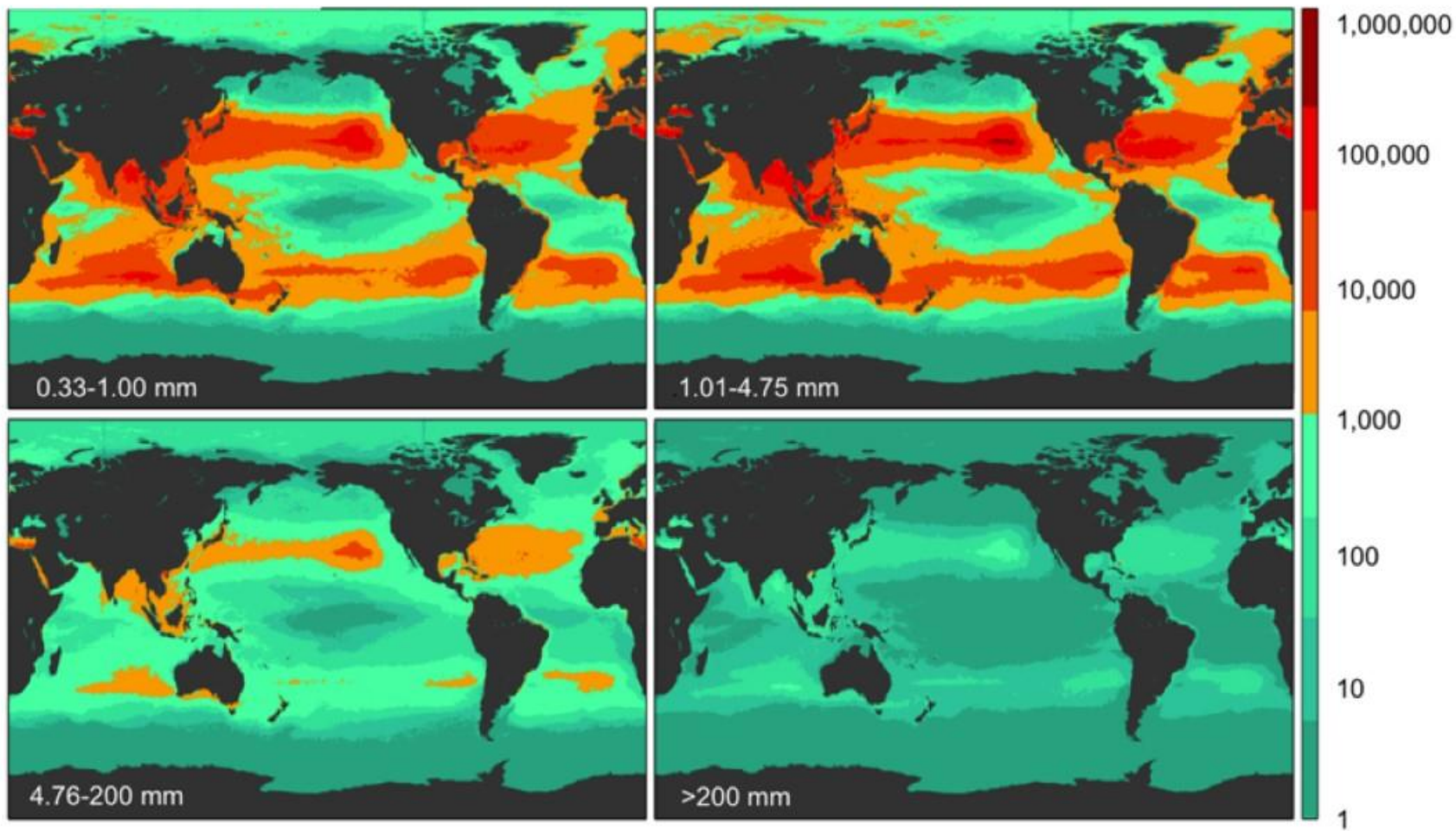
Plastic waste available to enter the ocean in 2010 (million MT)

- > 5.00
- 1.00 - 5.00
- 0.25 - 1.00
- 0.01 - 0.25
- < 0.01

## ○ Background & problems:

- Eriksen et al., (2014): Plastic Pollution in the World's Oceans:...

- 5.28 trillion of plastic pieces (268,940 tons afloat at sea)
- circle the Earth > 400 times.



