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## Application of the DPSIR model to assess the current status of solid waste management in Binh Hoa, Thuan An, Binh Duong province

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### **ABSTRACT**

*Through analysis of the DPSIR model, combined with research methods such as field surveys, and survey questionnaires, the author has given the following results: The amount of waste is increasing; Not paying attention to the classification at source, Solid waste collection is still limited; Environmental quality is degraded due to the stench caused by domestic waste in some neighborhoods; The soil environment is polluted due to solid waste treatment that is difficult to decompose; Surface water and groundwater are also leaked due to leachate, wastewater from landfills; The polluted environment has, directly and indirectly, affected the health and production and business activities of the people in the ward, degraded the ecosystem, and lost the urban beauty. The author has proposed solutions to reduce environmental pollution caused by domestic waste such as population policy, establishing collection groups, craft village planning, and applying the circular green model in economic development.*

**Keywords:** *DPSIR models, solid waste management, polluted environment by solid waste*

### **1. Introduction**

There have been many studies applying the DPSIR model in some fields, especially in environmental management such as AB Jago-on, S Kaneko, R Fujikura, and A Fujiwara, 2009 applying the DPSIR model in the management of urban environmental issues; Hong Minh Hoang (2017), application of DPSIR model in assessing factors affecting the

development of rice farming models applying new techniques in the Mekong Delta; Duong Hong Son, Ngo Tho Hung (2012), evaluating Hanoi air environment management system by DPSIR model.

The DPSIR model provides an approach to the analysis of environmental problems. In the DPSIR analysis, socio-economic factors are identified as driving forces (D) and pressures (P) on the environment. The result leads to the state (S) of the environment. Changes in the environment will cause impacts (I) on human health and ecosystems. To respond to these impacts, people need to take response actions (R).

Over the past years, along with the development of society, the process of industrialization and modernization has also developed faster and stronger, leading to the enhancement of human needs and interests. Accordingly, domestic waste is also increasing day by day (Adeoti & Obidi, 2010), causing adverse effects on the environment. According to the 2019 National State of the Environment Report, on the topic "Daily solid waste management", domestic solid waste in urban areas is 35,624 tons per day, more than 50% of the total solid waste in the country. This number is increasing in the coming years.

Binh Hoa Ward, Thuan An City, Binh Duong Province is located in the east of Thuan An City. This is the place where many army barracks under the 4th Army Corps, factories, schools, commercial and service centers, and traffic centers are concentrated. Therefore, a densely populated population leads to an increase in the amount of domestic waste. The assessment of the current status of domestic solid waste management is considered important and necessary (Nguyen Van Hoang, 2020). On that basis, give reasonable solutions, and orientation for sustainable economic development for the following years in the ward.

The article is based on other related studies, practical information, and the application of the DPSIR model to evaluate the dynamic aspects, pressures, current status, impacts, and responses in solid waste management in the study area.

## **2. Method of studying**

### ***2.1. Actual observation method***

Through a field survey on the current status of domestic solid waste pollution in the study area, seeing the process of collecting and classifying waste of households in the ward to assess the level of pollution, checking and correcting the information gathered from secondary documents. The actual observation method was carried out from November 8 to 21, 2021.

### ***2.2. Questionnaire survey method***

Collect information by a related questionnaire to serve the research objective. There were 500 survey forms distributed. Respondents are representatives of households and leaders of the ward. The content of the questionnaire includes personal information, questions related to people's awareness of garbage disposal, questions related to environmental pollution caused by domestic waste, questions about the impact of waste pollution on

people's health, and questions about solutions to reduce environmental pollution caused by domestic waste in the study area.

### 2.3. DPSIR model analysis method

Applying the DPSIR model (AB Jago-on, S Kaneko, R Fujikura, A Fujiwara, 2009) to analyze the current situation of domestic solid waste management in Binh Hoa ward to find better management solutions to improve the environment, raise the community's awareness to protect the environment and human health.

