

## Article

# Autonomous Motivation for the Successful Implementation of Waste Management Policy: An Examination Using an Adapted Institutional Analysis and Development Framework in Thua Thien Hue, Vietnam

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**Abstract:** Increasing waste production is a serious problem for every country with substantial waste management initiatives. This challenge can be addressed by establishing waste reduction as a strategic policy. To this end, a project prioritizing community-based composting was implemented in Vietnam's Thua Thien Hue province. The project mandated that the actors involved (i.e., local authorities, assistance groups, and residents) separate out organic waste for composting. To understand more fully how this policy could be implemented more successfully, first, the present study examined the links between local authorities' support, groups providing assistance to residents during initiatives, and the project's outcomes. Second, the research focused on the autonomous motivations influencing this project. These two points made our study novel. A case study design was applied based on self-determination theory and an adapted institutional analysis and development framework. Content analyses of qualitative and secondary data were conducted to examine the framework's relevant components. Focusing on the psychological states approach, results showed that autonomous motivation was the main driver of waste separation and was activated by the local authorities' autonomy support, deployed via an assistance group consisting of a waste collector and village leader, as well as other community attributes. These factors therefore affected the project's outcomes. The research demonstrates the need to advocate local authorities' autonomy support and residents' autonomous motivation for waste separation.

**Keywords:** waste separation; autonomy support; local authorities; organic waste

## 1. Introduction

The increased total volume of waste generated in developing countries has become a serious concern [1]. Waste mismanagement is also a problem, causing environmental contamination and social issues in these countries [2,3]. In Southeast Asian nations, municipal solid waste is treated primarily through landfilling and open dumping, incineration, composting, and recycling/recovery [4]. Among these approaches, the most dominantly adopted is landfilling [5], which has caused severe pollution in the aforementioned regions [6]. This situation gives rise to the question of how waste discharge into landfills can be reduced for an improved environment. Source separation is one possible answer that is considered an effective means of reducing waste disposal and environmental damage [7–10].

In Vietnam, addressing waste generation is a focal agenda item in the country's National Strategy for the Integrated Management of Solid Waste Until 2025 and Vision Toward 2050. This strategy stipulates that waste reduction necessitates separation at the source, currently the most critical policy task that provinces/cities correspondingly implement with guidance from their respective regulations [11,12]. One of the provinces pursuing this nationwide goal is Thua Thien Hue. Thus, waste management endeavors in this province have been implemented in accordance with its policy on reducing waste disposal to landfills via waste separation for recycling and composting. This policy, called Thua Thien Hue Province Solid Waste Management Master Plan till 2030 and Vision toward 2050 (WMMP for short), lays down directives for waste minimization and stabilization through treatment and the appropriate management of non-collected waste by the community (Article 4, Chapter 2 in [13]). This policy also foregrounded the 2016 initiation of a community-based composting project (CCP), whose direct objectives are to promote the separation of organic waste for composting to minimize the discharge of solid waste from rural areas into landfills [14] and develop know-how regarding this composting measure in all other rural areas. The Quang Tho commune and Huong Xuan ward in the Thua Thien Hue province were selected for CCP involvement from November 2016 to December 2017.

Our study concentrated on whether government policy implementation (i.e., projects and/or programs) in waste management has been effective. This research gathered data on the CCP, as exemplified by the locality in which the project succeeded (i.e., Huong Xuan) and another in which it failed (i.e., Quang Tho).

In academic studies, scholars have dedicated attention to how waste separation behaviors can be improved. The factors that influence these behaviors have accordingly been determined in numerous studies on the basis of different directions, such as management factors like collection frequency that positively influences recycling rates and behaviors [15], as well as the necessity for drop-off centers to increase separation rates, as confirmed by Saphores et al. [16]. Socioeconomic factors, such as gender [17], education [18], and income [19], likewise bear on waste separation behavior. Socio-psychological factors impact this behavior, especially attitude [20–26], satisfaction with local facilities [27], beliefs and social norms [28,29], and trust between people and authorities [22].

In the practical projects, in high-income countries the principle factors were learned from success stories such as voluntary participation systems, communication by local newspapers, and door-to-door campaigns deployed in apartment buildings. These factors defined the success of the implementation of food waste separation in Daejeon Metropolitan City in Korea, Umea in Sweden, and the Oxford City Council in the UK, where achievements are attributed principally to the focus directed toward community participation [30]. According to a study of waste management schemes in the 28 European Union capitals conducted by BiPRO and the Copenhagen Resource Institute, waste separation are successful practices in Ljubljana, Slovenia; Helsinki, Finland; Tallinn, Estonia; Dublin, Ireland; and Vienna, Austria. The ingredients contributing to their success are the introduction of appropriate infrastructure and equipment for residents' use, efforts to raise environmental awareness, and a stronger focus on service and communication [31].

Both the literature and real-world initiatives have two limitations: a lack of focus on the interactions among local authorities, groups providing assistance, and residents, as well as insufficient discussions about the psychological states (i.e., feelings) of participants when they join waste separation projects. These "soft" factors may advance success in low-income countries, such as Vietnam. In high-income nations, "hard" measures, such as appropriate infrastructure and equipment, are often useful in waste separation practices [32], but many low-income countries cannot afford to invest in these resources. Studies on "soft" factors are therefore highly significant. Relevant psychological factors include "autonomous motivation [which] is defined as engaging in a behavior because it is perceived to be consistent with intrinsic goals or outcomes and emanates from the self" [33]. Green-Demers et al. [34] argue that autonomous motivation is correlated with a variety of pro-environmental behaviors (e.g., recycling and purchasing environmentally friendly products). Cecere et al. [35] observed that waste prevention behaviors mainly depend on intrinsic motivation, which is

classified as autonomous motivation [36]. However, none of the above-cited authors highlight or seek to explain project participants' motivations in terms of their felt experiences and ways their autonomous motivation can be generated. Our study fills this gap in the waste management field.

To take into consideration the context in which the waste management project in question was implemented, the present study included actors' roles, actions associated with waste management, and their outcomes. An institutional approach was applied based on Ostrom's institutional analysis and development (IAD) framework [37], which constituted a unique tool used systematically in this case study. Various investigations of waste management policy have previously applied the IAD framework [38–41]. In IAD analysis, interactions among actors are emphasized, especially how the results of individuals' actions influence outcomes [38,40]. In addition, the IAD framework provides ways to analyze, measure, and understand an action's impact as "exogenous variables [that] affect the structure of an action arena, generating interactions that produce outcomes" [42].

Given the above approach, the current study's objectives were to (1) examine the links between local authorities' supporters, groups providing assistance to residents during initiatives, and the CCP's outcomes; and (2) investigate how residents' autonomous motivation influenced the project's results. The research's novelty lies in, first, its specification of support (i.e., interactions between actors) as a key aspect of initiatives based on the IAD framework's application to the waste management field; and secondly, this study integrated actors' psychological states (i.e., autonomous motivation) during waste separation into this framework to analyze a specific waste project's implementation (i.e., the CCP).

The results include lessons learned from the CCP, which were identified by applying an adapted IAD framework. The lessons can be used to improve future implementations of waste management policies in Vietnam and other countries. The results could also assist the authorities in strengthening the factors that lead to success in future waste-related projects and eliminate failure factors. This study's findings also shed further light on a specific facet of the waste management field, in which much research based on the IAD framework is being conducted.

## 2. Materials and Methods

### 2.1. Situation of Study

#### 2.1.1. Study Area

Thua Thien Hue has a population of 1,154,310 and occupies an area of 5025.3 km<sup>2</sup> [43]. Its domestic solid waste generation is predicted to increase from 422 tons/day in 2015 to 677 tons/day in 2030 and it is estimated that the waste generation will grow to 1093 tons/day in 2050. Domestic solid waste includes easily biodegradable organic waste, recyclable and reusable wastes, and other wastes. Its composition includes kitchen waste, grass, wood, plastics, paper, textile, metal, glass, rubber, leather, ceramic, and miscellaneous [44]. Waste in the province is processed by eight major waste management facilities, which include landfills, incinerators, and composting plants [45], among which five are landfills that have fewer than 10 years before they will reach their maximum capacity. According to the Vietnam Ministry of Natural Resources and Environment's online newspaper, pollution has become more serious due to increasing waste generation and a lack of waste management facilities in Thua Thien Hue [46]. The issue of capacity is poised to be a serious challenge for the province should the reduction of waste disposal in landfills prove insufficient given that existing facilities are already incapable of handling the amount of waste forecast to be produced in the future [47]. A pathway to resolution may rest in the fact that 84% of the waste generated in Thua Thien Hue is constituted by easily biodegradable organic waste. A tremendous amount of waste is disposed in landfills, accounting for 93% of the total—a percentage higher than the average of Vietnam's central region and the entire country [45].

