An Experience from Japan: The Challenge to Establish a Plastic Waste Recycling-Based Society in Vietnam

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Abstract: As a result of expanding economies and a growing pattern of mass production, mass consumption, and mass disposal, these last decades have seen an increase in the discharge of domestic waste on a global basis. Used plastic products are frequently pathogen-contaminated, and ought to be handled as hazardous waste. We have learned that companies and policy makers in Vietnam want to transform plastic waste to value and to create its first zero plastic waste cities, but they struggle to make connections, especially across industries, material types and districts. This paper gives a prospective outlook on plastic waste management practices in Vietnam. Based on Japanese plastic waste recycling basic laws systematically, we also discuss and propose the future tasks to apply them in Vietnam. The initiative is expected to help governments, enterprises, and social organizations develop knowledge, capacity, policy planning and plans of action to reduce plastic waste pollution.

Key words: Plastic waste, recycling-based society, pollution, policies and regulations.

1. Introduction

World population was estimated to have reached 7.8 billion people as of July 2020 [1], is forecast to exceed 9 billion by 2050. It is feared that the growing demand for resources will facilitate an increase in resource consumption and waste generation, contribute to deterioration of the natural environment and climate change, and impact on future generations [2]. Commercial production of plastics that started around 1950’s has enjoyed exceptional growth, to reach the present global annual production of 330 million Mt (Metric Tons) for 2016 [3, 4]. Plastics represent a low-cost, easily formable, high-modulus, hydrophobic, bio-inert material that finds use in a bewildering range of consumer products. It is often the preferred, and with some products an indispensable choice in consumer packaging that accounts for 42% of the global annual resin production [3, 5]. While the benefits of plastics are far-reaching, massive production and waste mismanagement have raised environmental concerns [6]. Used plastic products are frequently pathogen-contaminated, and ought to be handled as hazardous waste.

Even before the start of the COVID-19 pandemic, the management of plastic waste was considered to be a major environmental issue due to growing concerns about pollution in terrestrial and marine ecosystems [7]. Recently, the COVID-19 has led to a pandemic of plastic pollution. One of the acute environmental effects of the pandemic is the sudden surge in the demand for and use of plastic products to protect the general public, patients, health and services workers. Worldwide waste management systems have already been unable to deal with existing plastic waste satisfactorily, the impending surge in the volume of waste from the COVID-19 pandemic threatens to overwhelm existing waste management systems as does healthcare capacity [8]. Vietnam is not an exception of this situation. Urbanization and strong economic and population growth are causing rapidly increasing waste management and pollution challenges in Vietnam. Vietnam is one of the biggest...
consumers of plastic in the world, standing at 17th out of 109 countries. Vietnamese produces around 1.2 kg of waste per day, and 16% of them are plastic. In reality, Vietnam’s population just reached 93.7 million last year; this means Vietnamese people are generating nearly 18,000 tons of plastic waste a day [9]. Despite Vietnam’s many successes in responding to the current global pandemic, the resulting economic slump and plastic waste pollution has left many with significant challenges.

Many companies and policy makers in Vietnam want to transform plastic waste to value and to create its first zero plastic waste cities, but they struggle to make connections, especially across industries, material types and districts. This paper gives a prospective outlook on plastic waste management practices in Vietnam. Based on Japanese plastic waste recycling basic laws systematically, we also discuss and propose the future tasks to apply them in Vietnam. The initiative is expected to help governments, enterprises, and social organizations develop knowledge, capacity, policy planning and plans of action to reduce plastic waste pollution.

2. Methodology

This paper uses systematic literature review as a method to provide an overview of plastic waste problem. It may provide a theoretical foundation for the proposed study, substantiate the presence of the research problem, justify the research as one that contributes something new to the cumulated knowledge, or validate the methods and approaches for the proposed study [10].

3. Results and Discussions

3.1 The Current State of Plastic Waste Consumption, Classification and Collection in Vietnam

3.1.1 Plastic Waste Consumption

Vietnam plastic waste is amongst the highest in the world. Vietnam’s plastic consumption per capita increased significantly more than 10 times, from 3.8 kg to 41 kg during 1990-2015. More than 1.8 million tons of plastic are generated in Vietnam per year. The annual growth rate of plastic industry is 16%-18% [11]. The percentage of plastic waste in urban solid waste components in 2019 was only lower than that of organic waste and higher than other wastes (Fig. 1).