## ○ Background & problems:

- Gall and Thompson, (2015): *The impact of debris on marine life*
  - 700 marine species affected by ocean plastic
  - 17% of species affected by entanglement and ingestion
- Up to 9 of 10 seabirds;
- 1 in 3 sea turtles
- more than half of whale and dolphin species have ingested plastic
- .... Impacts:
  - => biodiversity => ocean environment => human-beings
  - River/ Coastal communities in in China, Indonesia, the Philippines, Thailand, and Vietnam (Jambeck et al., 2015)
  - Fisheries/ Tourism/ Agriculture



What are:

Perception

Attitudes

Solutions

Actions



- ❖ Global Instruments related to marine plastic pollution
- ❖ Civil society and behavioral economic approaches
- ❖ Legal frameworks and market-based instruments

## Global Instruments related to marine plastic pollution

- **United Nation Convention on the Law of the Sea (UNCLOS, 1994)** Part XII (articles 192–237):
  - Six main sources of marine pollution
  - Dedicated to the marine environment conservation (see Vince & Hardesty, 2017)
- **Sustainable Development Goals (SDGs):**
  - Four SDGs, including SDGs 6, 11, 12 and 14, are related to the marine environment.
  - Mostly committed to waste reduction and management(see, Löhr et al., 2017)
- **United Nation Environment Program (UNEP) Initiative on Marine Litter (UNEP, 2009, Chapter 2)**
  - assessment of the status of the marine litter
  - connecting experts and authorities to cope with marine litter issues
  - proposing regional strategies
  - promoting the International Coastal Cleanup (ICC) Campaign

## Global Instruments related to marine plastic pollution

- Supported by SIDA, since 2018 IUCN has been conducting a project:
  - ✓ Marine Plastics and Coastal Communities initiative (MARPLASTICCS)
  - ✓ 5 countries: Thailand, Viet Nam, Kenya, Mozambique and South Africa
  - ✓ 4 main components:
    - Increasing knowledge (many studies)
    - Improving policies (many studies)
    - Engaging businesses (CER?)
    - Catalyzing capacity (part of policies)