### 2.1.2. Description of the CCP

Huong Xuan and Quang Tho were selected as recipients of the CCP prioritization project, with a view to developing these localities' know-how regarding community-based composting, promoting the prevalence of the practice in entire rural areas, and ultimately reducing waste disposal to landfills, in accordance with the WMMP. The CCP's selection was based on four main criteria, namely, general advantages, the willingness of local authorities, the ability to implement the composting model, and demand for compost use [14]. As indicated in the CCP, the local authorities are the managers, the assistance groups are the supporters, and the households are the doers. The expert team is composed of technical consultants on knowledge provision regarding waste separation and composting. A brief description of the project activities and actors is provided in Table 1.

**Table 1.** Activities implemented by the community-based composting project (CCP) actors.

Activities	Actors
(1) Building one compost bin in each community	Expert team
(2) Distributing two baskets to each household	
(3) Organizing meetings for instruction on organic waste separation	Local authorities and expert team
(4) Disseminating information on the CCP	Local authorities with assistance groups
(5) Collecting organic waste and bringing it to the compost bin	Waste collectors
(6) Checking the composting process	Waste collectors and village leaders
(7) Harvesting compost products and distributing it across the community	Village leaders
(8) Monitoring and evaluating project activities	Expert team

These activities were comprehensively analyzed during the action situation stage involving the actors. We focused on waste separation implementation and thus directed our efforts toward Activities 3 to 7 (see Table 1) and eliminated Activities 1, 2, and 8, which were instead conducted by the expert team. Figure 1 Figure 2 Figure 3 Figure 4 show examples of the CCP's activities in the local sites.



**Figure 1.** Village leader and waste collector with residents—Activity 4.



**Figure 2.** Village leader and waste collector collecting organic waste in Huong Xuan—Activity 5.



**Figure 3.** Village leader and waste collector working in a compost bin in Huong Xuan—Activity 6.



**Figure 4.** Compost bin in Huong Xuan [48].

Eighty households in Huong Xuan and 100 households in Quang Tho were selected to join the CCP, which began in December 2016. A further 170 Quang Tho households were added to this project in July 2017. One compost bin was built in each community. Table 2 shows the context of the CCP in Huong Xuan and Quang Tho.

**Table 2.** Context of the CCP in Huong Xuan and Quang Tho.

Physical and Human Resources	Huong Xuan	Quang Tho	References
Biodegradable organic waste (84% of domestic waste)	0.88 kg per household per day		0.22 kg per capita per day [44] and the average number of members in one household is 4.0 (in section 3.2.1. Attributes of the Community).
Number of households	80 households	100 households (December 2016–June 2017) 270 households (July–December 2017)	
Compost bins	1	1	[48]
Buckets for each household	2	2	
Human resources	Local authorities with assistance groups (social organizations, village leaders, waste collectors) and residents		

Two periods were implemented in the CCP because of changes in the scheme underlying the waste collection system in Huong Xuan and the expansion of the number of participating households in Quang Tho. In Huong Xuan, an employee of the waste collection company collected the organic waste for the compost bin as well as the other waste for the waste transfer station during the first period that ran from December 2016 to June 2017 (see Figure 5). Then, the local authority appointed Mr. D (a Huong Xuan resident), with his consent, as an organic waste collector for July to December 2017 (see Figure 6). This time period was the second period of the CCP.

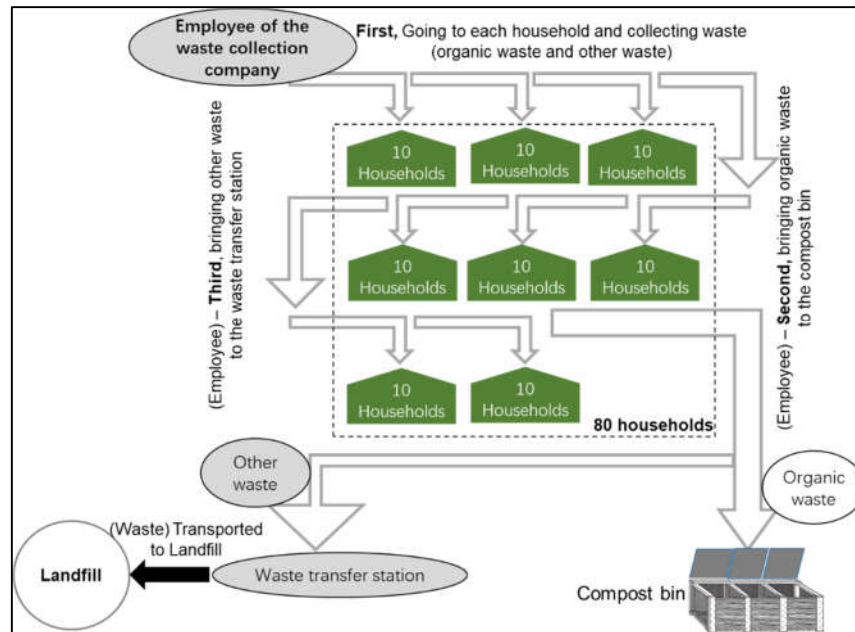


Figure 5. Waste collection system in Huong Xuan in the 1st period.

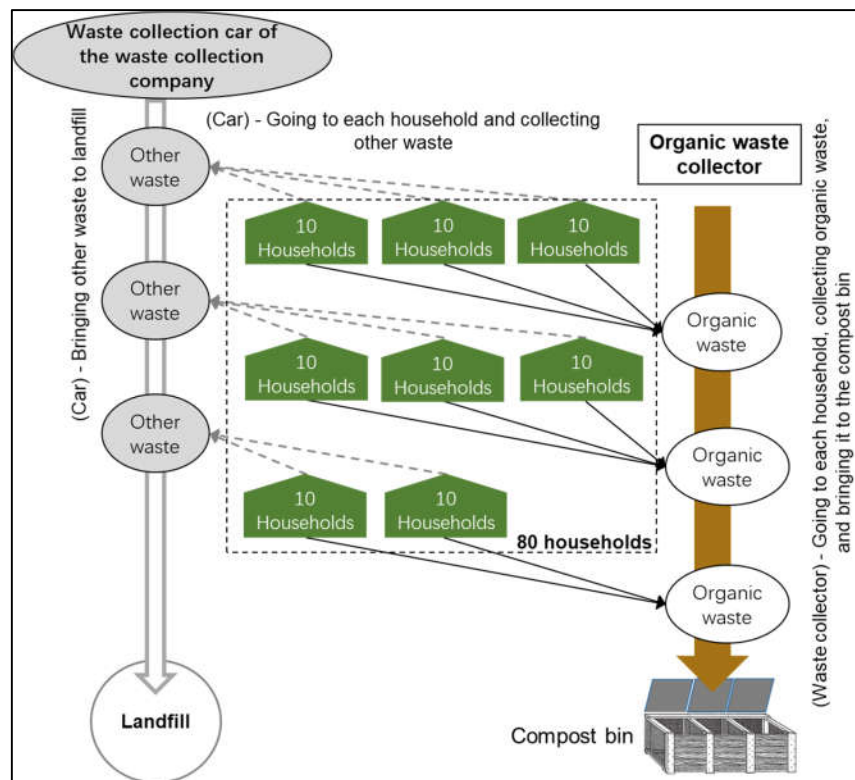
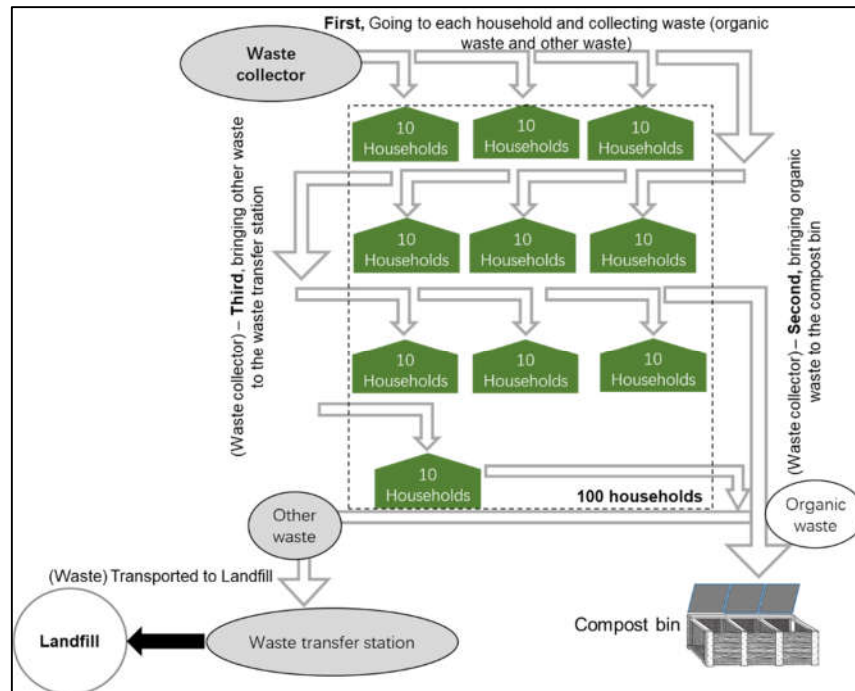


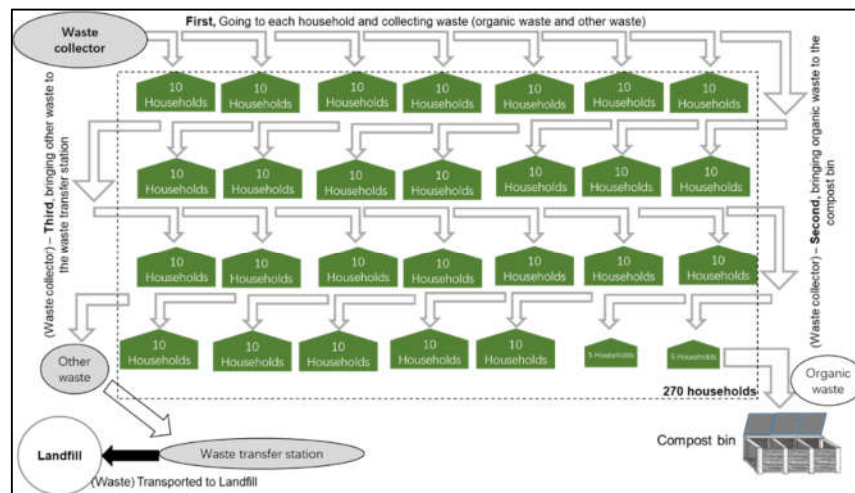
Figure 6. Waste collection system in Huong Xuan in the 2nd period.