DPSIR is a model that describes the interrelationships between:

Drivers (D) - Socio-economic development is the root cause of environmental changes

Pressures (P) - Discharge sources that directly pollute and degrade the environment

State (S) - Current status of environmental quality

Impact (I) - Impact of environmental pollution on public health, socio-economic development activities, and ecological environment

Response (R) - Environmental protection solutions

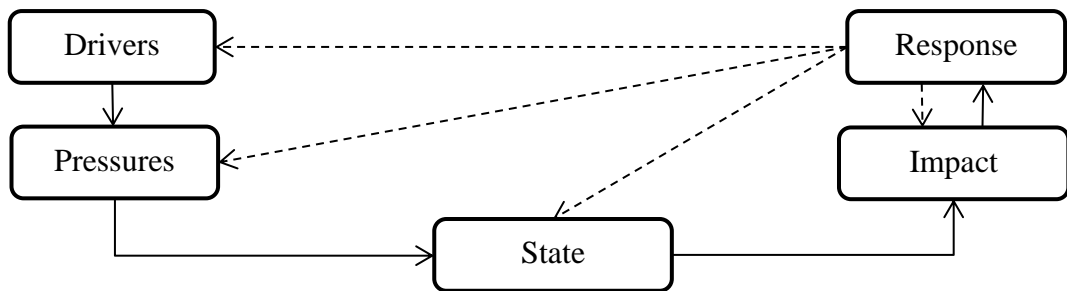


Figure 1. DPSIR Model

### 2.4. Data processing methods

Based on all data collected from documentary sources and interview survey data to process by Excel software and synthesize into charts for the assessment of the environmental status in the research area.

## 3. Results and discussion

### 3.1. Actual observation results on the status of solid waste disposal in Binh Hoa ward



Figure 2. Dong Ba



Figure 3. Dong An 1



Figure 4. Binh Duc 1

Figure 1: Solid waste image of a production facility in Dong Ba quarter, Binh Hoa ward, which has not been collected thoroughly, and the waste has been stored for many days. That causes environmental pollution and loss of urban beauty.

Figure 2: Image of domestic solid waste at a hostel in Dong An 1. Although there are 3 garbage containers with green, red, and yellow colors, there are no labels and people here do not classify them before putting them into the bin.

Figure 3: Image of domestic solid waste in Binh Duc 1, Binh Hoa ward. Many garbage containers are located here. However, many large-sized wastes are not put in the bin. This waste is dumped right next to the bins and it is also not taken away by the collectors.

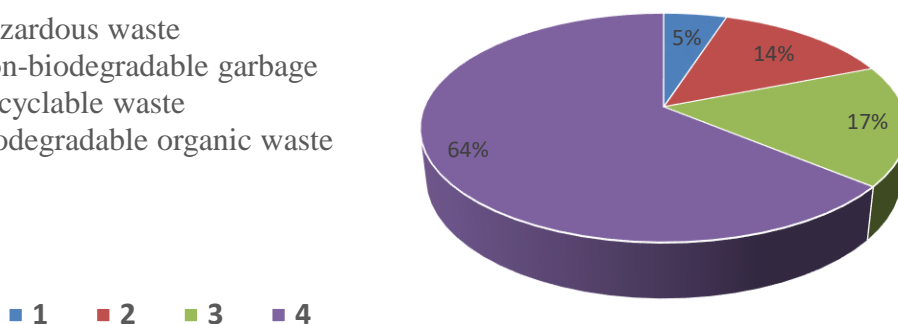
In summary, the current situation of solid waste management in Binh Hoa ward is still not good. Waste has not yet been separated at source. People's awareness of environmental protection is not good, leading to improper disposal of waste, causing environmental pollution as well as loss of urban beauty. The garbage collection is still incomplete. Cases causing environmental pollution have not been seriously handled by the authorities

### ***3.2. Results on the current state of solid waste management in Binh Hoa ward obtained from the survey form***

The survey consists of 18 questions. The content of the survey questions is designed to collect information on the amount of solid waste generated daily, and how to classify, collect and transport solid waste. People's awareness of environmental protection. Negative impacts due to solid waste pollution. Recommendations and suggestions of the people on the integrated management of solid waste in Binh Hoa ward.