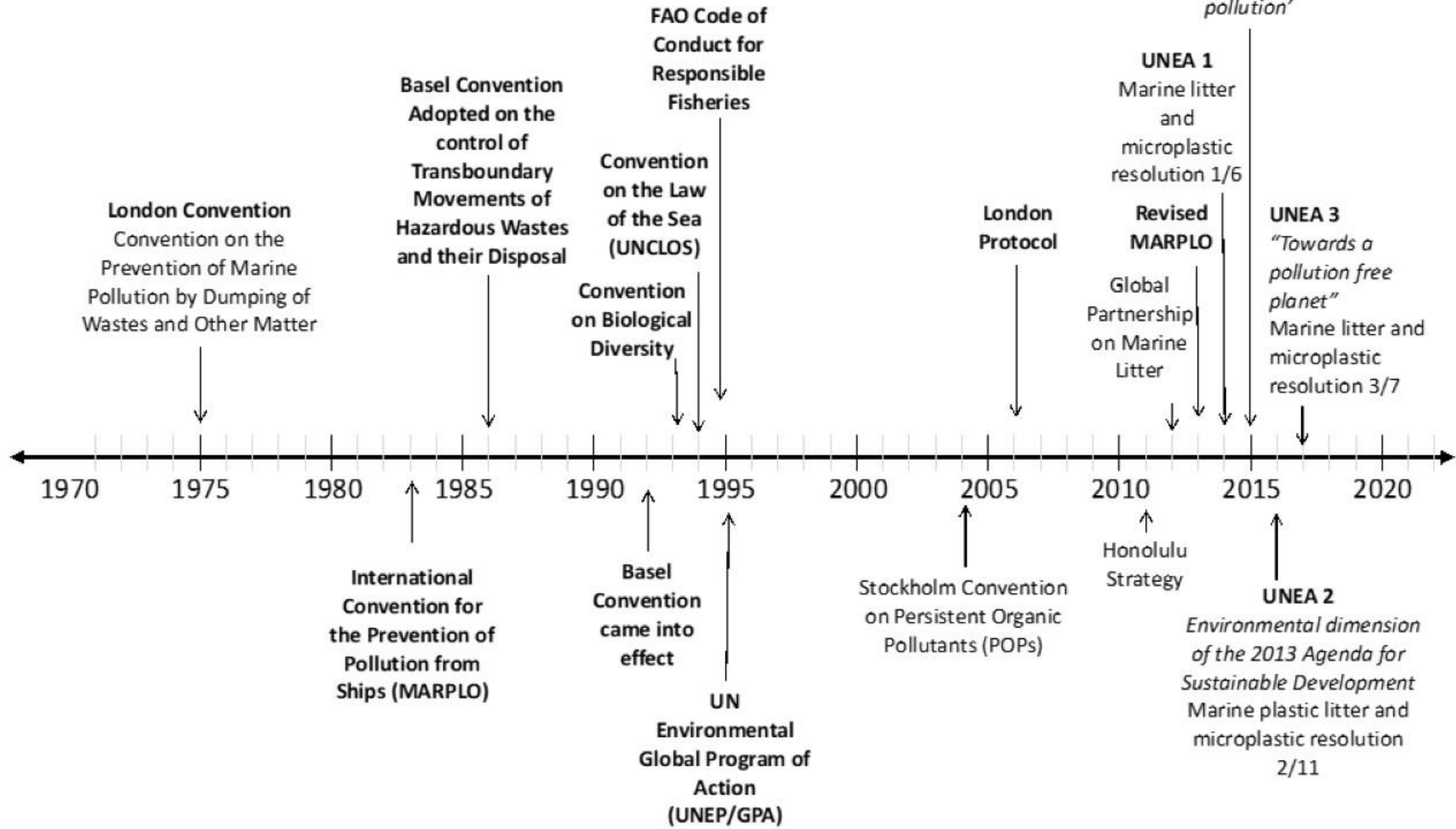


## Global Instruments related to marine plastic pollution

- The Honolulu Strategy, (UNEP and NOAA) (UNEP, 2012):
  - a set of three specific goals (no specific objective as due to local settings)
  - i.e., goal A:
    - reducing amount and impact of land-based litter
    - solid waste introduced into the marine environment
- Many more, i.e., (see Tiquio et al., 2017, Table 4 for details)

# Timeline of Global Instruments related to marine plastic pollution

**Agenda for Sustainable Development**  
*Target 14.1 Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution'*



## Legal frameworks and market-based instruments

### ○ Prohibition of plastic bags

- This was observed in many countries, i.e., China, Chile, Australia (some states), South Africa (Dikgang, Leiman, & Visser, 2012)
- Plastic-bag-ban (PBB) in China (Zhu, 2011)
  - in 2008 China prohibited the production, distribution, and use of plastic bags 25 mm thick
  - simultaneously introducing a fee on other disposable plastic bags
  - PBB worked well with super markets **but open markets**
- He (2012) interviewed 3,074 shoppers in Beijing and Guiyang *ex ante* and *ex post*:
  - after four months disposable plastic bag use had decreased by 49%
  - Compliance has been a challenge: open markets
  - This is based on **self-reported information** (measure the amount of plastic bags used)

## Legal frameworks and market-based instruments

- **Effects of levy and taxes are mixed** (Martinho et al., 2017)
  - In Belgium:
    - **Packaging levy and other ecotaxes** introduced in 1993 and reformed in 2004
    - focusing on non-reusable containers
    - the levy was EUR 9.86/hectoliter for non-reusable; EUR 1.81/hectoliter for reusable containers
    - **'Environmental Levy'** introduced from 2007:
      - single-use carrier bags (EUR 3/kg), single-use plastic (EUR 2.70/kg) and aluminum foil (EUR 4.50/kg), and disposable plastic cutlery (EUR 3.60/kg). Biodegradable bags were exempted from the tax
      - Environmental Levy was abolished in Jan., 2015 as the objective was met.
  - Similar taxes and levies in some countries:
    - Ireland in 2002, Luxembourg in 2007 and Malta in 2009,
  - **However, in Romania in 2009** after the introduction of environmental law and levy, the consumption of plastic bags **increased from 27 million bags in 2009 to 60 million bags in 2010**

## Civil society and behavioral economic approaches

- **Economic nudges:**
  - Nudge: *insignificantly changing their economic incentives*
  - When tax rate is relatively small or just symbolic (Rivers et. al., 2017)
  - Taxes vs economic nudges:

Jurisdiction	Year implemented	Type of policy	Cost to consumer per bag (equivalent in 2010 US\$)
Denmark	1994	Market-based	None. Cost is borne by retailers
Ireland	2002	Market-based, public education	\$0.20 increased to \$0.32 in 2007
South Africa	2003	Prohibition, nudge	Varies, no more than \$0.68, and usually much lower
Botswana	2007	Nudge	Varies \$0.03-\$0.05
China	2008	Prohibition, nudge	Varies, reliable data unavailable
Victoria, Australia	2008	Nudge	\$0.09
Toronto, Canada	2009	Nudge	\$0.05
Washington, DC	2010	Nudge	\$0.05
Wales	2011	Nudge	\$0.08
Montgomery County, USA	2012	Nudge	\$0.05
England/Scotland	2014	Nudge	\$0.08