In Quang Tho, the waste collector hired by the local authority agreed to collect organic waste separately and bring it to the compost bin (see Figure 7). But because she collected only a small amount of waste, the local authority decided to expand the number of households involved in the CCP from 100 to 270 in July 2017, starting the second period of the CCP in Quang Tho (see Figure 8).





**Figure 7.** Waste collection system in Quang Tho in the 1st period.



**Figure 8.** Waste collection system in Quang Tho in the 2nd period.

## 2.2. Theoretical Background

To explore the action situation characterizing the CCP, we reviewed the IAD framework and self-determination theory (SDT)—a key theory of motivation.

### 2.2.1. IAD Framework

The IAD framework has been widely applied in numerous studies on action or activity evaluation [39,49,50]. “It has proved useful in understanding a wide variety of institutional arrangements in both developed and developing countries... It emphasizes the careful consideration of contextual factors” [51]. The main components of the IAD framework are exogenous variables, the action arena, interaction patterns, and outcomes. The exogenous variables are as follows:

- Biophysical conditions are represented by physical and human resources or capabilities associated with producing and providing goods and services [52]. We specified human resources as the local authorities, assistance groups, and residents.
- Attributes of the community are focused on the basic socio-economic characteristics of Huong Xuan and Quang Tho, namely, educational level, occupation, income, average number of members in one household, livestock, and garden owned [52].
- Rules-in-use are “shared understandings among those involved that refer to enforced prescriptions about what actions (or states of the world) are required, prohibited, or permitted” [37]. These regulations influence the incentives and resultant outputs of participants. The IAD framework classifies rules-in-use into seven types that “designate all relevant aspects of the institutional context within which an action situation is located” [53]. These seven regulations are choice, payoff, position, boundary, aggregation, information, and scope rules. Choice rules specify the action (“to do”) to be exercised by the actors [42]. In our context, the local authorities and assistance groups as the actors independently chose the action for accomplishment, which was to provide management and support to the residents during the CCP. This support, in turn, was transformed into a benefit reflected in the form of motivation. Payoff rules “specify how benefits and costs are required, permitted, or forbidden to players [actors]” [53]. The payoffs obtained from the CCP, especially the internal benefits, were examined with emphasis on autonomous motivation to discover their influence on outcomes. Position and boundary rules pertain to the designations assumed by actors and the participants who are in positions of action, respectively. Aggregation rules “determine whether a decision of a single participant or of multiple participants are needed prior to an action at a node in a decision process”. Information rules affect how much information is shared among actors and the level of information available to participants. Scope rules exert an impact on “which outcomes must, must not, or may be affected within a domain” [42].

Action arena encompasses actors and action situations [54]. Patterns of interaction flow logically and directly from an action arena in a rigorous IAD analysis [52]. Outcomes are the results of each of the action situations of actors and are either observed (for empirical analysis) or predicted (for theoretical analysis) [42]. We analyzed the observed results of the CCP as the outcomes of the action chains in Huong Xuan and Quang Tho.

### 2.2.2. Self-Determination Theory (SDT)

SDT is a broad meta-theory that suggests people are inherently motivated to perform a given behavior [55,56]. It covers the encouragement of individuals to actively engage with the surrounding environment with which individuals have an interactive relationship [57]. SDT states that motivation is a multidimensional concept that resides along a continuum (see Figure 9), and that the form of amotivation or a general lack of initiative and the absence of self-determination is a state of non-existent intentional regulation. Next in the continuum are external regulation and introjected regulation, which refer to stimulating performance through rewards, punishment, or external forces. These forms are seen as equivalent to controlled motivation. “Being controlled involves acting with a sense of pressure, a sense of having to engage in the actions” [36]. Then, the form of autonomous motivation is reflected by the interest and enjoyment exhibited by individuals as they engage in behaviors or deal with goals, values, and regulations. This form involves the endorsement of individual actions [36]. SDT assumes that the key point driving the action or behavioral performance of individuals is motivation, indicating that people find pleasure in conquering their social environment and are naturally self-motivated to do so [56,58].



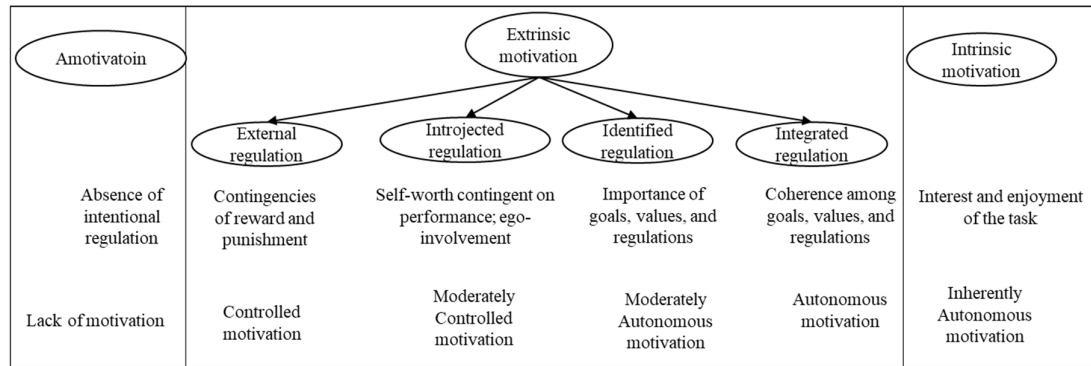


Figure 9. Self-determination continuum showing motivation [36].

### 2.2.3. Adapted IAD Framework

Exogenous variables create the environment that surrounds the actors, and this context might influence their reflection regarding their behavior. These variables enable the actors to ponder on the background in which they are situated. In this study, the support that the local authorities provided to the residents via the assistance groups was the factor that motivated the actors to exercise organic waste separation for composting and contribute to achieving the target collection of organic waste (amount collected). This kind of support was autonomy support that influenced autonomous motivation, which then generated the desired outcomes [36,59–61]. Over time, the CCP outcomes affected changes in the rules-in-use (modifications to the scheme of the waste collection system and the expansion of the number of households), thereby paving the way for deriving better outcomes in the future. An adapted IAD framework was established to analyze the CCP and realize the research objectives. Figure 10 illustrates the incorporation of the aforementioned concepts into the adapted framework.

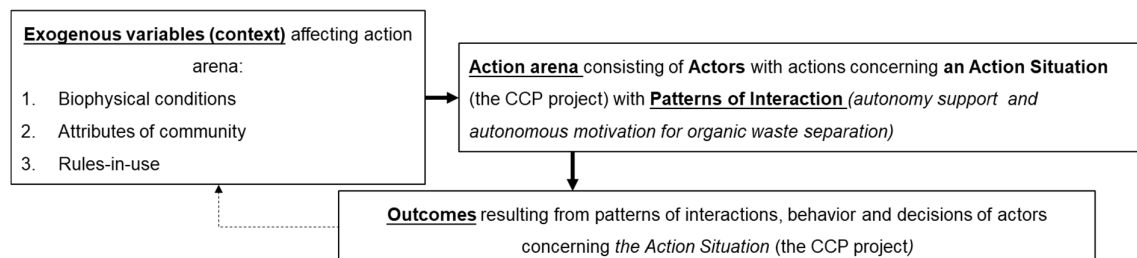


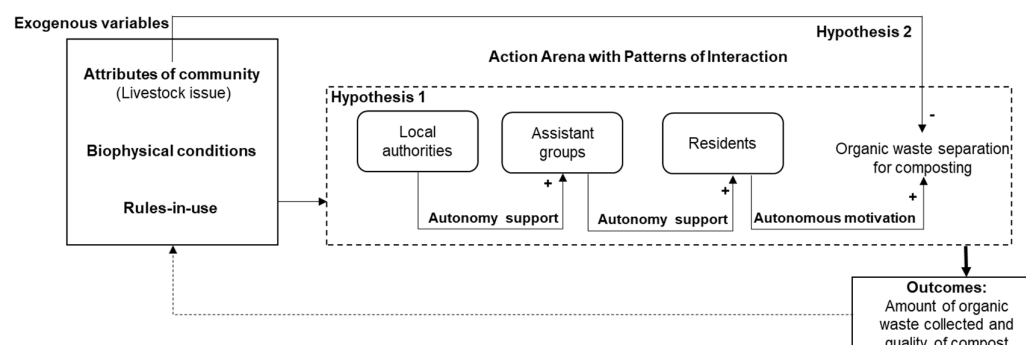
Figure 10. Adapted institutional analysis and development (IAD) framework from the IAD framework of Ostrom [53].

