A Study on Waste Separation Behavior in Rural Areas in A Developing Country: A Case Study in Thua Thien Hue Province, Vietnam

by

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ABSTRACT

Increasing waste production is a serious problem for every country with substantial waste management initiatives. It is an issue of universal concern not only for developed countries but also for developing nations. In the Southeast Asian countries, there are four treatment methods for municipal solid waste: landfill and open-dumping sites; incineration; composting, and recycling/recovery. In Asian countries, landfilling is the dominant method of municipal solid waste treatment. The insufficiency of waste treatment capacity is a considerable challenge that must be solved by cultivating concern for waste problems, especially in developing countries. Disposing of waste in landfill sites has caused severe pollution. In fact, increasing waste is tantamount to the expansion of landfills, which is a serious issue given that allocating land for this purpose leaves no room for other activities. This challenge can be addressed by establishing waste reduction as a strategic policy. One of the methods to improve the quality of the environment is to reduce the quantity of solid waste dumped into landfills. Source separation with recycling is a promising method which contributes to solving the problem related to landfill pollution and severe environment degradation. Preventing the wasteful use of a common resource such as land necessitates the promotion of effective waste reduction policies. Nevertheless, there are many policies issued for waste management improvement but Vietnam is still facing severe environmental problems, especially pollutions from open dumping and unsanitary landfills. There should be appropriate measures to improve waste management. Thus, this dissertation aims at finding out the way to contribute to enhance the capacity of waste management to solve waste problems by waste separation behavior (WSB) improvements.

In Thua Thien Hue province of Vietnam, there are two major waste-related problems. *First*, the waste treatment capacity of major landfilling facilities in the province is inadequate to handle the amount of waste forecast to be generated in the future. Many landfill sites in the area have less than 10 years remaining before they reach full capacity. *Second*, a tremendous amount of waste is disposed in landfills, accounting for 93% of the total waste - a percentage higher than the average of Vietnam's central region and the entire country. Based on the national policy called "National Strategy for Integrated Management of Solid Waste Until 2025 and Vision towards 2050", Thua Thien Hue

authority enacted the policy "Solid Waste Management Master Plan till 2030 and vision 2050" to manage waste in the province. From which, the project prioritizing community-based composting (CCP, for short) was implemented at two selected sites: Huong Xuan ward and Quang Tho commune. The project mandated that the actors involved (i.e., local authorities, assistance groups, and residents) separate out organic waste for composting. The direct objectives of CCP are to promote the separation of organic waste for composting to minimize the discharge of municipal solid waste from rural areas into landfills and develop know-how regarding this composting measure in all other rural areas. This project was conducted in one year from November 2016 to December 2017. Two periods were implemented in 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. The different outcomes of CCP in Huong Xuan and Quang Tho regarding the organic WSB led us to discover the factors influencing WSB with CCP and without CCP. Thus, two studies were conducted:

Study 1 scrutinized psychological perspectives regarding WSB for composting during CCP and proposed an adapted institutional analysis and development framework for analysis of the policy implementation. The relationship between the local authorities and the residents in waste management was evaluated when CCP was implemented. A case study-based designed has been applied in this study. The purpose sampling was carried out. By using new self-constructed approach and following the institutional analysis and development (IAD) framework of Ostrom integrated with self-determination theory and theory of planned behavior, the action arenas, patterns of interaction, and outcomes under the policy of waste management of Thua Thien Hue province as well as the attributes of the communities were analyzed. Surveys and follow-up surveys were conducted during 2016 to 2019, namely:

- ✓ The relevant participants were recruited to join the interviews in July 2016. The vice-chairpersons of the People's Committee and cadastral employees of Quang Tho and Huong Xuan were invited before CCP started. They were CCP's direct managers.
- ✓ Follow-up surveys were conducted with further interviews with representatives of social organizations, village leaders, and waste collectors after CCP implementation. The chairman of the farmer association in Huong Xuan and the chairwoman of the women union in Quang Tho joined in the interviews. Successful interviews were conducted with the village leader in Huong

Xuan and the waste collectors in both Huong Xuan and Quang Tho. In-depth interviews were also held with five residents in each community who were chosen as representatives of the community's households.

- ✓ Surveys in August and September 2017 as well as in February and March 2018 established the basic socio-economic data for the adapted IAD framework analysis. These surveys were also the basis for the next study in this research. Details of these surveys are presented in the next part.
- ✓ In-depth interviews with the representative of technical experts were carried out in 2019.