## Civil society and behavioral economic approaches

- Environmental education (Phan Hoang & Kato, 2016; Hartley et al., 2015; Eastman et al., 2013)
  - Schools and community/ household levels (in Chile and Vietnam, for example)
  - Long term and sustainable impact
  - Focusing on attitudes/ perception/ awareness
  - Positive effect as reported in the literature
  - However, hard to measure “real impact”

## Civil society and behavioral economic approaches

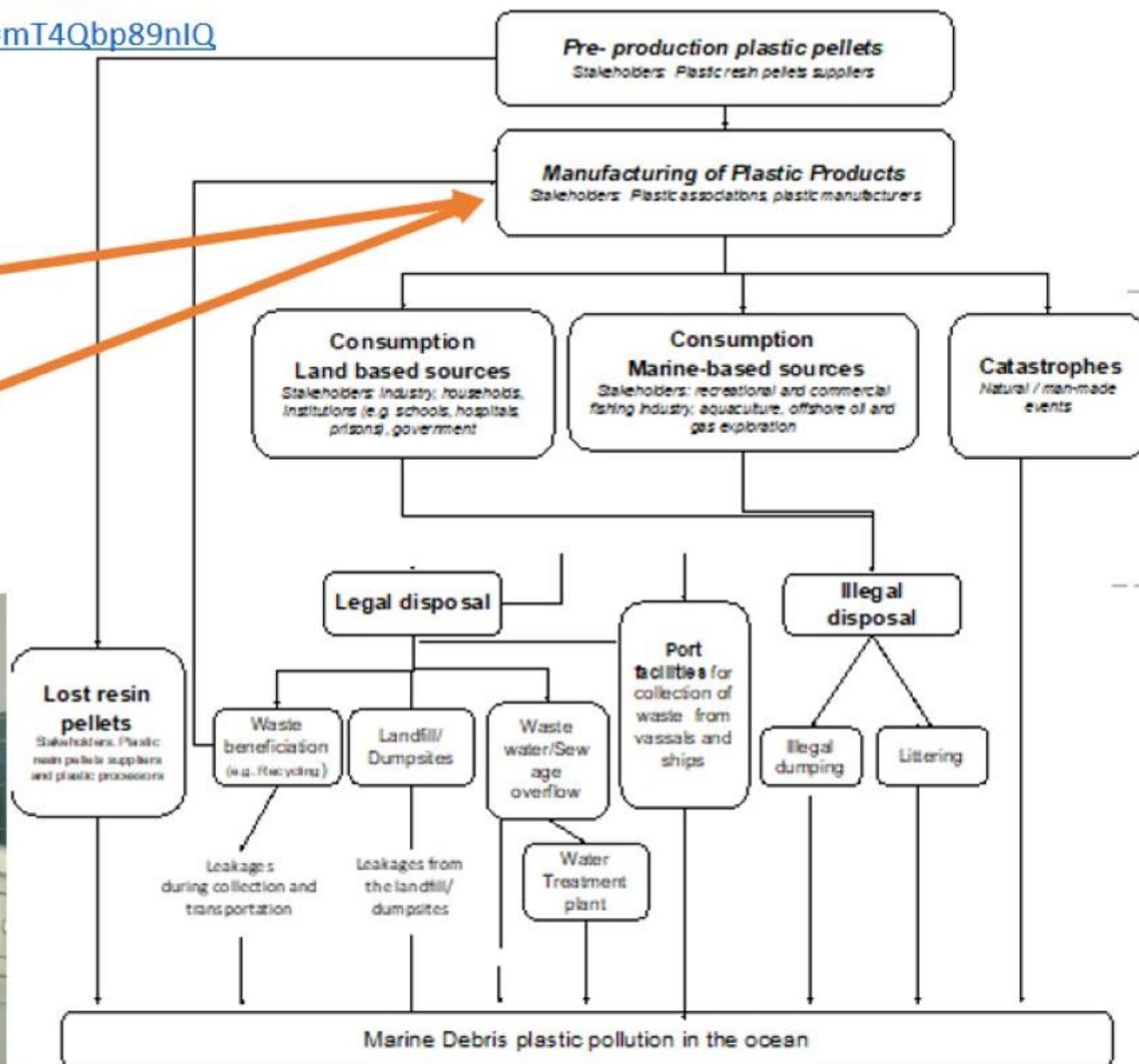
- Environmental education (Phan Hoang & Kato, 2016; Hartley et al., 2015; Eastman et al., 2013)
  - Phan Hoang & Kato, 2016: (Vietnam)
    - Pre and post treatment surveys: 247 students (2014)
    - Treatments: provided workshops / posters (2015) and post-treatment survey (2015)
    - in two elementary schools in Da Nang
    - Focused on students' knowledge of solid waste management
    - Main findings: Students are interested in waste management; pro-environmental awareness increased