### 2.3. Hypotheses

Under the management of the local authorities, the assistance groups (social organizations, village leaders, and waste collectors) functioned as representatives of the local officials and worked with the residents and directly influenced their performance. In our empirical study on the CCP, the feature that initially appealed to us was the self-enjoyment that motivated the Huong Xuan residents to join in the waste separation initiative. People exhibited interest and enjoyment as they engaged in a given behavior when they were autonomously (i.e., intrinsically) motivated [55]. The residents received the autonomy support from the assistance groups, which was presented by listening to and understanding the actors' perspective, providing feedback (dissemination), encouraging self-initiation, and avoiding control [36,55,62]. Autonomy support is the most important socio-contextual factor for promoting autonomous motivation, which, in turn, positively influences the manner by which people conduct themselves, thereby engendering their behavior [36]. The autonomy support provided by local authorities via assistance groups was converted into autonomous motivation among the latter. In this context, the assistance groups' autonomous motivation was harnessed to

provide support for residents' greater autonomy. This policy ultimately enhanced residents' own autonomous motivation to separate waste. Thus, the present study's first hypothesis was developed as follows (see Figure 11).

**H1:** *More autonomy support of the authorities and assistance groups will lead to more autonomous motivation among residents to join in organic waste separation for composting.*



**Figure 11.** Hypotheses in the CCP analysis.

For a long time, food waste has been commonly used to feed animals [63], and the same holds true in Vietnam, where households who raise livestock (i.e., pigs or chickens or both) conduct waste separation as a means of securing sustenance for their animals [21,22]. This means that communities' livestock negatively affects their engagement in waste separation for composting as residents have long used food waste to feed their animals. The second hypothesis, therefore, to be tested was as follows (see Figure 11 above):

**H2:** *Communities that have more households raising livestock will be less motivated to separate waste for composting.*

## 2.4. Methods: Secondary and Primary Data Collections

### 2.4.1. Secondary Data: Literature Review and Quantitative Data

To obtain the information required by the adapted IAD framework to conduct an analysis of the CCP, data were collected from the WMMP, reports, and materials released during the CCP, and the Vietnam Waste Project's final reports. The materials that were reviewed are shown in Table 3.

**Table 3.** Sources of information regarding the CCP.

Documents	Sources (Organizations)	For the Adapted IAD Framework
Thua Thien Hue Province Solid Waste Management Master Plan till 2030 and vision 2050	Thua Thien Hue Provincial People's Committee	Context and Outcomes
Final Report of The Project for Capacity Development on Integrated Management of Municipal Solid Waste in Vietnam	Vietnam Project Management Unit; Expert Team	Context and Outcomes
Meeting Record of Interaction between Huong Xuan and Quang Tho in CCP	Expert Team	Action Arena
Data Book 2016—Current Situation of Waste Management of Thua Thien Hue Province	Thua Thien Hue Provincial People's Committee	Outcomes

Quantitative raw data were obtained from Nguyen et al. [21], who also carried out a study in Huong Xuan and Quang Tho. These data were used to conduct an analysis of community attributes, which are part of the IAD framework.

#### 2.4.2. Primary Data: Qualitative Data

Following Yin's recommendations [64], a case study design was adopted that focused on qualitative data collection, through in-depth interviews and interactions with participants. This methodology was chosen as the best way to identify and clarify new interaction patterns in the research context in question, in particular the participants' psychological states during the CCP. The IAD framework is a tool that was applied for our case study analysis. Thus, the data were collected in accordance with the adapted IAD framework's components. The specific procedures followed are discussed in the subsections below.

##### Participants and sampling procedures

To analyze the CCP based on the adapted IAD framework, a purposeful sampling method was applied to invite the relevant participants to interviews. Even before the CCP was implemented, the vice-chairpersons of the People's Committee and cadastral employees of Quang Tho and Huong Xuan were also recruited because they were the CCP's direct managers. The interviews were geared toward ascertaining the project management's viewpoints. To balance these out with a bottom-up approach, further interviews were conducted with representatives of social organizations, the village leaders, and the waste collectors after the CCP was completed.

In-depth interviews were also held with residents introduced by the village leader in Huong Xuan and by the chairwoman of the women's union in Quang Tho. In-depth interviewing is defined as "a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation" [65]. As previously discussed, the residents that were selected needed to be representative of both communities. Thus, these interviewees were all over 50 years old and they had lived in their villages for a long time (i.e., more than 20 years) and had good relationships with other residents. Their opinions were, therefore, considered representative of their entire villages, which have special rural characteristics, such as a sense of community (i.e., close, open-hearted, and trusting relationships between people) [21]. In Huong Xuan, the waste collector, accompanied by the village leader, went to each household to collect organic waste around 5 a.m. every Tuesday, Thursday, and Sunday. At the village leader's recommendation, five residents were chosen as representatives of the households with whom he always interacted every collection day. In Quang Tho, the chairwoman also appointed five representatives of the five households with whom she spoke with most regularly. The details of the residents are shown in Table 4.

**Table 4.** Residents participating in interviews.

Code	Gender	Age	Occupation	Percentage of Resident Interviews	
Quang Tho					
Q1	Female	50	Farmer	5 household representatives of 270 households	
Q2	Female	55	Farmer		
Q3	Female	57	Farmer		
Q4	Male	65	Farmer		
Q5	Female	70	Farmer		
Huong Xuan					
H1	Male	50	Farmer	5 household representatives of 80 households	
H2	Female	56	Farmer		
H3	Male	60	Farmer		
H4	Female	65	Farmer		
H5	Female	70	Farmer		

In addition, one member of the team of experts providing technical support to the CCP was invited to our interview. In total, 20 individuals joined in the in-depth interviews. Table 5 summarizes the interviews in greater detail.

**Table 5.** Details of interviews.

Date and Time	Places	Actors	Organizations
19 July 2016 14:00 to 17:30	Office	Local authorities	Vice-chairperson of People's Committee of Huong Xuan Ward
			Cadastral employee
22 July 2016 8:00–11:30			Vice-chairperson of People's Committee of Quang Tho Commune
			Cadastral employee
25 February 2018 8:00–11:30	Home in Tan Xuan Lai village—Quang Tho	Social organization	Chairwoman of women's union
12 March 2018 8:00–11:00		Waste collector	-
26–27 February 2018 (30 minutes each)		5 Residents	-
27 March 2018 7:00–11:00	Home in Xuan Dai village—Huong Xuan	Social organization	Chairperson of Farmer Association
19 March 2018 14:00–17:00		Village leader	-
19 March 2018 8:00–11:00		Organic waste collector	-
30–31 March 2018 (30 minutes each)		5 Residents	-
9 November 2019 13:00–13:40	By video calling (From Japan)	Consultant	Expert team

### Data collection

Regarding the local authorities, the interviews focused on their status reports on waste management as an instrument in order to evaluate management policies' strengths and weaknesses [66]. These interviewees were questioned about issues related to waste management, waste separation behaviors, the composting situation, and the waste collection system in specific localities. The other interviewees were asked about how they joined the CCP, as well as their understanding of the project participants' performance, especially their feelings and experiences connected to the CCP. The objective was to answer the main research question: What are the main factors influencing the CCP's success? Details about the questions are shown in Table 6.

**Table 6.** Interview questions.

Interviewees	Questions	Recording Methods
Local authorities	1. Could you please provide us the basic information of your locality? 2. Could you please describe the waste management in your locality? 3. Could you please give us your opinions about the CCP conducting in your locality?	
Others	1. How would you describe the procedure for joining the CCPP? 2. What are the advantages and disadvantages of your participation in this project? 3. How would you explain the performance of the local authorities/assistance groups/residents during the CCPP implementation? 4. How do you feel about the CCPP? Why do you have that feeling? 5. Yes-No questions for the autonomy supports from the local authorities/assistance groups about listening and understanding actors' perspectives, providing information; encouraging initiative, and avoiding control.	Record words by using a note taker [65,67]

In order to gain a deeper understanding of the information provided by the CCP participants, we followed the guidelines of Carolyn et al. [65], Ryan et al. [68], and Barbour [69]; the procedure was conducted as follows:

- ✓ Interviews were set up with the participants, and the purpose of the interviews were explained to them.
- ✓ Informed consent was obtained from the interviewees (verbal consent, as we were restricted from releasing private personal information).
- ✓ The purpose of the interviews was re-explained, and additional discussions were devoted to how the information acquired from the participants will be kept confidential and the implementation of note-taking during the sessions.
- ✓ Key data were summarized immediately after an interview.
- ✓ The information given by the interviewees was verified as necessary.