Content analyses of qualitative and secondary data were conducted to examine the framework's relevant components.

After CCP finished, the study 2 tried to determine factors influencing WSB without CCP by examination of societal perspectives according to the typical characteristics of rural areas. To reach the aim of this study, data was collected by surveys. One survey was conducted in August and September 2017, then primary data were collected during February and March 2018. The household-head[1] or sub-household-head[2] who is representative of the household was interviewed using the questionnaire package. The questionnaire package was designed based on the consideration of influential factors on waste separation in previous studies and the results of the preliminary surveys. This package includes thirty-two questions in 5 sections which were developed using the 5-point Likert-scale. WSB is considered as the entire household's view, therefore, the observations of social demographic factors were associated with WSB. Data was collected successfully in 298 households, which were divided into livestock and non-livestock groups on the basis of livelihood activities. Data was analyzed using an independent samples t-test and multiple regression.

The main findings of the whole research were that:

First, the CCP was successful in Huong Xuan. Its reasons are summarized as follows:

(1) Happiness and enjoyment of psychological states of the residents existed in conducting the waste separation. With the self-determination theory, it was identified as intrinsic motivation, with the highest level of autonomous motivation;

[1] Household head refers to a person whose name is in the household book.

[2] Sub-household head refers to a person who is wife/husband/oldest child of the household head.

(2) Other actors, social organizations (farmer association and women union), village leader, and waste collector also felt autonomous motivation;

(3) Autonomy supports activated the intrinsic motivation of the residents during waste separation performance. This support was initiated by the local authority, led to generation of autonomous motivation of the other actors, enable them to give autonomous support to the residents.

Second, the CCP was not successful in Quang Tho. After the CCP was finished, however, it was found that residents with livestock did waste separation as habit. Its reasons are summarized as follows:

(4) The typical characteristics of rural areas were confirmed as very important influences on perspectives of waste and WSB of the residents, namely: 4a) the livestock group exhibits more positive attitudes toward waste separation, greater concern for subjective norms, a stronger awareness of the negative effects of waste, a more well-developed perception of the encouragement of waste separation, and higher waste separation performance than does the non-livestock group; 4b) the presence of a garden—a common feature characteristic of rural areas in Vietnam—is a very significant and powerful factor that affects the locals' waste separation habits;

(5) The households with livestock raising conducted waste separation for their priority of meeting their physical needs indirectly (i.e., having the profits for their livelihood).

Third, the research admitted the role of the village leader and waste collector in waste management system. They are the key persons playing the role in the success of waste-related projects. The residents "*need*" them for their initiation of the autonomous motivation. They need to meet their basic physical needs – autonomy support, including financial support.

In summary, beyond the attributes of the communities, the success of WSB emphasized the roles of the key persons, specifically in CCP case, village leaders and waste collectors. The basic psychological needs of the residents in waste separation actions should receive attention. Meanwhile, the basic physical needs of the key persons must be met. Therefor, the findings of this research demonstrate the need to advocate local authorities' autonomy supports to the assistants and then, to the residents for their autonomous motivation for waste separation in rural areas. By this mean, the policymakers can promote and increasingly encourage people's WSB. In fact, support from local authorities and their assistants for the residents is a necessity in successful waste policy implementation.

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CHAPTER 1. INTRODUCTION

1.1. Background

1.1.1. Waste Problem Statement

Waste problem has been an increasingly serious issue due to the growing global population in the 21st century (D'Amato et al., 2016; De Feo et al., 2019; Stoeva and Alriksson, 2017). Prediction of global waste is up to 3.40 billion tons by 2050. Annually, 2.01 billion tons of municipal solid waste have been generated, with at least 33 percent of that—extremely conservatively—not managed in an environmentally safe manner, especially in developing countries (World Bank, 2018a). Municipal solid waste mismanagement is a big issue regarding environmental contamination, social inclusion, and economic sustainability (Guerrero et al., 2013; Gupta et al., 2015; Mor et al., 2006; Vitorino de Souza Melaré et al., 2017). In Southeast Asian nations, municipal solid waste is treated primarily through landfilling and open dumping, incineration, composting, and recycling/recovery (UNEP, 2004). Among these approaches, the most dominantly adopted is landfilling (Idris et al., 2004), which has caused severe pollution in many Asian countries, such as ground water pollution by landfill leachate in India (Mor et al., 2018), negative influence on children's health by air pollution from landfill in China (Yu et al., 2018). In order to solve those problems, the development and improvement of waste management is necessary (Beigl et al., 2008).