## Impact Pathway of Plastic

### ○ Impact pathway of marine plastic pollution

- TED talk: <https://www.youtube.com/watch?v=mT4Qbp89nIQ>



○ Impact pathway of marine plastic poll

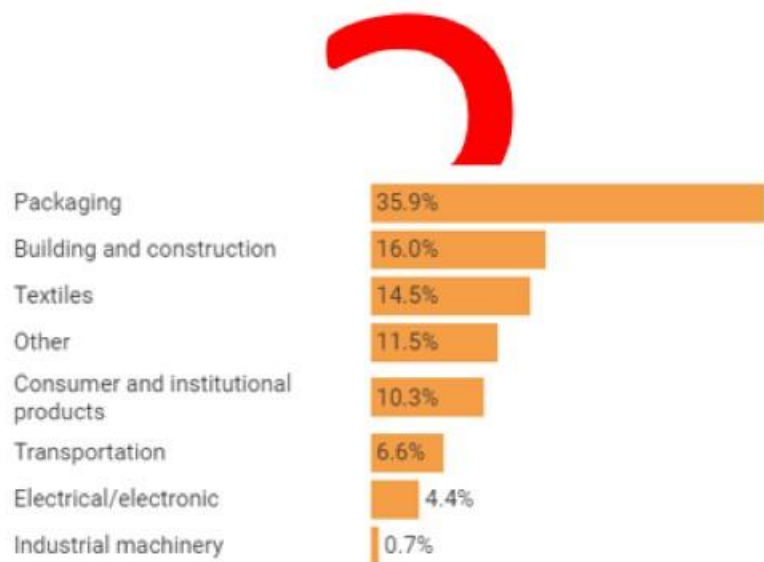
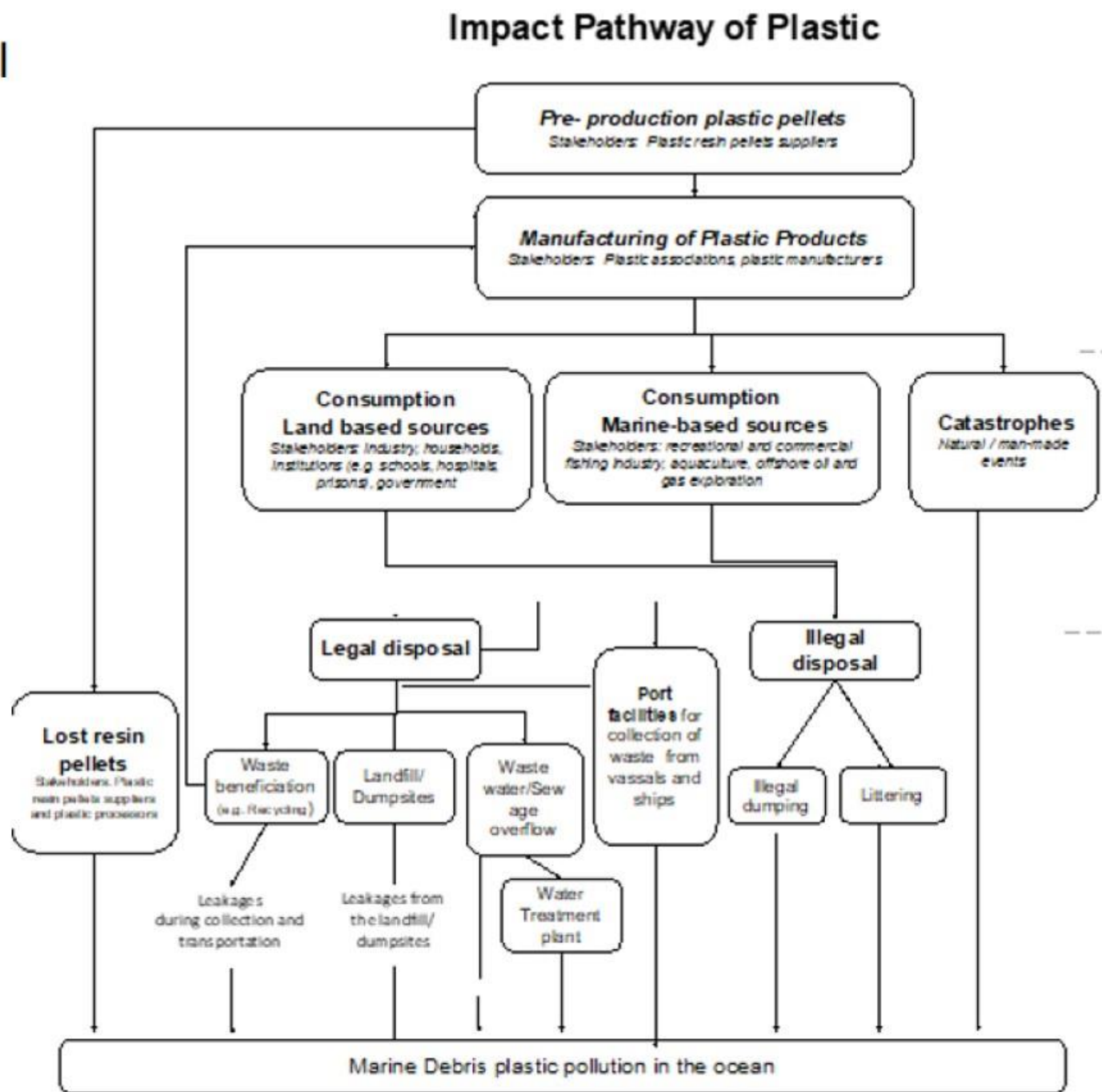