### Data analysis

To prepare the data for analysis, the transcripts had to be interpreted as the interviews were conducted in a language similar to the informants' native tongue [70,71]. In addition, observations were extracted from field notes [72] taken to describe the relevant conditions in Huong Xuan and Quang Tho. Next, the most important content was summarized into descriptive memos [73].

Segments of text were then marked according to the participants' meaning by coding key phrases. Focusing on the types of motivation [36], we organized our research data as shown in Table 7. Thick descriptions were applied to provide more "detailed background information [that] tells about an event(s) [sic], and relates how persons experience that event" [73].

**Table 7.** Key segments of text according to the types of motivation in the qualitative data.

Types of Motivation		Description	Key Segment of Text
Autonomous motivation	Intrinsic motivation	Interest and enjoyment	"I am happy", "I am interested in", "I enjoy", "I am excited"
	Extrinsic motivation—integrated regulation	Coherence among goals, values, and regulations	"I must be responsible"
	Extrinsic motivation—identified regulation	Importance of goals, values, and regulations (personal value)	"I understand the importance of", "It is necessary for everyone"
Controlled motivation	Extrinsic motivation—introjected regulation	Self-worth contingent on performance; ego involvement	-
	Extrinsic motivation—external regulation	Contingencies of reward and punishment	"Because it is my task", "I cannot refuse"
Amotivation	Lack of motivation	Absence of intentional regulation	"I do not think it is efficient", "I do not have motivation"

"-": No observation, such as "I join the project because it makes me feel like a worthy person."

## 2.5. Methods: Data Trustworthiness

### 2.5.1. Literature Review

To confirm the data's reliability further, the data sources' provenance and credibility were checked. The document review (Table 3) was conducted by Japanese and Vietnamese waste management experts and approved by the Thua Thien Hue Provincial People's Committee [47]. Thus, the data's reliability was guaranteed by these sources' credibility.

### 2.5.2. Quantitative Data

The description of Huong Xuan and Quang Tho's general context was based on raw data provided by Nguyen et al. [21] who carried out a study in the same sites: "The specific localities in

the province [Thua Thien Hue] that were included in the investigation were ... Quang Tho commune and ... Huong Xuan ward. In these localities, people join the priority project for community-based composting... Data were collected through survey administration, with the preliminary stage conducted in August and September 2017 to unravel the socioeconomic situation." The cited study's quality was confirmed by its publication.

### 2.5.3. Qualitative Data

To confirm the data's trustworthiness, the data collection process was reviewed and repeated with reference to similar previous field studies that applied an IAD framework in waste management by using qualitative methods [38,74]. In addition, after the participants' answers were processed, they were also asked to review the data (i.e., member checking to ensure credibility). This step allowed the participants to clarify their intentions, correct their errors, and provide additional information if available. Overall, the data collection was based on a prolonged engagement with and persistent observations of all the participants. The data were thus based on the participants' responses and not distorted by any researcher's potential bias or personal motivations (i.e., confirmability). To verify the data's dependability, peer checking was also used to carry out expert revisions. This study's results are based on thick descriptions (i.e., paying attention to contextual details) in order to ensure the findings' transferability, facilitating their application to other situations.

Our study focused on the psychological states of the participants. Thus, the significance of the qualitative method for our research lies in the following: "Quality refers to the what, how, when, and where of a thing – its essence and ambience. Qualitative research thus refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things" [75].

After collecting the data and conducting data analysis, we organized the results following the adapted IAD framework. The structure is shown in Table 8.

**Table 8.** Linkage between components of the adapted IAD framework and the methods.

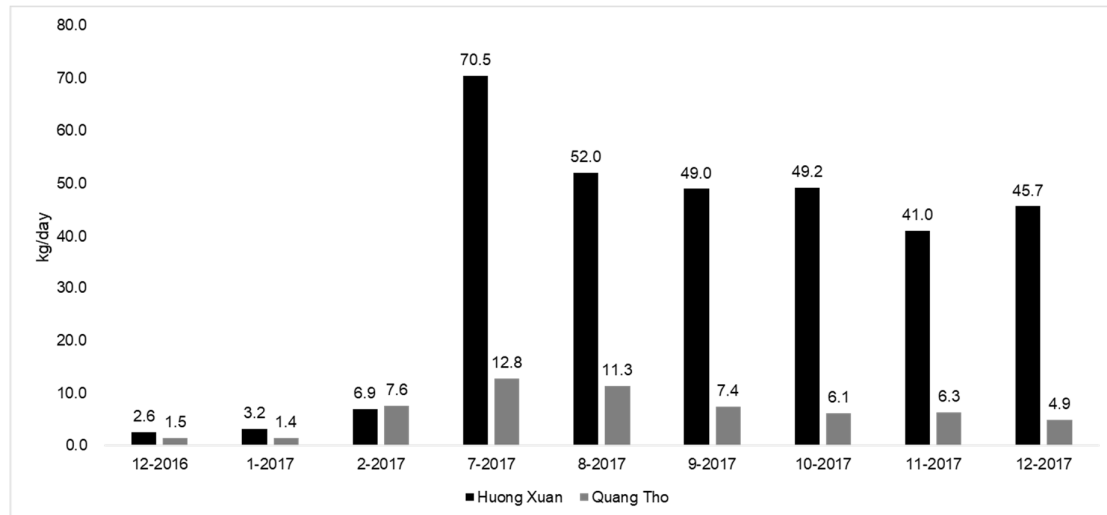
Components of the adapted IAD framework		Results From
Outcomes		Secondary data: Literature review
Exogenous variables	Biophysical conditions	Secondary data: Literature review
	Attributes of community	Secondary data: Quantitative data
	Rules-in-use	
Action arena	Actors	Secondary data: Literature review and primary data: Qualitative data
	Action situation with patterns of interaction	

## 3. Results

### 3.1. CCP Outcomes

To probe into the outcomes of the CCP, we applied two criteria: (1) the amount of organic waste collected and (2) the quality of compost generated. The data on the project's outcomes were obtained from the final report of the Project for Capacity Development on Integrated Management of Municipal Solid Waste in Vietnam, which was written by Japanese and Vietnamese waste management experts. According to this report, these experts' evaluations revealed that Huong Xuan's average volume of organic waste per day of collection was larger than that of Quang Tho. The largest amount of organic waste collected per day of collection was 70.5 kg per day of collection from 80 households in Huong Xuan, while, in Quang Tho, 270 households generated only 12.8 kg per day of collection (see Figure 12). From July to December 2017, the average volume of organic waste per day of collection in July was the highest due to the waste produced from the vegetable (sweet potato) and fruit (peanut) harvest during this month. In this period, the average volume of organic waste per day of collection dramatically increased in Huong Xuan.





**Figure 12.** Amounts of organic waste collected in Huong Xuan and Quang Tho [48].

This final report [48] also reflected that in Huong Xuan “the quality of compost produced was very good. It was used as agricultural material in the community.” Mr. D and Mr. V used the compost for their own vegetation farming, and both expressed satisfaction with the output. By contrast, in Quang Tho, “composting went poorly” (Figure 13) [48].



**Figure 13.** Image of the compost bin with small input of organic waste in Quang Tho [48].

These outcomes served as a reference point as further data were gathered on the situation in Huong Xuan. A cost–benefit analysis further highlighted this area’s successful implementation of the CCP, as shown in Table 9. The project’s cost had only one component: subsidy costs. The benefit consisted of two elements: costs saved by waste management and prices of the compost product.

**Table 9.** A cost–benefit analysis of CCP in Huong Xuan in the 2nd period.

Categories		Value	Formula with Explanation
Status of organic waste collection	Estimated organic waste generation per day (E)	70.4 kg/day	$E = \text{waste generation per household} * \text{average number of households (kg/day)}$ $= 0.88 * 80$ (Data from WMMP [44])
	From July 2017, Average organic waste collected for composting per day of collection (A1)	51.2 (kg/day of collection) (SD = 10.2)	$A1 = \text{Mean (average organic waste per day of collection collected in the 2nd period)}$ Experts' evaluation [48] SD was calculated based on the monthly data in Figure 12 provided in the final report of the Project for Capacity Development on Integrated Management of Municipal Solid Waste in Vietnam.
	Average organic waste collected for composting per day	21.9 (kg/day) (SD = 4.37)	$A2 = A1 * 3/7$ (Organic waste is collected three times a week [48])
Percentage of reduction in organic waste disposed of landfill (R)		31.1% (SD = 13.3)	$R = \frac{A2 \text{ (kg/day)}}{E \text{ (kg/day)}} * 100$
Cost (C)	Subsidy costs	10,000 VND/day	Interview (300,000 VND/month)
Benefit (B)	Costs saved by waste management (B1)	15,600 VND/day (SD = 3,100)	$B1 = A2 * 712 \text{ (VND/day)}$ Waste management cost per kg is 712 VND (Data book [45]).
	Prices of compost product (B2)	43,800 VND/day (SD = 8,700)	$B2 = A2 * 0.2 * 10,000 \text{ (VND/day)}$ One ton of organic waste produces around 20% of end-product compost [76]. Market price in 2017 (interview: 10,000 VND/kg)
	Total benefit	59,400 (VND/day) (SD = 11,800)	$B = B1 + B2 \text{ (VND/day)}$
Net benefit (NB)		49,400 (VND/day) (SD = 11,800)	$NB = B - C \text{ (VND)}$
Cost–benefit ratio (CBR)		5.94 (SD = 1.18)	$CBR = B/C$

Calculations followed the guidelines of Boardman et al. [77] and were based on the monetized impact.