1.1.2. Practical Solutions for Waste Treatment

1.1.2.1. In Developed Countries

Many solutions for waste problems have carried out all over the world, especially in developed countries. The waste hierarchy for waste management applied in EU (Figure 1) is the disposal of waste, recovery, recycling, reuse, and prevention (European Commission, 2019).

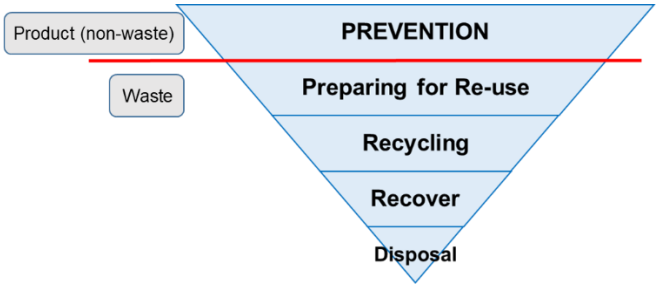

Figure 1. Waste hierarchy in EU

In which, waste reducing, reusing, and recycling (3R) behaviors have been worldwide encouraged for waste management (Ma et al., 2018; Matsuda et al., 2018; Pandey et al., 2018). Waste separation could be seen as a starting point of 3R. Many waste separation-related projects have been carried out. The principle factors were learned from success stories of these practical projects 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 (Seadi et al., 2013). 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 (Seyring et al., 2015).

1.1.2.2. In Developing Countries

In developing ASEAN countries, organic waste is the highest fraction of municipal solid waste. With prevalent open dumping and open burning of waste, it causes severe pollution in these countries. Although they have put efforts towards waste management (Table 1), they are still challenged by "various technology, infrastructure, financing, policy, and stakeholder participation issues". According to the recommendation of UNEP, three important aspects should be emphasized in order to improve the waste management in these countries, which are: i) Policy and Regulatory, ii) Institutional, Technical and Performance, and iii) Funding/Financing/Economics aspects. Waste manager must focus

on waste generation, segregation, collection, transfer, treatment, disposal, and resource recovery through 3Rs (United Nations Environment Programme (UNEP), 2017)

Table 1. Municipal solid waste management situation

Country	Source segregation	Collection rate (Urban)	Recycling rate
Cambodia	<50%	90%	15%
Indonesia	<50%	80%	<50%
Lao PDR	<50%	56% - 75%	<50%
Malaysia	<50%	>70%	Organic <50%
Myanmar	<50%		
Philippines	50% - 70%	40% - 90%	
Thailand	<50%	80%	
Vietnam	<51%	80% - 82%	Organic <50%

In order to promote waste separation for waste problem solution, there is a successful pilot project conducted in Sri Lanka. This project encouraged 1,280 families in Moratuwa area to separate the waste at source in their households. Then, separated waste is used for small scale composting units and biogas generation, and recycling of paper. The success factors of this project are regarding the public participation via sharing of information within the network for the benefit of the community (Visvanathan and Trankler, 2003).

In Thailand, there is one successful example of pro-poor approach of waste management with active participation of the informal waste sector. The project's name is ''Zero Baht Shop''. This shop allows customers to exchange recyclable wastes for consumer goods. The people of On Nut 14 Rai community, Prawet district are "waste pickers". Seventy out of 140 households are engaged in waste picking as their subsistence occupation. This project encouraged people to separate different types of waste, convert trash (recyclables) into cash, and to help lessen the amount of garbage being dumped. The success of this project expressed the important role of informal waste sector (individuals) and the direct profit (cash) entering to the waste pickers' pocket. More than this, the waste pickers in the community "enjoy the identification card that legitimizes their waste picking occupation to collect recyclables from other collection points in Bangkok Metropolitan Administration" (Prakriti and Chettiyappan, 2014).

Kathmandu Metropolitan City promoted household composting by conducting public awareness campaigns, providing training and selling compost bins as well as vermin compost kits. This program

is successful as the survey results conducted by Surya and Bhushan (2014).

