Data Article

Recyclable waste collection by informal sector in Vietnam: Dataset from Vinh, Nha Trang, Buon Ma Thuot, Da Nang, Ho Chi Minh and Hanoi Cities

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\section*{A B S T R A C T}

Even though the matter was not widely acknowledged, informal recycling plays a vital role in waste treatment in many developing countries. In Vietnam, the management of waste collection and treatment faces many difficulties, as there is no statistical data or description of the informal sector in waste collection and recycling to clarify their role, their scale, and their capacity. This paper presents the preliminary data processed by informal waste collectors and aggregators in six Vietnamese cities, namely, Vinh, Nha Trang, Buon Ma Thuot, Da Nang, Ho Chi Minh, and Hanoi. The surveys were conducted from January 2017 to December 2019 by the JEAI Recycurb Viet project \cite{1} and then from August 2019 to December 2020 in the framework of the COMPOSE project (2019–2021) \cite{2}. Geographical and sociology data of aggregators will demonstrate the overall background of the presence, spatial allocation, and the establishment process of aggregators in the surveyed cities to find the patterns of establishment and operations of these aggregators. The data will be the basis for the development of policy making on Extended Producer Responsibility (EPR) in Vietnam.

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Specifications Table

| Subject Specific subject area | Planning and Development Informal economy |
|--------------------------------|------------------------------------------|
| Type of data                  | Table Figures Map                        |
| How data were acquired        | Field survey and observation             |
| Data format                   | Aggregated data, and concise numerical data |
| Parameters for data collection| The surveys were anonymous and included questions regarding the owners of the aggregators (hometown, the reasons for choosing the job), information about space, geographical conditions and context, working hours, category of collected materials and date of establishment of aggregators. In the scope of this article, the concept of aggregator is understood as the recyclable waste collection points in the city, operated in the form of an aggregator with sign-board; however, most of them have no business registration [3]. |
| Description of data collection| The data of aggregators in Hanoi were collected many times in the survey for three years from January 2017 to December 2019 and updated in November 2020 [4]. Also, the data of five cities, Vinh, Da Nang, Nha Trang, Buon Ma Thuot, and Ho Chi Minh City, were performed twice per site during 5–10 days of investigation from August 2019 to December 2020 [5–9]. Two types of data were collected: observational and survey data. The geographical data were first generated using Google My Maps and then input to QGIS 3.12. To develop the reference database, the aggregators’ locations were achieved with a GPS, and the distribution of aggregators was mapped per city. For the survey information, respondents answered questions concerning the aggregator's activities (establishment year, operating hours, number of employees in the aggregator; classifications of recyclable waste purchased; aggregator owner's information (name, age, reason of business's line). |
| Data source location          | Cities: Vinh, Nha Trang, Buon Ma Thuot, Da Nang, Ho Chi Minh, Hanoi |
| Country                      | Vietnam                                  |
| Data accessibility           | [https://doi.org/10.23708/WQUVXF](https://doi.org/10.23708/WQUVXF) |
|                             | [https://doi.org/10.23708/CGLFIL](https://doi.org/10.23708/CGLFIL) |
|                             | [https://doi.org/10.23708/VRAASG](https://doi.org/10.23708/VRAASG) |
|                             | [https://doi.org/10.23708/8LFPT4](https://doi.org/10.23708/8LFPT4) |
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|                             | [https://doi.org/10.23708/QVLEIIZ](https://doi.org/10.23708/QVLEIIZ) |
| Other data is included in this article | |

Value of the Data

- The data allows an approach to the informal sector in recyclable waste collection in Vietnam and the conditions of those involved in this informal activity. Information is available to develop Extended Producer Responsibility (EPR) policy led by the Ministry of Natural Resources and Environment of Vietnam (MONRE). They can also be used by authorities to define the concept of integrating the informal sector into formal waste collection.
- The data allows evaluation the role and impact of the informal sector in recyclable waste collection in cities and will benefit national, provincial and local authorities, manufacturing enterprises, recycling businesses, official collectors, non-governmental organizations and researchers.
- Data collected in this study can be compared with similar studies conducted about the spatial distribution and the role of the informal sector in recyclable waste collection in...
developing countries. Questions about network, activities, and spaces are like different international studies. They can be updated continuously by carrying out social surveys in other cities using the same methodology.