### 3.2. Exogenous Variables

The biophysical conditions are described in the Section 2.1.2; thus, the attributes of the community and rules-in-use are presented as follows:

#### 3.2.1. Attributes of the Community

Investigating community attributes is notoriously difficult [52], but endeavoring to accomplish this task yielded valuable information on the basic socio-economic characteristics of Huong Xuan and Quang Tho (see Table 10). After having the raw data from Nguyen et al. [21], we conducted the statistical description analysis. The results reveal that the females surveyed were 41.9% and 31% of the final sample from Quang Tho and Huong Xuan, respectively. The age group of 40 to 59 years old in Quang Tho (56.4%) was larger than that of Huong Xuan (45.1%). The residents' level of education in the two communities was low, with only a small percentage completing a degree past the secondary level. The authors also found that the percentage of high-income (>391.3 United States dollars (USD)) households in both communities was low. The dominant occupation of the residents was agriculture, and a substantial number of them owned gardens. In both communities, the average number of members in each household was four. Quang Tho and Huong Xuan significantly differed in terms of livestock situation; in Quang Tho, 81.5% of the households reared livestock (i.e., pigs or chickens or both), whereas in Huong Xuan, only 29.6% of inhabitants were engaged in this livelihood.

With respect to the number of households surveyed, there were 71 out of 80 samples and 227 out of 270 samples in Huong Xuan and Quang Tho, respectively. These high percentages disregarded the necessity of expounding on confidence interval.

**Table 10.** Huong Xuan and Quang Tho attributes.

	Huong Xuan	Quang Tho
Number of surveyed households	71	227
Female (%)	31.0	41.9
Male (%)	69.0	58.1
Middle age group of 40 to 59 years (%)	45.1	56.4
Education (% >high school level)	7.0	2.2
Income (% >391.3 USD)	4.2	7.9
Occupation (% agriculture)	71.8	65.6
Average number of members per household	4.0	4.0
Livestock (%)	29.6	81.5
Garden (%)	87.3	82.8

391.3 USD (United States dollars) = 9,000,000 Vietnamese dong (VND).

#### 3.2.2. Rules-in-Use

We familiarized ourselves with the CCP by reviewing the documents listed in Table 3 and used this understanding, along with Ostrom's [42] guidelines, as bases in specifying rules-in-use. Accordingly, rules are created by actors and applied in "a particular situation, and attempt to enforce performance consistent with them" [42]. Rules-in-use were analyzed to understand their influence on the action arena explored in this work. In the CCP, the three positions in place were that of a manager, a supporter and a doer. Management in the CCP was placed in the hands of the local authorities, who were key to the acceptance of the project and the direction and management of all CCP activities. They instructed the assistance groups to circulate information to the residents, who were the CCP doers (i.e., separated waste) and the recipients of support from the local authorities/assistance groups. These positions remained unchanged over the course of the CCP.

Rules-in-use can be perceived as the prime explanation for how the behaviors of actors produce different outcomes [52,78]. This idea was further clarified by Ostrom [42], who stated that actors would change one or more rules in an adaptive process in order to improve performance—an attempt evident in the change in

boundary and pay-off rules for the enhancement of waste separation behavior in Huong Xuan and Quang Tho. Table 11 lists the rules-in-use applied during the CCP. Changes in the rules divided the CCP into two periods: before and after July 2017 (1st and 2nd periods).

**Table 11.** Rules-in-use influencing the action arena.

Rules-in-use	1st period of CCP (Before July 2017)	2nd period of CCP (From July 2017)
Position rules	Three positions: CCP doers, CCP supporters, and CCP managers	
Boundary rules	80 households in Huong Xuan and 100 households in Quang Tho were permitted to join the CCP. Local authorities/assistance groups must be selected on the basis of the governmental system.	More than 170 households in Quang Tho were permitted to join the CCP. There must be an organic waste collector in Huong Xuan.
Choice rules	All households are encouraged to separate waste willingly. Local authorities must manage and implement the CCP.	
Information rules	CCP information must be shared transparently from the local authorities to the residents via formal channels (4 meetings in Huong Xuan and 5 meetings in Quang Tho) and informal channels (dissemination 3 times per week in Huong Xuan by the waste collector and the village leader).	
Aggregation rules	All actors agree to participate in the CCP.	
Payoff rules	Each actor can obtain benefits from the project. Costs must be considered for each actor.	
	No external rewards or sanctions or payment to particular actions from the authorities.	Giving subsidy to the waste collector in Huong Xuan.
Scope rules	All actors work toward common targets: - Decreasing the amount of organic waste discharged to landfills. - Using organic waste for composting. - Making the surrounding environment cleaner.	

### 3.3. Action Arena

Thick descriptions from the in-depth interviews were developed that ensured each part of the IAD framework was represented. The results were extracted from the participants' answers regarding the procedure they followed to join the CCP and their explanation of the project participants' performance levels during the CCP. The descriptions also included the information gathered from the literature review.

#### 3.3.1. Actors

The local authorities in the study communities consisted of the chairpersons and vice-chairpersons of the people's committees and cadastral employees who served as consultants for decision making on environmental issues. Under the supervision of the local authorities, the assistance groups worked directly with the residents in fulfilling the aims of the CCP. The local authorities, assistance groups, and residents, who interacted with one another and generated the actual outcomes, were analyzed in this study.

#### 3.3.2. Action Situation with Patterns of Interaction

##### Support from Local Authorities and Assistance Groups

The local authorities' management of the policy implementation was subject to approval at a higher level of authorization (i.e., the provincial government). At the practical level, they were paramount in directing and helping the residents implement the activities mandated in the policy. As the CCP managers, they were tasked

(via the assistance groups) to remind and encourage the residents about organic waste separation—a duty that was nevertheless accomplished according a voluntary sense of the residents. The assistance groups did not have the same authority in decision making as that conferred to the local authorities.

### Differences in Support in Huong Xuan and Quang Tho

In Huong Xuan, the local authority overseeing implementation in the ward recognized consequent problems in the first period of the CCP: (1) Without reminders the residents rarely conducted waste separation, and (2) the work strategy of the waste collector was unproductive. Modifying the waste collection system of the waste collection company helped the local authority conceive a solution: The local authority appointed Mr. D (a Huong Xuan resident) as an organic waste collector for July to December 2017. Mr. D worked with the village leader in disseminating information and reminding the residents to separate organic waste for composting.

In Quang Tho, the waste collector hired by the local authority agreed to collect organic waste separately and bring it to the compost bin without any monetary subsidy.

### Types of motivation in interaction among assistance groups and residents

Analyses were conducted of the data drawn from in-depth interviews with the CCP participants in both communities and the opinions shared during a meeting on October 5th, 2017. The latter data were extracted from the meeting record of the interaction between the two communities.

In Huong Xuan, the village leader, Mr. V, shared the following sentiments and recommendations:

To ensure the success of the CCP, the most important activity is the involvement of women, who are the key persons separating waste at home [79]. The sub-association comprising women in the community should hold a briefing session to explain source separation or integrate the introduction in meetings, such as the assembly for the celebration of Vietnamese Women's Day (observed annually, on October 20) [79].

He also spoke about the difficulty of convincing people to cooperate in the CCP activities: "It is very difficult to convince all residents to join the project because they do not really understand the benefits of this project", Mr. V said. "Sometimes I felt tired and frustrated, but I overcame this feeling because I really hope that this project will be successful". He lamented the challenge in ensuring that every household performed organic waste separation. "Some people were busy, whereas others cared little about waste", he said. Despite this situation, he strived to talk to household members for as long as he could. "As a village leader, I feel I must be responsible for encouraging the residents to take part in this project. Besides being motivated by this responsibility, I am happy to see my village become cleaner."

The chairperson of the farmer's association, Mr. H, joined the course meetings and listened to the opinions of the residents. He also experienced difficulties in working with the residents: "It is very difficult to convince all to join." He believed that he tried his best to campaign for waste separation in each household and acknowledged the benefits that the CCP was bringing to his community: "Although I know it is very difficult to carry out the CCP, I am interested in encouraging the residents to join for the success of the project."

The waste collector, Mr. D, expressed how he was initially exhausted in completing his work:

In the beginning, I felt too tired and frustrated to participate in the project, but then, the local authority sent officials to the community to inspire advocacy on the basis of the project's meaning. Thanks to the support of the village leader and the women actively engaging in waste separation, the collection became easier. After concern was shown by the people's committee, working with the village leader, Mr. V, I felt duty-bound to accomplish this task for our community. I would feel happy if our village becomes cleaner.