In Vietnam, the waste separation at source has been occurring in most urban areas. However, only a few households sort municipal solid waste in order to sell certain waste such as bottles, jars, metal and paper to scrap collectors. Recently, many pilot projects of waste separation conducting in some big cities such as Hanoi, Da Nang and Ho Chi Minh City were generally not successful. The reasons are the lack of community awareness and the lack of treatment facilities to process separated municipal solid waste (Thai, 2014).

In fact, in developing countries like Malaysia, Vietnam, Indonesia, Bangladesh, Thailand and the Philippines, waste reduction strategies are not as successful as in the economically developed countries such as Japan, Singapore and Korea. The reasons are significant due to inadequate orientation in governmental policy, low public awareness and the lack of pertinent technology (Pariatamby and Fauziah, 2014).

According to Andrew. C (2020), there are five lessons improving the waste management in developing countries: (1) Opt for technology within the budget; (2) waste collection improvement and haulage efficiency; (3) Landfill management improvement; (4) Introduction of public-private partnerships; (5) Implementation of long-term awareness-raising campaigns.

1.1.2.3. Summary of Practical Measures Influencing Waste Separation Behavior (WSB) in Waste Management in Developed and Developing Countries

On the basis of practical projects, there are two types of measures influencing success or failure of waste management in developed and developing countries. They are:

- ✓ "*Hard*" measures, such as infrastructures (e.g., waste collection system) and treatment facilities (e.g., incinerators, composting plants, landfills). These measures are the success factors in developed countries. Meanwhile, they are failure factors in developing countries.
- ✓ *"Soft"* measures, such as law, policies, psychological factors (e.g., attitude, awareness of the people), especially human resources (i.e., human is the center of attention). These factors are challenges in both developed and developing countries however, they might be potential success factors in developing countries.

1.1.3. Academic Studies for Factors Influencing WSB Improvement

Many scholars have dedicated attention to how WSB 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 (Williams and Cole, 2013). There is the necessity for drop-off centers to increase separation rates confirmed by Saphores and Nixon (2014). Socioeconomic factors, such as gender (Oztekin et al., 2017), education (Saphores et al., 2006), and income (Alhassan et al., 2018), likewise bear on WSB. Socio-psychological factors impact this behavior, especially attitude (Alhassan et al., 2017; Knussen et al., 2004; Nguyen et al., 2015; Pakpour et al., 2014; Refsgaard and Magnussen, 2009; Vassanadumrongdee and Kittipongvises, 2018), satisfaction with local facilities (Stoeva and Alriksson, 2017), beliefs and social norms (Abrahamse and Steg, 2013; Thomas and Sharp, 2013), and trust between people and authorities (Nguyen et al., 2015).

Based on the factors influencing the WSB, tools for promoting this behavior have been encouraged: for convenience improvement such as improvement of recycling infrastructure, distance to the recycling facilities (Miliute-Plepiene et al., 2016; Rousta et al., 2015; Struk, 2017; Zhang et al., 2016), for enhancing the awareness and perception of waste separation such as promotion of campaigns and prompts for information and knowledge of waste problems (Lee et al., 2017; Stoeva and Alriksson, 2017; Wadehra and Mishra, 2018; Xiao et al., 2018).

1.1.4. Studies on waste management in rural areas in developing countries:

In developing countries, “in 2018, a majority of the population is still living in rural areas in Africa and Asia, with 40 and 48 per cent of their respective populations living in urban areas” (United Nations, 2018). In Vietnam, there is 65% of total population living in the rural areas (General Statistics Office, 2017). The problem regarding pollutions resulting from inadequate treatment of rural waste has become a serious threat to the environment. In fact, the lack of hygiene services and inadequate waste management facilities has caused serious environmental pollutions, especially a negative influence on local people’s health in developing countries (Apostol and Mihai, 2012; Balasubramanian and Birundha, 2011). For example, “in the absence of proper disposal of solid waste, vector borne diseases such as diarrhea, malaria, polio, dengue, cholera, typhoid and other water borne diseases are spreading.

Close to 88 percent of the total diseases load is due to lack of clean water, sanitation and the improper solid waste management--which intensify their occurrences, e.g." (Balasubramanian and Birundha, 2011). The poor management of waste has been conducting in rural areas in developing countries. The reason is the lack of attention to the waste in these areas. "In most cities of developing countries, municipal solid waste management services primarily include waste collection, transfer, and disposal. In rural areas, these services are rare and, if they exist, are reduced to collection and disposal" (Zarate et al., 2008). The findings of Wang et al. (2018) suggests that "infrastructural developments are critical for environmental protection" due to the extremely high proportion of designated dumping.