#### *3.2.1. Survey results on types of household waste and the percentage of each*

1. Hazardous waste
2. Non-biodegradable garbage
3. Recyclable waste
4. Biodegradable organic waste



**Figure 4.** Survey results on types of household waste

Here is a chart showing the answers to the question:

"The composition of household waste includes which types of waste? Percentage by weight of each type?"

General comment: Based on the chart we see:

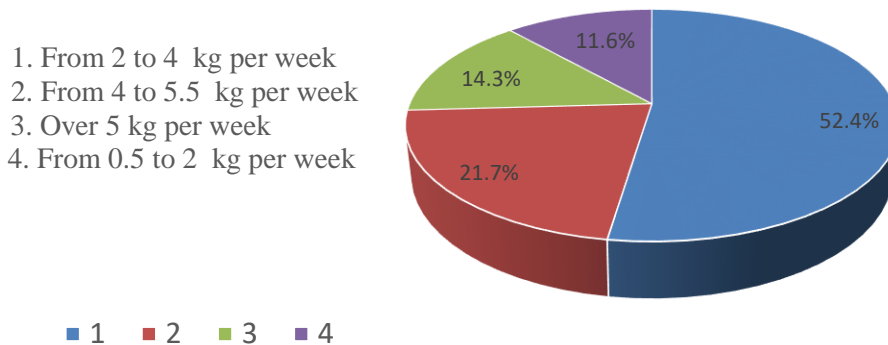
Compostable organic waste has the highest percentage by weight (64%). The composition of this type includes food waste, peels of vegetables and fruits, tea residues, and leaves...

Recyclable waste has the second highest percentage by weight (17%). The composition of this type includes: plastic bottles, beer cans, metal, cartons

Non-biodegradable waste has the third highest percentage by weight (14%). The composition of this type includes: plastic bags, foam boxes

Hazardous waste has the 4th highest percentage by weight (5%). The composition of this type includes batteries, accumulators, and discarded electronic components...

### 3.2.2 Survey results on the volume of waste in 1 week of each household



**Figure 5.** Survey results on the volume of waste in 1 week of each household

The chart showing the answers to the question:

"How much waste does the family dispose of in a week?"

General comment: Based on the chart we see:

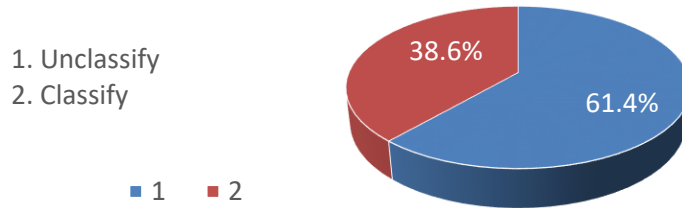
There are 58 households out of 500 surveyed households with the result that the amount of waste is more than 5.5kg per week, accounting for the lowest rate (11.6%).

The number of households with waste weighs from 2 to 4kg per week, accounting for the highest rate (52.4%).