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# Impact pathway of marine plastic pollution

## Production

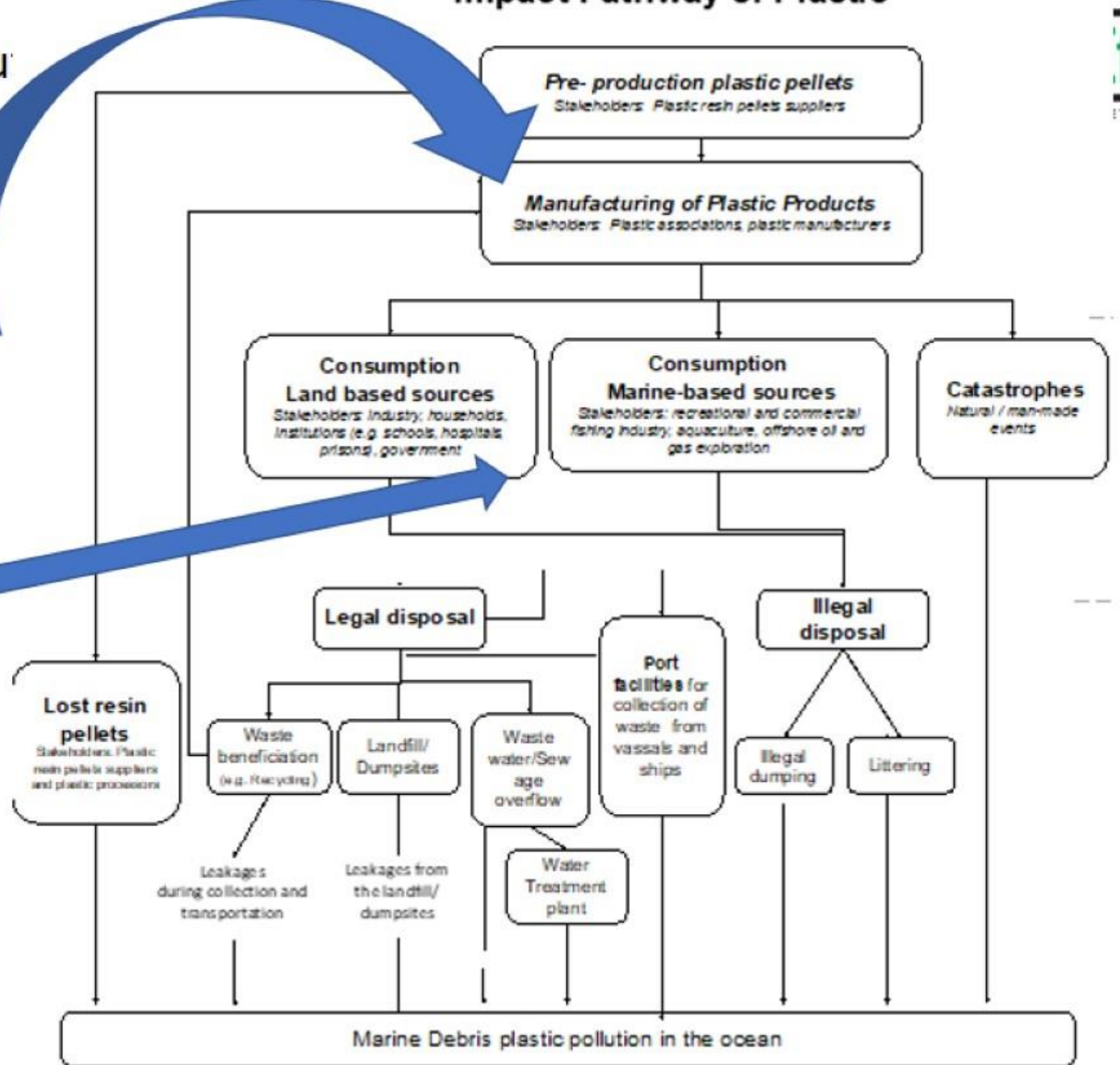
To reduce the amount and quality of plastic generated