The above studies reflected three important points:

- ✓ The high rate of population living in rural areas in developing countries under the poor waste management leads to the severe environmental problems in the society.
- ✓ The infrastructure for waste treatment in rural areas in a developing country is poorer than that of in the urban areas in the same country.
- ✓ The little attention has been paid to rural waste compared to "hot trend" of urban waste in both practical incentives and theoretical studies.

1.1.5. Limitations of Practical Projects and Previous Studies

On the basis of the real-world initiatives and literature reviews, there are four limitations:

(1) There is lack of attention to rural areas in waste management. Most studies focused on the urban areas and had very little attention to rural areas, especially the typical characteristics of a given region have not been highlighted yet (e.g., living conditions, livelihood activities).

(2) There are insufficient discussions about the generation of the psychological states (i.e., feelings) of the residents when they join waste separation projects.

(3) The roles of local authorities, assistance groups providing assistance were not emphasized in the policy implementation via projects.

(4) There is lack of specific discussions about the specific roles (e.g., roles of waste collectors and village leaders) in waste collection system for waste separation encouragement.

Different from the developed countries with advantages of "hard" factors, these above "soft" factors may advance success in developing countries like Vietnam, in waste management through WSB

improvement. The invisible factors regarding the people's feeling in waste management was accentuated in this research, especially how to motivate the people joining waste management with their happiness and enjoyment. Thus, this research tried to improve the waste management view by discovering those "soft and invisible" factors.

1.2. Scope of Research

1.2.1. Waste Management in Vietnam

Vietnam is a developing country located in the South-East Asia. It has a border with China in the North, Laos and Cambodia in the West. It has an area of 331,231 km^2 with population of 92.70 million in 2016 (General Statistics Office, 2017). It is one of the most densely populated countries in the world with the 15th largest population (Nations Online, 2020). Vietnam is one of developing countries facing severe environmental pressures in general and insufficient municipal solid waste management in particular. The increasing rate of municipal solid waste generation is 10%/year and continues to increase rapidly in the coming time (MONRE, 2011).

In Vietnam, landfilling is by far the prevailing waste disposal solution (World Bank, 2018b). There are 660 landfills in Vietnam. Daily, they receive about 20,200 tons of waste. Only 30% of 660 waste disposal sites can be classified as engineered landfills. About 63% of collected waste goes to landfills. Other 22% goes to various treatment facilities (recycling 10%, composting 4%, incineration 14%). There are about 105 waste treatment units comprised of small capacity incinerators (42%), composting plants (24%), combined composting and incineration plants (24%) and other technologies (10%). Total installed capacity is 17,600 tons/day waste processing.

Waste treatment facilities include as follows:

- ✓ Incineration, which is a treatment method used in waste management. There are small-scale waste incineration plants (less than 500kg/h), mostly located in rural areas, which substantially contribute to air pollution. Fourteen percent of waste is treated by this method.
- ✓ Composting, four percent of collected waste has been composted. Composting capacity is approximately 2,500 tons/day waste.

✓ Recycling, ten percent of collection waste is recycled. In which, recycling of mostly packaging waste is dominated by the informal sector (e.g., junk buyer, waste picker). The amount collected and separated by the informal sector is about 6% of the total generated waste. The formal collection sector separates about 4% (World Bank, 2018b). Figure 2 shows the municipal solid waste flow in Vietnam.