21.7% of households with waste weigh from 4 to 5.5kg per week

14.3% of households with waste weigh more than 5kg per week

3.2.3. Survey results on the classification of household waste



**Figure 6.** Survey results on the classification of household waste

The chart showing the answers to the question:

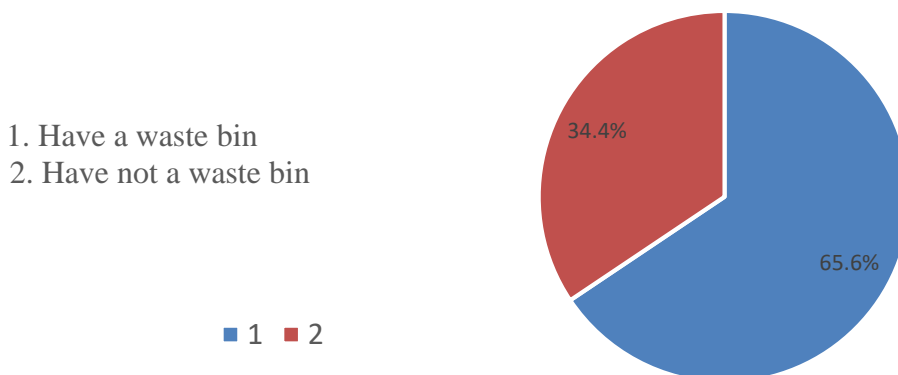
“Does your family sort garbage?”

General comment: Based on the chart we see:

There are 193 households out of 500 families participating in the survey to sort waste before disposal, accounting for 38.6%.

The number of households that have not sorted their waste is still relatively high, accounting for 61.4%.

3.2.4. Survey results on equipping garbage bin



**Figure 7.** Survey results on equipping garbage bin

The chart showing the answers to the question:

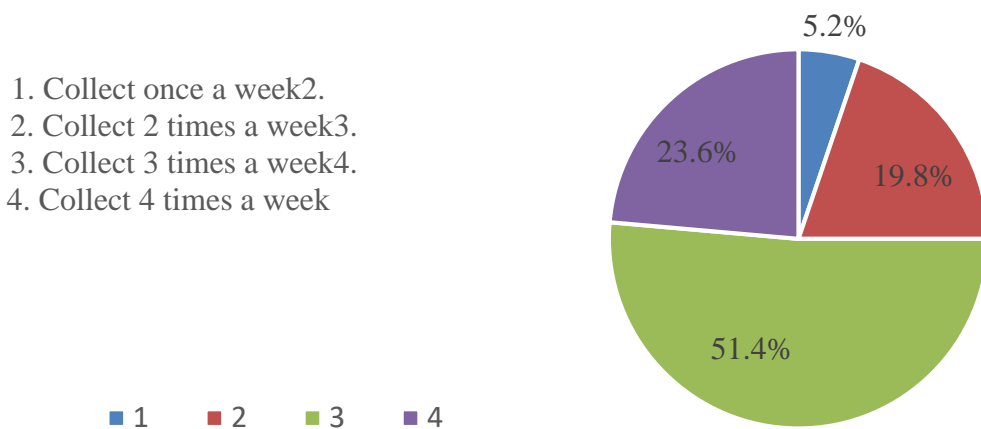
“Does your family have a waste bin to store garbage?”

General comment: Based on the chart we see:

There are 328 out of 500 households that equip their own waste bin, accounting for 65.6%.

172 households do not have waste bins, accounting for 34.4%

### 3.2.5. Survey results on the frequency of garbage collection in the study area



**Figure 8.** Survey results on the frequency of garbage collection

Here is a chart showing the answers to the question:

“How many times is garbage collected in a week?”

Based on the chart we see:

The frequency of collection once a week accounted for the lowest rate (5.2% of the total survey questionnaires).