There are five categories of plastic products, including packaging (39%), households (32%), construction materials (14%), technical products (9%) and other (6%), in which plastic packaging is the highest. Besides, according to the recent survey, plastic products are used popularly in households which 2 to 4 pieces littered per day had the greatest percentage (over 40%). Even they used over 7 plastic pieces daily for their life’s activities (Fig. 2).

Besides, Vietnam is at high risk of becoming a garbage dump in the world. This is because Decision No. 73/2014 TTg [12] regulated the category of plastic scraps permitted for import. However, in fact, it is impossible to classify plastic scraps into specific substances. They even create environmental contamination in the waste classification process. As a consequence, many foreign companies have made use of this gap in the environmental law to export illegal plastic waste to Vietnam with 245.8 TMT (Thousand Metric Tons) in 2016; 385 TMT in 2017 and 277.7 TMT in the first 6 months of 2018 [13]. In general, the import of scrap for production has not been performed as regulated. The import of plastic scrap plays an insignificant role in the development of the sector, but it creates trouble for management and will not be continued after 2024. The material flow in the plastic sector is presented in Fig. 3. The material flow in the plastic sector showed a gap of around 2.1 million tons (input-output). Domestically, plastic materials for industrial use (including primary and recycled) meet only 20% of the demand; 80% of input materials for manufacture is imported [11].

3.1.2 Plastic Waste Classification and Collection

For plastics from domestic consumption and production, the classification of plastic waste at sources has not
Fig. 1  Percentage of urban garbage components in 2019 [14].

Fig. 2  Numbers of plastic bags, bottles/foam were disposed per day in households in 2019 [14].

Fig. 3  Overview of material flow in Vietnam plastic sector [11].
been conducted yet. Recyclable plastic waste (water bottles, plastic bags, thick plastic bags, etc.) is collected from many places (households, supermarkets, collection sites and gathering sites). Fig. 4 shows that 33% of households do classify to reuse and recycle plastic waste. Besides, the percentages of plastic waste classification of waste collection workers at collection sites and gathering sites are 64% and 55% (Fig. 5). Plastic waste which does not have or has low recycling value, including plastic bags, foam boxes, plastic straws are disposed into the environment.

For scrap plastic from manufacturers, most are collected and sold to recycling establishments. The main problem now is disposable plastic products and ultra-thin plastic bags, which are difficult to decompose after one use [15].

3.2 Solutions to Reduce Plastic Waste and Causes of Failure in Vietnam

3.2.1 Policies and Regulations

Vietnam has developed a comprehensive legal framework for waste recycling, including legislation for enforcement and incentives. Vietnamese government is aware of negative environmental impacts of plastic waste by issuing policies to reduce plastic waste problems [13] shown in Table 1.

In general, policies are aimed at environmental protection. However, the policy and regulatory system in Vietnam lack a robust framework to support recycling activities or mechanisms to promote the segregation of waste at the source, key to any sustainable waste-to-resource approach. Moreover, there is no
Table 1  Overview of main incentives and enforcement framework for plastic waste management.

<table>
<thead>
<tr>
<th>Law</th>
<th>Contents</th>
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<tr>
<td>Resolution No. 1269/2011/UBTVQH12 [17]</td>
<td>Impose the environmental tax of VND 40,000 per kg on plastic bags.</td>
</tr>
<tr>
<td>Law on Environmental Protection 2014 [18]</td>
<td>Advices to control, collect, reuse and recycle wastes.</td>
</tr>
<tr>
<td>Decision No. 44/2018/UBND of HCMC [21]</td>
<td>Implement the solid waste sorting law in HCMC (Ho Chi Minh City) and regulate punishment of VND 20 million for violating this law.</td>
</tr>
<tr>
<td>Resolution 579/2018/UBTVQH14 [22]</td>
<td>Impose the environmental tax of VND 50,000 per kg on plastic bags.</td>
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| Decision 491/QD-TTg 2018 [23]                                   | Identified the specific requirement for domestic waste at urban area is to use 100% environmental friendly plastic bags in shopping centers, supermarket instead of normal plastic bags and 90% of domestic waste in urban area is collected and treated properly, in which direct landfill is expected to be lower than 30% of amount of waste collected.