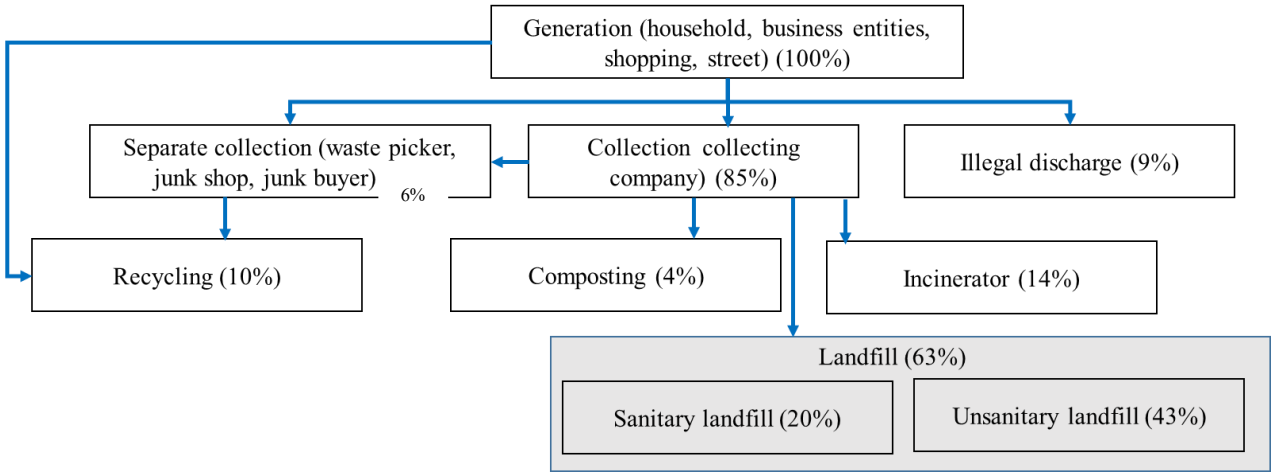

Figure 2. Municipal solid waste flow in Vietnam (World Bank, 2018b).

The high rate of waste entering to landfills causes pollution problems (MONRE, 2011). To deal with this issue, the Vietnamese government enacted the National Strategy for Integrated Management of Municipal solid waste Until 2025 and Vision towards 2050, which stipulate that waste must be separated at source (Office of the Prime Minister, 2009) as this is a sustainable method of waste reduction entering to landfills (Song et al., 2015). This document is the basis of the waste policies implemented in the whole country, including Thua Thien Hue province.

Therefore, Thua Thien Hue enacted the policy on reducing waste disposal to landfills via waste separation for recycling and composting. This policy, called Thua Thien Hue Province Municipal 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 Thua Thien Hue Provincial People's Committee (2016)). 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 municipal solid waste from rural areas into landfills (Expert

Team, 2016) 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. There are two periods implemented in CCP due to changes in the waste collection system schemes in Huong Xuan and the expansion of the number of participating households in Quang Tho. The differences of outcomes of CCP in Huong Xuan and Quang Tho shows the hidden problems in waste management in general and in waste policy implementation in particular. There is success of CCP in Huong Xuan and failure of CCP in Quang Tho in waste separation performance for composting.

1.2.2. Waste management in Thua Thien Hue Province

The research focuses on a case study in Thua Thien Hue province, Vietnam (Figure 3). Thua Thien Hue has a population of 1,154,310 and occupies an area of 5025.3 km^2 (General Statistics Office, 2017).