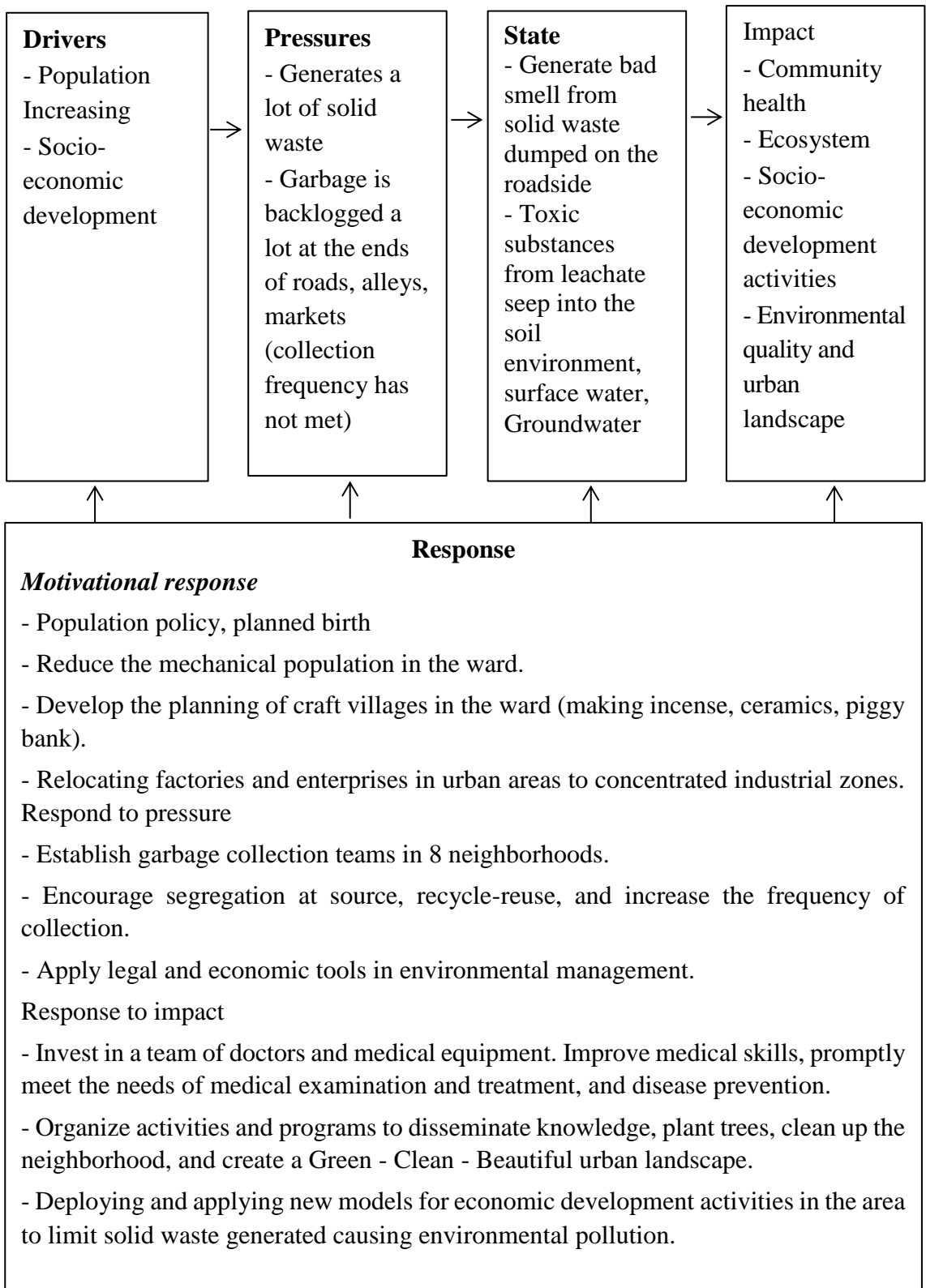
The frequency of collection 3 times a week accounted for the highest rate (51.4%)

The frequency of collection twice a week is still quite high (19.8%).

For locations where the frequency of collection is once a week and twice a week, it is necessary to increase the number of collection times to ensure that garbage is not stagnant, polluting the environment and affecting people's health.

### 3.2.6. Results of DPSIR modeling to assess the current status of solid waste management in Binh Hoa ward

From the survey results and collected information, a diagram to assess the current status of solid waste management in the ward as follows:



**Figure 9.** Diagram of assessing the current state of solid waste management in Binh Hoa ward, Thuan An city, Binh Duong province according to the DPSIR model



*3.2.7. Proposing responsive solutions to overcome the current situation of solid waste management in Binh Hoa ward.*

*3.2.7.1. Motivational Response*

Promote the effective implementation of craft village planning in the area in the period of 2025 - 2030.