In the project's second period, the residents report that they started enjoying the process of source separation: "I received the reminders of Mr. V and Mr. D regularly. Then, I decided to separate organic waste for this project", H1 said. As acknowledged by the residents, having the encouragement of the village leader and organic waste collector stimulated them to pay attention to the CCP: "I appreciate their [Mr. V's and Mr. D's] efforts to encourage us to join the project. In the beginning, I did not feel that this project is meaningful.

However, after having their encouragement, I recognized its meaning and I am happy to join”, H4 presented. They also expressed concern about their surrounding environment and wanted the alleys along their homes to be cleaner: “I could feel that the surrounding environment is cleaner. Of course, you see, if there is a good waste collector and everyone pays attention to separating waste, the environment must be clean”, H3 said. Under reminders from Mr. V and Mr. D, they realized their responsibility (experiencing autonomy) conducting waste separation: “Finally, I recognized my responsibility to make my village cleaner”, H3 said. They were dismissive in the beginning, but they eventually felt happy (experiencing competence and relatedness) about their participation after communicating with Mr. V and Mr. D.

In Quang Tho, although the local authority instructed the village leader to cooperate in the CCP implementation, he rarely appeared during activities. A member of the expert team confirmed the considerable difficulties in scheduling meetings with him, and he was seen as unprepared to join the CCP.

Contrastingly, the chairwoman of the women’s union in the commune, Ms. Th, expressed her excitement and interest to take part in the project and often visited each household to urge women to separate waste for composting. Her reminder to the residents went “Besides handling food waste for your own livestock, other organic waste should be separated.” However, she also clarified that many households who raised livestock had no organic waste for composting; that is, organic waste (mainly food waste) was reserved as sustenance for their livestock. These individuals were therefore minimally concerned about other waste issues.

The waste collector, Ms. M, transported organic waste to compost bins and brought other refuse to the waste transfer station. Her salary remained at the same level even as her workload increased. She confessed her hope that an allowance would be given to waste collectors as this “will be a big encouragement to collaborate in the project activities.” She also complained about the awareness of the residents regarding waste separation, feeling frustrated that nothing changed in how they behaved even after multiple reminders from her. She described the residents as displaying minimal concern about what they threw away, placing different kinds of garbage in a single plastic bag and leaving it in front of their houses, waiting for it to be collected.

The participants explained that they used food waste to raise livestock, leaving no organic waste for composting: “I have 8 pigs and 10 chickens. Organic waste? I used all food waste for their feed. Other organic waste such as tea leaves is thrown away in my garden. I do not have organic waste for composting”, Q2 said. They also viewed throwing decomposed waste (i.e., fruit peels or leaves) in their gardens as convenient: “It is very convenient for me to throw tea leaves to my garden”, Q2 presented.

The interviewee responses were analyzed further to clarify motivations. In Huong Xuan, all five interviewees gave Yes answers about the role of the chairperson of the farmer’s association, the waste collector, and the village leader in terms of their autonomy support. In Quang Tho, the five interview participants shared the same opinion regarding the autonomy support from the chairwoman of the women’s union, the waste collector, and the village leader. Table 12 summarizes the comparison of insights into the autonomy support from the local authorities and assistance groups in Huong Xuan and Quang Tho. In accordance with the guidelines offered by Deci and Ryan [36,57], types of motivation were clarified based on each participants’ responses (Table 13).



**Table 12.** Comparison of autonomy support in Huong Xuan and Quang Tho in the 2nd period.

Factors	Local authorities to assistance groups		Social organizations to residents		Waste collectors to residents		Village leaders to residents	
	Huong Xuan (Waste collector)	Quang Tho (Waste collector)	Huong Xuan	Quang Tho	Huong Xuan	Quang Tho	Huong Xuan	Quang Tho
Listen and understand actors' perspectives	Yes	No <sup>1</sup>	Yes: 5/5	Yes: 5/5	Yes: 5/5	-	Yes: 5/5	No <sup>5</sup> : 5/5
Provide information (dissemination)	Yes	Yes	Yes: 5/5	Yes: 5/5	Yes: 5/5	No <sup>3</sup> : 5/5	Yes: 5/5	No <sup>5</sup> : 5/5
Encourage initiative	Yes	Yes	Yes: 5/5	Yes: 5/5	Yes: 5/5	No <sup>4</sup> : 5/5	Yes: 5/5	No <sup>5</sup> : 5/5
Avoid control	Yes	No <sup>2</sup>	Yes: 5/5	Yes: 5/5	Yes: 5/5	-	Yes: 5/5	No <sup>5</sup> : 5/5

-. Not available; 1: Listened to the waste collector but did not respond to her demands; 2: Controlled the waste collector's operation (increased her workload); 3, 4: No action; 5: No attendance.

**Table 13.** Motivation according to self-determination theory (SDT) [36] in Huong Xuan and Quang Tho in the 2nd period of the CCP.

	Huong Xuan		Quang Tho	
		Description in types of motivation in Huong Xuan		Description in types of motivation in Quang Tho
Social organization	Chairperson of farmer's association: "I am interested in encouraging the residents to join for the success of the project." With his love for the community, he encouraged the residents to participate in waste separation through his own interest and enjoyment.	Interest and enjoyment— Intrinsic motivation— Autonomous motivation	Chairwoman of the women's union: "Talking to the residents is my interest. I am happy to encourage women to join the project." With her love for the community, she was very eager to convince the residents to separate waste for composting.	Interest and enjoyment – Intrinsic motivation— Autonomous motivation
Village leader	Mr. V.: "I feel I must be responsible for encouraging the residents to take part in this project." He identified his responsibility in common activities, particularly the CCP. He worked without conflict. This was his autonomous choice and functioning in his encouragement of the residents to separate waste.	Coherence among goals, values, and regulations— Extrinsic motivation, integrated regulation— Autonomous motivation	It was very difficult to set up meetings with him. Although he is the village leader, he did not encourage the residents.	Absence of intentional regulation—Lack of motivation— Amotivation
Waste collector	Mr. D.: "I received this task because I understand the importance of this project... I would feel happy if our village becomes cleaner... I think it is necessary for everyone to help our village cleaner." Although his behavior was caused or pointed out by the local authority, the collector understood that it was important to follow directions and satisfy expected outcomes (separation by residents owing to reminders). There was also compost for his farm. He appreciated the concern and support from the local authority and regarded his job as worthwhile.	Importance of goals, values, and regulations (personal value)—Extrinsic motivation, identified regulation— Autonomous motivation	Ms. M.: "I accepted this task because I cannot refuse... I need financial support because my current work is overloaded." She accepted the task administered by the local authority.	Contingencies of reward and punishment—Extrinsic motivation, external regulation— Controlled motivation
Residents	H1: "I enjoy this activity because of Mr. D and Mr. V." H2: "After having the reminders of Mr. V, I think I should separate waste for the project. I felt that this activity is interesting."	Interest and enjoyment— Intrinsic motivation— Autonomous motivation	Q1: "My household does not have organic waste for composting. We have 7 pigs and 10 chickens so we use food waste for their feed. I do not have motivation to separate waste for composting."	Absence of intentional regulation—Lack of motivation— Amotivation

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H3: "At first, I joined but I did not feel that the project is necessary or effective so I almost stopped. However, after receiving the encouragement of Mr. D and Mr. V, I felt that this project is really meaningful. I am happy to participate in."

H4: "I am excited to talk to Mr. D and join the project."

H5: "I am happy to join and cooperate with Mr. V and Mr. D."

They exhibited motivational changes gradually. After receiving encouragement and fully understanding the CCP, they participated in separation with happiness and pleasure.

Q2: "I think this project is not effective... I have 8 pigs and 10 chickens... I do not have organic waste for composting."

Q3: "I do not have motivation to separate waste for composting because I use food waste for a pig and 10 chickens."

Q4: "I do not conduct separation because I do not think it is efficient. I am busy."

Q5: "I feel the project is not appropriate in this region. I used organic waste for a pig and 20 chickens. I do not have organic waste for composting."

In-depth interactions indicated their disregard of waste separation for composting. They were too busy to engage in this activity.

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#### 4. Discussion

The analyses' results validated the hypotheses developed for this study. The findings highlight that autonomy support from the authorities and assistance groups positively influences the residents' autonomous motivation to engage in source separation in Huong Xuan. In Quang Tho, the livestock's needs had an unfavorable effect on the locals' motivation to separate organic waste for composting.

##### *4.1. Autonomy Support for Waste Separation and Influence of Autonomous Motivation on Waste Separation*

Differences in the quality of support from the local authorities in the two communities led to varying CCP outcomes. In Huong Xuan, the local authority supported the waste collector in terms of monetary assistance (300,000 VND/month) and verbal encouragement. In Quang Tho, the waste collector worked without any financial support. Although rewards or extrinsic support can undermine intrinsic motivation [80,81], the findings reflected the opposite: The autonomous motivation of the waste collector in Huong Xuan was cultivated and appreciated through subsidies (rewards) from the local authority. The financial support from the local authority denoted concern for the waste collector. The amount of the subsidy was minimal compared with market figures, but the gesture nonetheless encouraged the worker to accomplish the job with genuine spirit and enjoyment. Our results are consistent with those of Ryan et al. [82], who similarly contended that monetary rewards can enhance intrinsic motivation.