1. Data Description

In Vietnam, recyclable waste collection is carried out mainly by the informal sector, which consists of thousands of collectors and aggregators [10]. The data presented herein shows the spatial location and aggregator characteristics in recycle waste collection in six cities of Vietnam, including three central cities and three cities-Category 1, covering the North and South (Hanoi, Vinh, Da Nang, Nha Trang, Buon Ma Thuot, Ho Chi Minh city). In each city, the locations of the aggregators are categorised into urban and rural areas (Fig. 1).

1.1. The development of aggregators per city over the periods of time

The establishment of aggregators was divided into four periods (Table 1), before 1990, from 1990 to 2005, from 2006 to 2015 and from 2016 to the present, and corresponds to important national phases in Vietnamese urban planning. The before 1990 period marked a change from the booming private economic activity after Doi Moi 1986. The period from 1990 to 2005 marked 15 years after the boom. We note that in 2003, the Land Law was passed and was applied two
years later. The period of 2006 to 2015 marked the implementation of the Land Law. In 2013, the Land Law was revised and started to come into effect two years later. The period from 2016 to the present marked an important change in waste collection and recycling activities in Vietnam, according to the Land Law revision. Also, until 2017, China took about 50% of all plastic waste trade [11], but from January 2018, China banned the import of plastic waste, and from June 2018, Vietnam stopped granting plastic recycling import licences.

The Figs. 2a and 2b present the geographical locations of aggregators in each of the six cities. Specific figures were demonstrating their period of establishment.

### 1.2. Allocations of aggregators according to the owner’s age when established

Table 2 is consolidated from data collected from 1514 aggregators out of 2135 aggregators identified in six cities, accounting for 70.9% of aggregators.

Figs. 3a and 3b present the geographical locations of aggregators according to age of owner. Owners’ ages are divided into three types: less than 30 years, from 31 to 50 years old, and older than 51 years.

### 1.3. Relationship between number aggregators and city’s area, inhabitants and amount of domestic waste generated

The amount of domestic waste generated in each city was collected from local official reports and converted to tonnes per day for comparison among cities. The number of aggregators is shown in relation to the area, population and the amount of domestic waste generated in each locality (Fig. 4).

The data illustrates that, in general, the number of aggregators is proportional to the scale of areas per city, as well as to volumes of daily waste release and the population. Vinh is the city with the smallest population and the least number of aggregators. While Nha Trang and Buon Ma Thuot are similar in total area and population, the number of aggregators is similar in the two cities. The chart indicates that cities—Category 1 (Vinh, Nha Trang, Buon Ma Thuot)—have
Fig. 2a. Spatial distribution of aggregators in three cities Category 1. Aggregators are presented both in rural and urban areas and regarding to their period of establishments before 1990; from 1990 to 2005; from 2006 to 2015; from 2016 to present.
Fig. 2b. Spatial distribution of aggregators in three central cities. Aggregators are presented both in rural and urban areas and regarding their period of establishments before 1990; from 1990 to 2005; from 2006 to 2015; from 2016 to present.
Fig. 3a. Geographical locations of aggregators according to the owner’s age category per their establishment (under 30 years old, from 31 to 50 years old, and over 50 years old) in the three cities Category 1.
Fig. 3b. Geographical locations of aggregators according to the owner’s age category at their establishment (under 30 years old, from 31 to 50 years old, and over 50 years old) in the three central cities.
Table 2
Numbers of aggregators surveyed within age ranges in a city.

| City          | Type of information | Aggregators surveyed | Less than 30 years old | From 30 to 50 years old | Older than 50 years |
|---------------|---------------------|-----------------------|-------------------------|--------------------------|---------------------|
| Vinh          | Number              | 35                    | 1                       | 28                       | 6                   |
| Nha Trang     | %                   | 100%                  | 2.86%                   | 80.00%                   | 17.14%              |
| Buon Ma Tho   | %                   | 100%                  | 1.52%                   | 72.73%                   | 25.76%              |
| Buon Ma Tho   | %                   | 100%                  | 11.11%                  | 58.73%                   | 30.16%              |
| Da Nang       | %                   | 100%                  | 3.47%                   | 54.05%                   | 42.47%              |
| Ho Chi Minh   | %                   | 100%                  | 5.76%                   | 69.30%                   | 24.94%              |
| Hanoi         | %                   | 100%                  | 5.49%                   | 68.99%                   | 25.52%              |
| **All**       | Number              | **1514**              | **79**                  | **1007**                 | **428**             |

Fig. 4. Correlation between the number of aggregators identified in each city with the a) city’s area, b) the inhabitants, and c) the amount of domestic waste generated per day.

similarities in total area, population, and number of aggregators. Meanwhile, in central cities (Ha Noi, Da Nang, Ho Chi Minh), the total area, population, and arising waste are dominant; the number of aggregators was much higher than in cities—Category 1.