clear distinction between waste and scrap [11]. Especially, the implementation of government policies has not been effective enough because of the following main causes [13]:
- The classification of plastic waste at sources has not been conducted yet;
- Lack of an effective regulatory system;
- Lack of clear instructions and notifications to the public;
- Inadequate tax and tariffs;
- Hard to change consumers’ habit of consuming plastic bags.

3.2.2 Packaging Manufactures and Brand Owners

Plastic packaging manufacturers’ initiatives toward new packaging innovations are more sustainable to help reduce plastic waste. Plastic packaging manufacturers started producing innovative plastic materials and packaging products that are more sustainable and eco-friendly. Besides innovative plastic packaging, packaging manufacturers invent alternative packaging products which are made from bamboo, grass and cloth instead [13].

Brand owners’ initiatives are to help reduce plastic waste and promote a sustainable environment. Fast moving consumer goods take the initiative to replace all plastic packaging with recycled plastic products. Famous coffee chains and restaurants take the initiative to replace single-use plastic containers and straws with other eco-friendly products. Retailers start using eco-friendly packaging products such as banana leaves, bio-plastic bags [13].

However, the price of these eco-friendly alternative products is relatively higher than this of plastic products. Biodegradable plastics are also not and should not be considered as a solution to the problem of litter [16].

3.2.3 Recyclers’ Side

Vietnamese plastic recycling industry is still not developed. The plastic recycling industry requires relatively high technology, while a majority of factories in Vietnam are small with the outdated technology and poor management. The solid waste management system in Vietnam has not been operated as an integrated system, leading to a reduction in the efficiency of waste classification during recycling, dust and VOCs (Volatile Organic Compounds) disperse into the surrounding environment causing air pollution [13].

Now, it is urgent to review our lifestyles and economic activities and pursue a society in which consumption of natural resources is restricted, with a reduced environmental burden.

3.3 An Experience from Japan: The Plastic Waste Recycling-Based Society

Japanese have lived a prosperous life in the 20th century, which was supported by the system of mass production, mass consumption, and mass disposal [24]. Japan produces 9.4 million tons per year, accounting for 2% of total waste and recycling and recovery rate
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is 81.6% [25]. The material flow of plastics in Japan is shown in Fig. 6.

Based on Japan’s basic law for establishing the recycling-based society in 2000 [24], the fundamental plan for establishing a sound material-cycle society since 2003 [26] states that measures with regard to waste shall be promoted as far as they are technologically and economically viable according to the priority stipulated in the basic law (Fig. 7). Table 2 lists the laws for waste management and recycling.

Fig. 6  The material flow of plastics in Japan [25].

Fig. 7  The basic law for establishing recycling-based society [24].
Table 2  Legal system for building a sound material-cycle society [27].