1. Regulation and enforcement
2. Technological – innovation
3. Economic
  - Under the Extended Producer Responsibility normative (tax-subsidy, recycling fees and norms)
  - Disincentives (Penalties, taxes/charges) / incentives (Subsidies and fiscal incentives)
4. Behavioral
  - Social influence and social reputation (key members of the plastic industry)
  - Organizational and operational changes

## Consumption

To reduce the amount of plastic consumed and disposed

1. Regulation and enforcement
2. Economic
  - Disincentives (fines, taxes/charges per single use plastic (i.e., bags), landfill tax, incineration tax)
3. Behavioral
  - Provision of information
  - Social norms and social comparison
  - Changes in the physical environment and setting “green” default options
  - Education



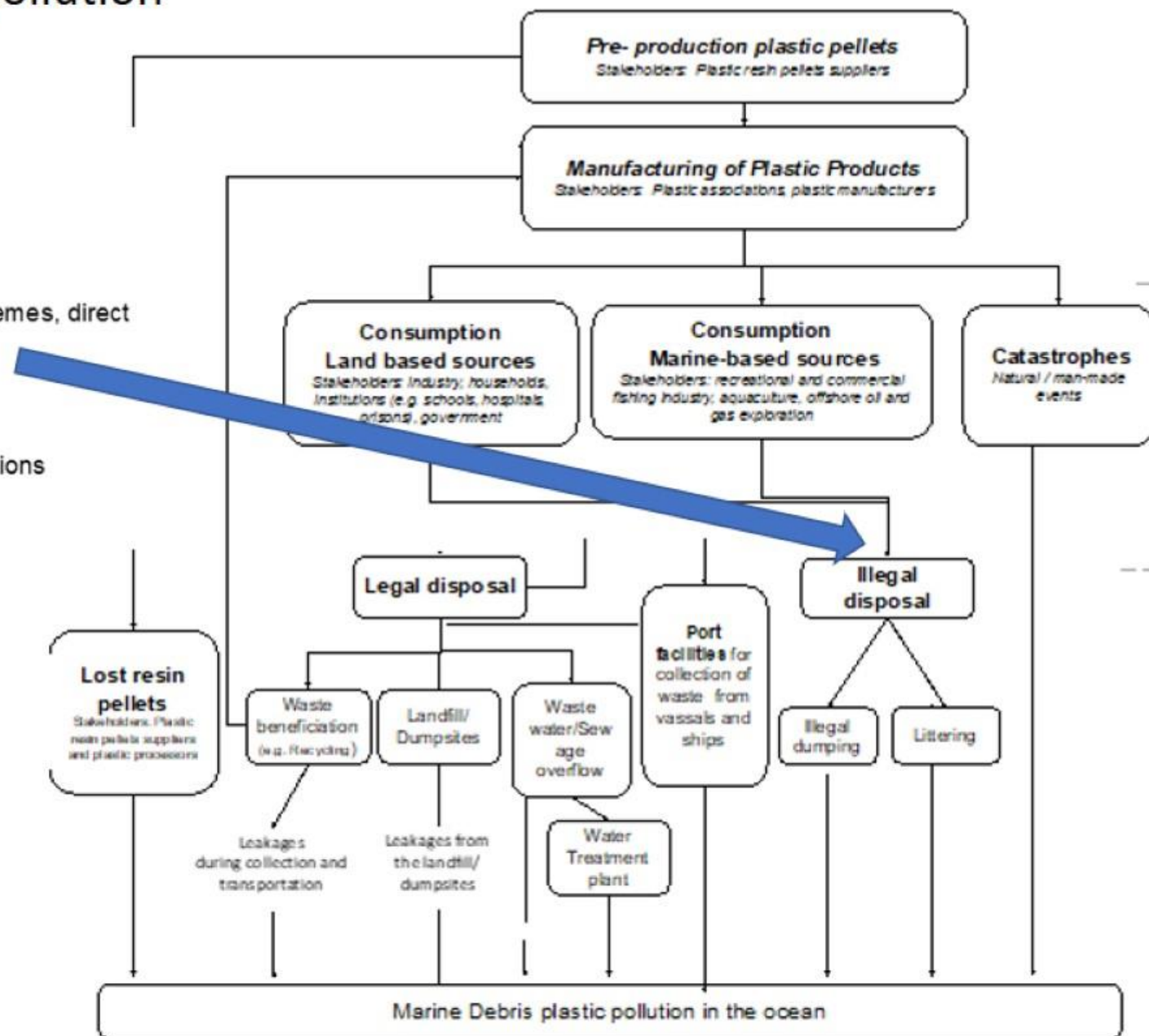
# Impact pathway of marine plastic pollution