Besides, as the city where waste collecting and recycling by informal sector existed for more than 100 years, Hanoi still has a bigger number of aggregators even though the population and daily arising waste in Hanoi is less than Ho Chi Minh city.

1.4. Classification of recyclable waste collected in the six cities

Currently, three main groups of recyclable waste are purchased by the aggregators in Vietnam, plastic: plastic bottles (Polyethylene terephthalate (PET), Polypropylene (PP)), colored plastic bottles (High-density polyethylene (HDPE)), household plastics (furniture, baskets, plastic household items), hard plastic (pipes, ceilings, floors, ...), plastic bags, plastic sack bags, polystyrene; paper: books, documents, cardboard, paper boxes; and metal: scrap, copper wire,
aluminium, can shell, iron milk boxes; Also, other recyclable waste is purchased by aggregators such as feather, hair, and textile waste (Table 3).

2. Experimental Design, Materials and Methods

The collection of data on recyclable waste aggregators started in January 2017 in Hanoi, the capital of Vietnam. The survey was carried out on all 12 urban districts, 17 rural districts, and 1 town of Hanoi, which covers an area of 3359 m²-ethes. Then, in 2020, the data collection continues to be expanded in five cities: Vinh, Da Nang, Nha Trang, Buon Ma Thuot, and Ho Chi Minh City, and the data of Hanoi was totally updated. From January 2017 to December 2020, about 350 students and lecturers from Hanoi Architectural University and other universities participated in survey implementation [12]. For each city, the survey team based on the administrative boundaries of communes and wards are the smallest administrative units in the city to divide the surveyed areas for investigators to oversee. These surveyed conductors are organized into groups of two to three people per group; each group is in charge of surveying from 1 to 3 wards/commune in 1 day. The investigators go along the road axis to search and locate the aggregators. At each aggregator found, the investigators asked the owners to direct them to nearby aggregators in the ward/commune. So, data was collected in many times, ward by ward, commune by commune and district by district until covering all over the city.

2.1. Data collection

The questionnaire was developed to collect two types of data: observational and survey data (Figs. 5 and 6 present the details).

2.1.1. Observation, location, and mapping of aggregators using Google map

Observation data is collected based on a standardized observational format to gather information about: 1. Aggregator's around context (located inside the collective area, located in a tube house, located on vacant, standardized observational format, located next to a new urban
Survey date:.........................

IDENTIFICATION OF SITE

AGGREGATOR CODE

City.................District...............................Ward/Commune:............................

Address: ...........................................................................................................................

Tel: .............................................................Tax Code:......................................................

| AGGREGATOR'S AROUND CONTEXT |
|--------------------------------|
| **Site Location** (Tick many applicable choices) |  |
| inside a KTT | inside a tube house area | on an empty land | on large shed, big road, with or without houses around | next to KDTM | inside a village |

| Transportation in front of site |  |
|--------------------------------|
| Pavement roads | Highways | Car accessible distance |  |
| Yes | No | Yes | No | Car accessible | .................m |
| Road width before site |  |
| 3m | 3-5m | 5-7m | >7m |  |
| Pavement area or empty land before site |  |
| ..............................................m² |  |

| SOURCES OF RECYCLABLES MATERIAL WITHIN RADIUS 500M |
|------------------------------------------------------|
| Materials within 500m of the site |  |
| Restaurants within 500m of site | Super market within 500m of site | School within 500m of site | Groceries within 500m of site | Offices within 500m of site | Hotels, Motels within 500m of site | Other Recycling sources within 500m of site (markets, coffee shops, construction sites, etc...) |

Fig. 5. Standardized observational format for aggregators of recyclable waste.

area or inside a village); 2. Type of road in front of the aggregators (Pavement roads, Highways), accessibility of automobiles, the width of the road in front of it; 3. Types of recyclable materials sources within radius 500 m (restaurants, supermarkets, schools, offices, hotels, motels, markets, cafes, construction site, etc...); 4. Aggregator's structure and occupied space (aggregator covered by tarpaulin, by fibro cement or steel sheet roof; 5. Accessory spaces(storage, loft); 6. The area and the number of floors of the aggregators. The above information is observed by investigators, marked on the sample questionnaire.