The autonomous motivation of Huong Xuan residents directly influenced the activities in which they engaged and how they proceeded with these occupations. They gladly cooperated with the other CCP actors after acquiring assistance from the assistance groups, thereby contributing to a high waste collection volume. Autonomous motivation was also confirmed as a positive influence on recycling behavior by Green-Demers et al. [34], but Fan et al. [83] argued that the intention to engage in waste sorting is driven by motivation related to general environment-related behavior. In contrast to previous studies, which have not focused on motivations in detail, our research explored and categorized assistance groups and residents' motivations according to the SDT classifications [36] (see Table 13 above). The success factor in Huong Xuan was the residents' intrinsic motivation of "doing" source separation with interest and enjoyment, which was generated by autonomy support given to the village leader and waste collector. Due to the local authorities' support, extrinsic motivation was generated and backed by the village leader's integrated regulation (i.e., coherence among CCP values). Extrinsic motivation was also produced by the waste collector's identified regulation (i.e., importance of CCP values). Both these individuals' motivation was classified as autonomous motivation, based on Gagné and Deci's definition [36]. The village leader and waste collector's autonomous motivation subsequently translated into the autonomy support for the residents.

##### *4.2. Influence of Community Attributes on Waste Separation*

The situation in Quang Tho differed from that in Huong Xuan because of the lack of motivation among the actors and particular livestock situation in the commune. The high rate of livestock breeding in Quang Tho meant that minimal organic waste could be collected. Compared with the Huong Xuan residents, the inhabitants in Quang Tho used organic waste (mainly food waste) as livestock feed. Clarifying this situation, Nguyen et al. [21] stated that livestock is a positive influence on the waste separation behavior of residents in rural areas. In the present study, we focused on the autonomous motivation leading to waste separation and narrowed down the concept to waste separation for composting. Thus, the analysis results emphasized the potential unfavorable effects of livestock on the motivation to separate organic waste for use as compost.

##### *4.3. Policy Implication and Influence of Rules-in-Use on Management*

The successful CCP implementation in Huong Xuan can be attributed largely to the village leader and waste collector, whose efforts fostered and expanded the residents' autonomous

motivation. The local authorities' autonomy support was manifested through listening and understanding, providing feedback, encouraging self-initiation, and avoiding control, which in turn cultivated the village leader and waste collector's autonomous motivation to support the residents. The authorities' autonomy support thus engendered the residents' autonomous motivation to separate waste.

This finding is the key lesson learned. It is an implication for the local authorities, who need to promote and encourage key people to engage in waste policy implementation. The authorities should formulate a solution that promotes autonomous motivation and that can result in residents taking pleasure in exercising the desired behaviors. This process can be seen as a "transition from a conventional waste management to an integrated and comprehensive [resource] management system" [84].

According to Ostrom [42], one or more rules could have been changed to improve the project's outcomes. This would require making a more concerted effort to increase the amount of organic waste collected. During the CCP, changes in the rules were recognized by all participants. In both communities, the boundary rules were changed in two different directions to reflect each local authority's decisions. In Huong Xuan, one villager was assigned to become the organic waste collector. In Quang Tho, more than 170 households were designated as part of the CCP. The two changes in rules generated the starting point that led to the differences in outcomes between the communities (see Figure 12 above).

In addition, at the beginning of the CCP pay-off rules were nearly absent, offering no rewards, sanctions, or payments connected to particular actions. A change also occurred in Huong Xuan when the authorities decided to support the waste collector through a monetary subsidy. The Huong Xuan leader's autonomy support (i.e., listening to and understanding the waste collector's perspective and responding to him) resulted in a change in the pay-off rules, which had an expected consequence. In contrast, no changes were made in Quang Tho to the pay-off rules, although the authority was alerted to the same perspective by their own waste collector.

Therefore, changing the rules divided the CCP into two periods. In Huong Xuan, the second period improvement was the result of the adjustment following the first period based on the existing patterns of autonomy support and changes in rules (see Figure 14). The results shown in this figure could provide the basis for recommendations for which aspects the authorities need to pay closer attention to when implementing waste management policies.

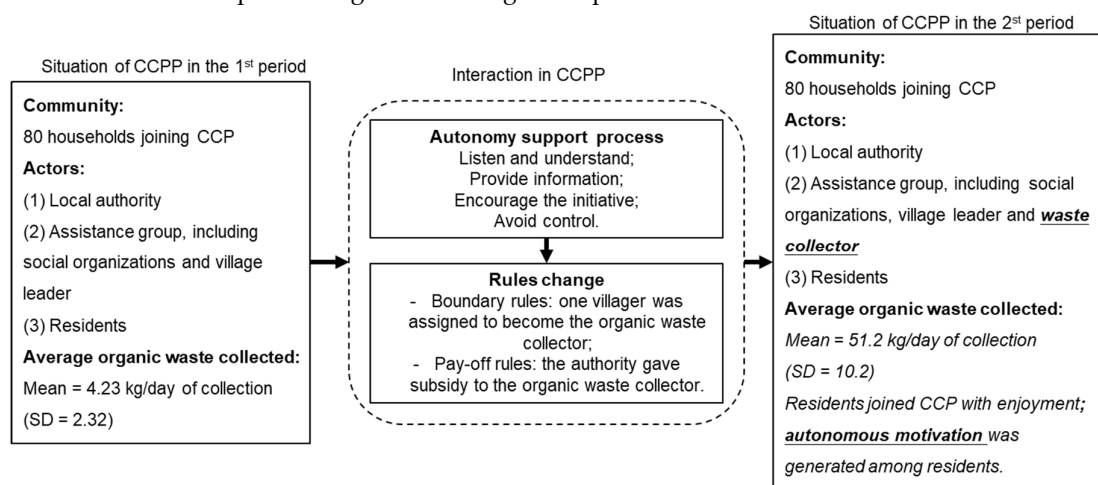


Figure 14. CCP in Huong Xuan in two periods.

In Huong Xuan, the monetary subsidy provided to the waste collector was suspended after December 2017. The local authority justified this decision by stating that they could not find a budget to carry on with this supportive measure. The operation of the two composting systems is currently discontinued. Without any calculation of the costs and benefits presented by the CCP, the local authorities may not appreciate the advantages of the project. The estimated organic waste generation

per day was reduced by 31.1% in terms of the waste discharged to landfill in Huong Xuan. The CCP's net benefit was estimated as 49,400 VND (2.15 USD) per day and up to 18,000,000 VND (782 USD) per year. The project's cost-benefit ratio was found to be 5.94. Our calculation showed the proportion of benefits that can be received from the CCP. The potential long-term advantages manifest in environmental value (e.g., a reduction of waste disposed to landfills, whose longevity would therefore improve) and social value (e.g., the autonomous motivation of the residents to separate waste and the sustainability of practice). We encourage local authorities to reconsider re-instating the budget for resuming CCP operation in Huong Xuan.

The authorities' support of the residents is important, but project management also should include ensuring that the support moves from residents to the authorities. The policy implementation's results should be considered as the outcome of a two-way assistance process between the authorities and residents. Therefore, future research needs to examine this important finding further.

## 5. Conclusions

Valuable lessons were learned from the CCP's success. Important links were identified between autonomy support given to the local authorities and assistance groups, the residents' autonomous motivation, and CCP outcomes, thereby revealing the project's key success factors. More specifically, the provision of autonomy support of one village leader and one waste collector via their autonomous motivation to the residents significantly contributed to the CCP's success. The details highlighted by the classification of motivations provide a lesson in how to promote autonomous motivation, which positively influences residents' waste separation behaviors.

In contrast, the lack of success in the second locality constitutes a warning. The failure allows telling a lesson learned from the absence of autonomous motivation among the assistance groups and residents. The local leader's inappropriate decisions included an attempt to control the motivations of the waste collector, who was the chief engine of the waste collection system, as well as the residents' motivations. In addition, community attributes, particularly the high rate of livestock breeding, dissuaded these residents from genuinely cooperating with other CCP actors.

The adapted IAD framework with SDT facilitated a better understanding of the roles played by the village leader and waste collector in the CCP's success. The results especially shed light on the interactions between the local authority and assistance group and between this group and the Huong Xuan's residents. The findings include which psychological states contribute to residents' enjoyment of waste separation, as well as how the generation of residents' autonomous motivation was influenced by the autonomy support provided by the local leader, which have not been discovered in the previous studies in rural areas in Vietnam. Future research should apply this approach in the other regions (e.g., urban areas) in other countries (e.g., developed countries) with different social conditions. These success factors should be taken into consideration when waste management policies are implemented. This case study therefore offers insights on paying attention to key actors (i.e., waste collectors and village leaders) in waste management both in Vietnam and around the world. Focusing on these individuals would also promote the autonomous motivation of residents to separate waste.

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