<table>
<thead>
<tr>
<th>Law</th>
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<tr>
<td>Basic law for establishing the recycling-based society</td>
<td>Basic framework determining the role of stakeholders for establishing the sound material-cycle society.</td>
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<tr>
<td>Waste management and public cleansing law</td>
<td>Defines municipal wastes and industrial wastes. The roles and duties of a municipality, waste generator, waste management company, and other stakeholders are strictly provided. The related regulations and rules define both technical and social conditions and guidelines to keep the sound business in addition to construction of a facility, installation and operation of equipment. Promotion of waste reduction through recycling. The roles and duties of the stakeholders are mentioned. Promoting reduction of wastes through recycling and suitable disposal in several fields of industries and products such as steel production, paper production, construction, automobile, electric and electronic equipment, batteries, metal cans and Polyethylene terephthalate (PET) bottles.</td>
</tr>
<tr>
<td>Law for promotion of effective utilization of resources</td>
<td>Promotion of recycling containers and packaging through separate collection of those wastes made from paper, metal, glass, PET and the other plastics by municipalities with cooperation of citizens. Producers of the material, manufacturers of the commercial products with containers and packaging and retail stores cover recycling costs. Recycling methods are provided in the related regulations.</td>
</tr>
<tr>
<td>Containers and packaging recycling law</td>
<td>Forcing consumers to give wastes of home appliances to retailers with paying recycling fees. Air conditioner, refrigerator/freezer, television set, washing machine and cloth dryer are recycled with suitable treatment of fluorocarbons and other potential hazardous substances.</td>
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<tr>
<td>Electric household appliance recycling law (home appliance recycling law)</td>
<td>Forcing car owners to cover the cost for suitable disposal of hazardous wastes and wastes of no commercial value with recovering valuable resources from end-of-life vehicles.</td>
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<td>End-of-life vehicle recycling law</td>
<td>Reducing the amounts of construction and demolition wastes through recycling.</td>
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<tr>
<td>Construction material recycling act</td>
<td>Reducing the amounts of food residues from restaurants, food processing industry and supermarkets through recycling waste foods.</td>
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<td>Food recycling law</td>
<td>Promoting the national and local governments to buy products that are made from recycled materials.</td>
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<td>Law on promoting green purchasing</td>
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The basic law for establishing the recycling-based society aims to promote waste measures and recycling measures comprehensively and systematically [24]. Firstly, restriction of generation is to reduce production of plastic wastes as much as possible. Secondly, reuse is to use as many times as possible things that are no longer needed. Thirdly, recycling is to recycle, as resources, things that cannot be used repeatedly. Lastly, appropriate disposal is to appropriately dispose of things that cannot be reused or recycled and that must be disposed of, in a manner that does not contaminate the environment. After tacking to change from a one-way society to the recycling-based society, the generation of municipal waste continues to decrease after recording a peak of 548.3 million tons in 2010. The amount of final disposal tends to decrease along with progress in recycling and reduction of waste generation (Fig. 8). The total generation of industrial waste has remained 390 million tons in 2010, almost unchanged since 1990. The final disposal tends to decrease with progress in recycling and there is a declining tendency of industrial waste in recent years (Fig. 9).

3.4 Discussions and Future Tasks in Vietnam

Dissemination of recycling in the local society is of importance with respect to the promotion of the sustainability in Vietnam. However, there are many obstacles and discrepancies between the idea and reality. Wastes and plastic wastes are useful things that can be used repeatedly or recycled. There are orders in handling wastes in considering the environment. Opinions will be heard widely from the general public. The responsibility of a person who discharges wastes, and the responsibility of a person who produces things, are clearly stated: Try not to produce wastes, as much as possible; use the produced wastes as resources, as much as possible and properly dispose of wastes that cannot be used by any means [24]. Additionally, the government should enhance the enforcement law on collection, transportation and treatment of plastic waste.
The MONRE (Ministry of Natural Resources and Environment) has proposed a draft law revising the 2014 Law on Environment Protection, which has specified the volume-based waste fee is appropriate and necessary for Vietnam. By this amended law, the government has started seeking ways to fundamentally reduce the amount of waste, which means promoting the reduction and segregation at source for reuse and recycling.
recycling of solid waste in general and plastic especially. This is a general trend of civilized society and sustainable development.

4. Conclusions

As a result of expanding economies and a growing pattern of mass production, mass consumption, and mass disposal, these last decades have seen an increase in the discharge of domestic waste on a global basis. Used plastic products are frequently pathogen-contaminated, and ought to be handled as hazardous waste. This paper just emphasized on the strict basic laws to establish a plastic waste recycling-society systematically in Vietnam to tackle waste problems which affect directly the conveniences of modern life. Therefore, we have no choice to review our economic activities and lifestyles. Besides, waste plastics recycling technologies have also been recognized as an important and effective tool to control plastic wastes. These contents will be discussed more in the next papers.

References

[23] Decision No. 491/QĐ-TTg dated May 07, 2018 Approving Adjustments to National Strategy for General Management of Solid Waste to 2025 with Vision towards
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