Integrating the planning of new economic zones with the planning of environmental protection

*3.2.7.2. Pressure Response*

\* Sorting waste at source

Benefits: Saving materials from recyclable waste; reducing processing costs; Improving processing efficiency (Dang Thai Hoc 2012). There are some Proposes:

- At the beginning of each alley, 03 separate garbage containers are arranged: Containers for biodegradable organic waste, Containers for recyclable waste, Containers for hazardous waste, and Containers for other wastes.

- Allocate collection schedules such as Monday, Wednesday, and Saturday to collect food waste; Tuesday and Thursday to collect recyclable garbage, Sunday to collect hazardous waste and other waste.

\* Apply economic tools

- Increase the collection fee for unsorted garbage to encourage people to do the sorting.

- Implement a return deposit system (Huynh Thi Dan Xuan, Khong Tien Dung 2021) - As the consumer has to pay an additional amount when buying the product (the deposit for the product packaging). When the consumer returns the product's packaging, the seller or collection center will return the original amount deposited to the consumer.

- Product charge

Product charges are added to the price of products when used causing pollution either at the production phase or at the consumption phase.

\* Raise awareness of the community

- Education: Training self-discipline, awareness of environmental protection, creativity in recycling - reuse of waste should be integrated into the curriculum from preschool and primary school levels. Regularly organizing events extracurricular activities, and exchanges on the topic of environmental protection.

- Propagate: In addition to the methods of propaganda by banners, newspapers, posters, leaflets, etc., we can also use propaganda vehicles, neighborhood meetings, the school's weekly flag-raising sessions, and television. Radio stations, especially social networks, through youth volunteer teams, factory workers, women's unions, school representatives, etc.

\* Recycle and Reuse

Recycling and reusing should be focused on because they will reduce pressure on collection and transportation. For example:

- For plastic, glass, styrofoam containers, etc., we can use them to grow flowers, grow vegetables at home or sell them to scrap collectors.
- For food waste, we can use it to compost fertilizer or process it into food for livestock and poultry.
- Hazardous wastes should be disposed of in accordance with regulations, safely and hygienically.

\* Legal tool

Acts of unintentionally or intentionally discharging hazardous wastes into the environment will be punished according to the provisions of the law.

*3.2.7.3. Impactive Response*

Research, develop, and transfer solid waste treatment technology towards recycling - reuse.

Promote the development of pilot models on waste segregation at source, collection, transportation, and energy recovery from solid waste.

Propaganda, advocacy, commitment to say no to plastic packaging.

Increasing the application of sustainable development models to economic development associated with ecosystems and natural landscapes.

Mobilizing people to regularly clean up living areas, combined with planting more trees to both protect the environment and create urban landscapes.

#### **4. Conclusion**

- In general, to achieve good results in the management of domestic solid waste in Binh Hoa ward, it is necessary to have a specific plan and implementation roadmap for equipping trash cans and sorting, collecting, and transporting waste. move in every household and every neighborhood. To perform well in the integrated management of domestic solid waste, it is necessary to have consensus and consistency from the authorities, environmental managers, and the people.

- In fact, the ward has successfully implemented a number of solutions to reduce environmental pollution. However, there are still many difficulties such as low collection frequency in some small alleys; some people lack awareness of environmental protection; Many households do not have their own waste containers.

- A DPSIR diagram has been established to assess the current status of solid waste management in Binh Hoa ward, Thuan An city, Binh Duong province.

- Each element D, P, S, I, and R in the diagram has been analyzed.
- Responsive solutions have been proposed to overcome the current state of solid waste management in the study area (Motivational Response, Pressure Response, and Impactive Response).

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