Also, at each collection point, the survey team used the Google map positioning tool to mark the exact location of the facility and to record the location of the collection point. The aggregator was anonymously saved using an anonymous advance defined code. Points across all wards and communes of the city.

2.1.2. Social survey by face-to-face interview with aggregators' owners, employees or neighbors (Fig. 7);

Respondents answered questions concerning: 1. The aggregator's activities (establishment year, operating hours, number of employees in the aggregator; 2. Classifications of recyclable waste purchased; 3. The aggregator owner's information (name, age, reason of business's line).
Also, investigators assessed the level of openness of the facility owner according to levels from difficult to very open. Investigators also clearly marked the source of information obtained from the owner of aggregators, from the collectors or from other sources.
2.2. Data aggregation

Data collected from aggregators were aggregated in the form of an Excel datasheet per city and in a compilation of all cities. Data were divided into four groups: about aggregators, about owners, about aggregator’s activities and about different kinds of recyclable materials purchased. Each aggregator was defined with code according to their administrative position and their survey period.

2.3. Data processing

Quantitative and qualitative analyses were done on an aggregated Excel database. From the coordinates and the marked location, the research team created a map to locate positioning collection. The qualitative data analysis was also done through the system mapping tool of aggregators by using QGIS software 3.12 (Fig. 8), an open-source geographic information management software.

The first geographical location data was created for all the aggregators using Google My Maps during data collection. The geo-coordinates were then imported to QGIS to generate a map of aggregators for each city. OpenStreetMap base map was used as the map’s background for each city. This one is shown separately for urban and rural areas. The determination of urban and rural boundaries was decided based on the resolution of the National Assembly Standing Committee No. 1211/2016 / UBTVQH13 on standards of administrative units and classification of administrative units of Vietnam [13].

The aggregators’ system mapping allowed analysis of spatial distributions and correlations with other properties.

Ethics Statement

• Originality and plagiarism: We ensure that we have written entirely project content. The publications and/or words of others have been appropriately cited or quoted.
Fig. 8. Illustration of QGIS software interface.

- Multiple, redundant, or concurrent publication: We declare that this data article is original, has not been published before, and is not currently being considered for publication elsewhere.
- Acknowledgement of sources: Proper acknowledgement of the publications of others was given.
- Fundamental errors in publication: When we discover a significant error or inaccuracy in our own publication, we will be responsible to promptly notify the journal editor or publisher and cooperate with the editor to retract or correct the paper.

Informed consent: We confirm that the participants were asked for individual consent before the interview, and that the informed consent has been obtained from all the participants.

The survey follows local and international rules for empirical research and is approved by the French National Research Institute for Sustainable Development (IRD). Likewise, respondents provide verbal consent before survey commencement. Information of this study (JEAI Recy-curns Viet and COMPOSE project), available at: https://en.ird.fr/node/8294 and https://en.ird.fr/vietnam/projects.

CRediT Author Statement

Authorship of the paper: Our research team confirms that the data article has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. The contribution of each author is as follows:

(1) **Nguyen Thai Huyen**: Conceptualization; Methodology; Writing- Original draft preparation; Data collections and checking; Data Processing/Analysing; Leader of survey team; Interviewer
(2) **Hoa Nguyen**: Data collection and checking; Data Processing/Analysing; Writing- Reviewing and Editing
(3) **Nguyen Tien Tam**: Data collection and aggregation; Mapping, Figuring
(4) **Le Thi Thao Trang**: Data collection and aggregation, interviewer
(5) **Nguyen Thi Hai Yen**: Data collection and aggregation, interviewer
Declaration of Competing Interest

The authors declare that they have no known conflict of interests or personal relationships that have, or could be perceived to have, influenced the project reported in this article.

Data Availability

Informal waste collection system (Original data) (Dataverse).

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Data on Hanoi City's recyclable waste collection network was collected/estimated under the framework of the JEAI Recyrcurbs Viet project funded by IRD for the period 2017–2019 and updated in 2020 using the author's financial resources and be added synchronized data within the framework of the COMPOSE project. Data on aggregator networks in six cities of Vinh, Da Nang, Nha Trang, Buon Ma Thuot, and Ho Chi Minh were collected under the framework of the FPSI COMPOSE project implemented in 2020.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2021.106979.