## Disposal

To promote proper disposal, recycle and reduce leakages

1. Regulation and enforcement
2. Economic
  - Disincentives (fines, taxes/charges)/incentives (Deposit-refund schemes, direct payments/award)
3. Behavioral
  - Provision of information
  - Social norms and social comparison
  - Changes in the physical environment and setting "green" default options
  - Moral Suasion (morality, moral norms, level of moral development)
  - Education

## Impact Pathway of Plastic



## ○ Research ideas ...

- **Idea 1:** Reducing land-based marine pollution from coastal urban communities
  - Target areas & respondents:
    - Coastal and river communities
    - Local shops: the use of plastic bags
    - Community members/ consumers
  - Hypotheses:
    - Environmental messages would also help bring about a positive change in the attitude of consumers towards marine pollution (i.e., efficient use of plastic bags)
    - Environmental messages would have a negative impact of littering on marine ecosystem will reduce the amount of littering
    - The knowledge will also transfer to wider communities and reduce their consumption of plastics

## ○ Research ideas ...

- **Idea 1:** Reducing land-based marine pollution from coastal urban communities
  - Methods/ instruments
    - RCT
    - Providing plastic bags
    - Surveys
  - Treatments:
    - Treatment 1: Poster presentation
    - Treatment 2: Poster presentation + training for cashiers/ shopkeepers/operators
  - Outcome variables:
    - **KAP Survey Model (Knowledge, Attitudes, and Practices) pre and post**
    - Behavior changes: number of plastic bags consumed



## ○ Research ideas ...

- Idea 2: Reducing marine debris pollution by changing household behavior through children education and outreach programs
  - Target areas & respondents:
    - Coastal and river communities
    - Schools/ classes/ individual students
    - Family/ parents
  - Hypotheses:
    - Education would also help bring about a positive change in the attitude of students towards marine pollution
    - Educating students on negative impact of littering on marine ecosystem will reduce the amount of littering
    - The knowledge will also transfer to the parents and reduce their consumption of plastics
  - Methods: RCT; class level
  - Treatments:
    - Treatment 1-> education + personal norms
    - Treatment 2-> education + social norms

## ○ Research ideas ...

- Idea 2: Reducing marine debris pollution by changing household behavior through children education and outreach programs

- Outcome variables:

### **Students**

- KAP Survey Model (Knowledge, Attitudes, and Practices) pre and post
- Campus Cleanup Datasheet

### **Households**

- Consumption/ Expenditure Diaries for households (3 times + baseline)

## ○ Research ideas ...

- Idea 3: Celebrity endorsement and advocacy for reducing marine debris pollution
  - Target areas & respondents:
    - Urban coastal areas
    - University/ college students
  - Hypotheses:
    - Celebrity endorsement would also help bring about a positive change in the attitude of students towards marine pollution
    - Celebrity advocacy would have a negative impact of littering on marine ecosystem will reduce the amount of littering
    - The knowledge will also transfer to wider communities (i.e., Facebook friends, family) and reduce their consumption of plastics
  - Methods: RCT
  - Treatments:
    - Treatment 1-> celebrity + personal norms
    - Treatment 2-> celebrity + social norms

## ○ Research ideas ...

- Idea 3: Celebrity endorsement and advocacy for reducing marine debris pollution
  - Outcome variables:

### **Students**

- KAP Survey Model (Knowledge, Attitudes, and Practices) pre and post
- Campus Cleanup Datasheet

### **Other communities: i.e., Facebook friends**

- Consumption/ Expenditure Diaries

Thank you very much!