References

[1] IRD, La culture scientifique au Vietnam, (2020). https://www.ird.fr/vietnam/culture-scientifique (Accessed February 5, 2021).
[2] Qu’est-ce que le projet COMPOSE ?, La France au Vietnam. https://vn.ambafrance.org/Qu-est-ce-que-le-projet-COMPOSE (Accessed February 4, 2021).
[3] T.H. Nguyen, in: Changing Cities: Challenges, Predictions, Perspectives, NBU Press, Sofia, 2020, pp. 311–321. https://publishing-house.nbu.bg/bg/elektromni-izdaniq/knigi/villes-en-transformation-defis-pre-visions-perspectives-changings-cities-challenges-predictions-perspectives.
[4] T.H. Nguyen, T.T.T. Le, T.H.Y. Nguyen, N.A. Dinh, V.A. Le, T.M. Le, C.H. Phan, T.T. Nguyen, D.C. Trinh, B.X.Q. La, K.H.S. Do, V.M.C. Pham, M.N. Le, T.H. Nguyen. Informal waste collectors and aggregators space and activities in Hanoi city, Vietnam, COMPOSE project (2019-2021), (2021). doi:10.23708/QVLEUZ.
[5] T.H. Nguyen, T.H. Nguyen, T.H.Y. Nguyen, M.T. Le, T.M. Le, V.C. Hoang, N.T. Pham, C.H. Phan, T.T. Nguyen. Informal waste collectors and aggregators space and activities in Vinh city, Vietnam, COMPOSE project (2019-2021), (2020). doi:10.23708/WQUVXF.
[6] T.H. Nguyen, T.H.Y. Nguyen, T.T.T. Le, T.H.Y. Nguyen, T.K. Kieu, M.H. Nguyen, T.D. Tran, M.T. Hoang, T.H. Le, V.A. Le, N.A. Dinh, T.T. Nguyen. Informal waste collectors and aggregators space and activities in Da Nang city, Vietnam, COMPOSE project (2019-2021), (2020). doi:10.23708/CGLFL.
[7] T.H. Nguyen, T.T.T. Le, T.H.Y. Nguyen, T.H.Y. Nguyen, N.A. Dinh, V.A. Le, T.M. Le, C.H. Phan, T.T. Nguyen, T.M. Nguyen, D.C. Trinh, T.N.T. Nguyen, T.K.A. Ninh, T.T. Tran. Informal waste collectors and aggregators space and activities in Nha Trang city, Vietnam, COMPOSE project (2019–2021), (2021). doi:10.23708/JUKOFL.
[8] T.H. Nguyen, M.V. Ngo, T.T.T. Le, T.H.Y. Nguyen, N.A. Dinh, V.A. Le, T.M. Le, C.H. Phan, T.T. Nguyen, T.M. Nguyen, D.C. Trinh, H.P. Nguyen. Informal waste collectors and aggregators space and activities in Buon Ma Thuot city, Vietnam, COMPOSE Project (2019–2021), (2020). doi:10.23708/8LPPT4.
[9] T.H. Nguyen, T.T.T. Le, T.H.Y. Nguyen, T.H.Y. Nguyen, N.A. Dinh, V.A. Le, T.M. Le, C.H. Phan, T.Q.A. Nguyen, K.H.S. Do, D.L. Nguyen, T.T. Nguyen. Informal waste collectors and aggregators space and activities in Ho Chi Minh City, Vietnam, COMPOSE project (2019–2021), (2020). doi:10.23708/YRAASC.
[10] R. De Bercegol, J. Cavé, T.H. Nguyen. Waste municipal service and informal recycling sector in fast-growing asian cities: co-existence, opposition or integration? Resources 6 (2017) 70. doi:10.3390/resources6040070.
[11] A.L. Brooks, S. Wang, J.R. Jambeck, The Chinese import ban and its impact on global plastic waste trade, Sci. Adv. 4 (2018) eaat0131, doi:10.1126/sciadv.aat0131.
[12] IRD, Recyclage Au Vietnam, Dong Nat & Villages De Métiers, 2019. https://www.youtube.com/watch?v=bFeWYJG6nX8 (Accessed February 25, 2021).
[13] Standing Committee of the National Assembly, Resolution On Urban Classification of Vietnam, 2016. http://vbpl.vn/TW/Pages/vbq-toanvan.aspx?ItemID=111516 (Accessed February 3, 2021).