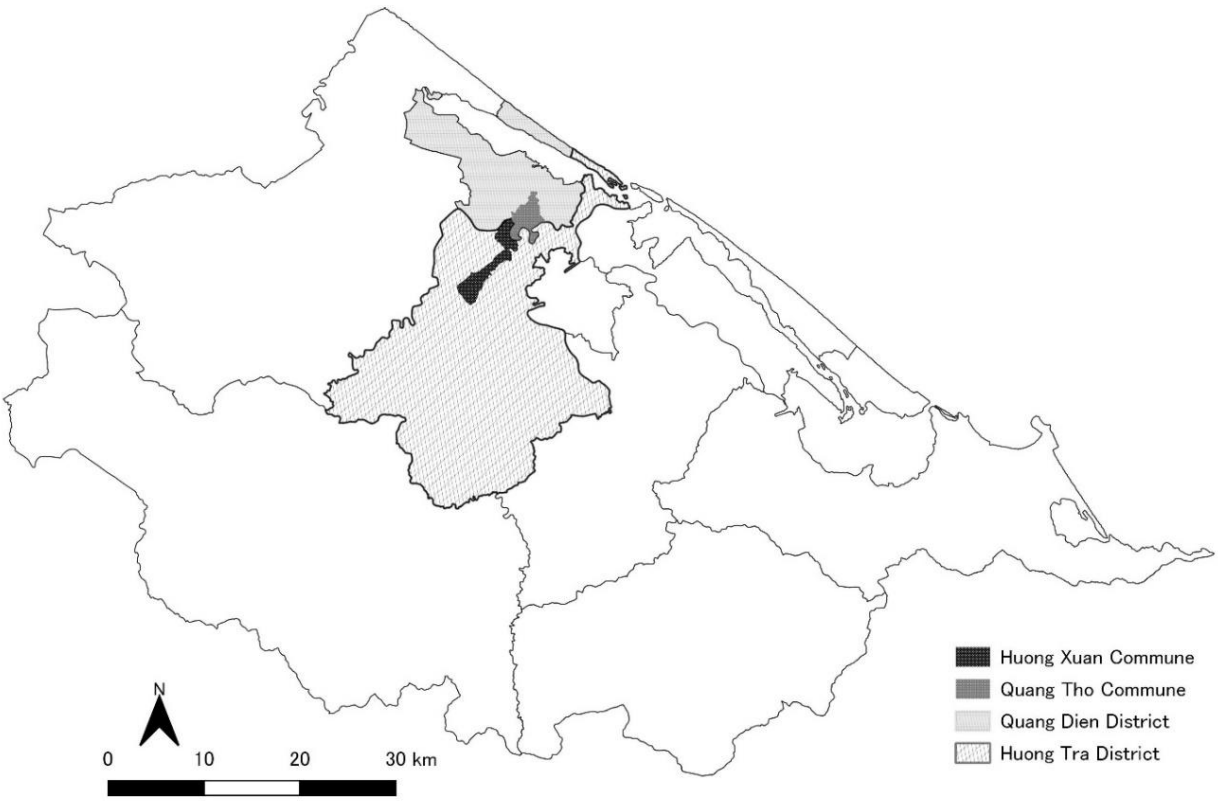

Figure 3. Research site: Selected communicities in Thua Thien Hue

Its municipal 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. Municipal 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 (Thua Thien Hue Provincial People's Committee, 2016). In Thua Thien Hue province, the sources of waste generation are mainly from: 1) households, 2) commercial and services activities (market, food services, commercial, public); 3) office, schools, research institutes, roads, bus stations, railway stations, airport; 4) hospitals and 5) industrial zones.

The municipal solid waste from Hue City and the surrounding areas are treated by being transported to the composting plant and the residues are landfilled. The waste in other districts are transported directly to their landfills. The waste stream in Thua Thien Hue Province is shown in Figure 4 (Thua Thien Hue Provincial People's Committee, 2016).

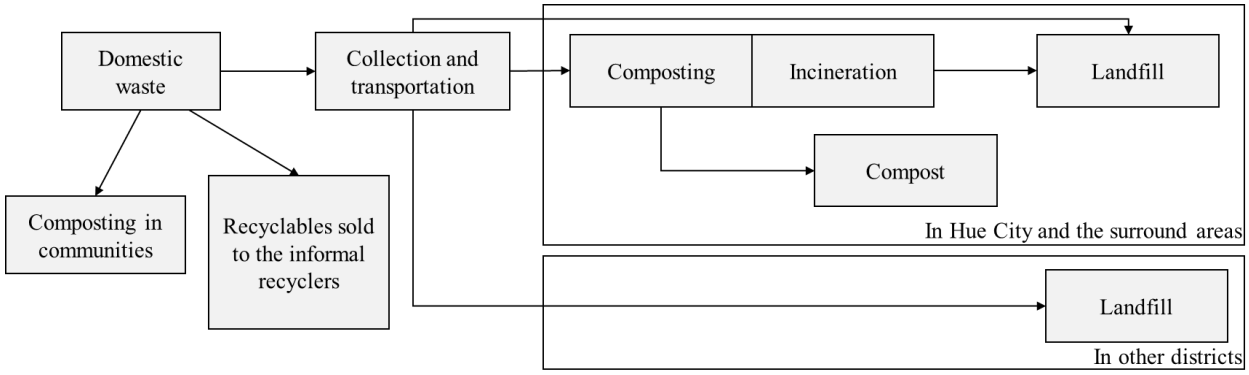

Figure 4. Waste stream for municipal solid waste in Thua Thien Hue

Waste in the province is processed by eight major waste management facilities, which include landfills, incinerators, and composting plants (Thua Thien Hue Provincial People's Committee, 2018), 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 (Resources and Environment Online Newspaper, 2019). 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 (Thua Thien Hue Provincial People's Committee, 2016). 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 (Figure 5), accounting for 93% of the total—a percentage higher than the average of Vietnam's central region and the entire country (Thua Thien Hue Provincial People's Committee, 2018).

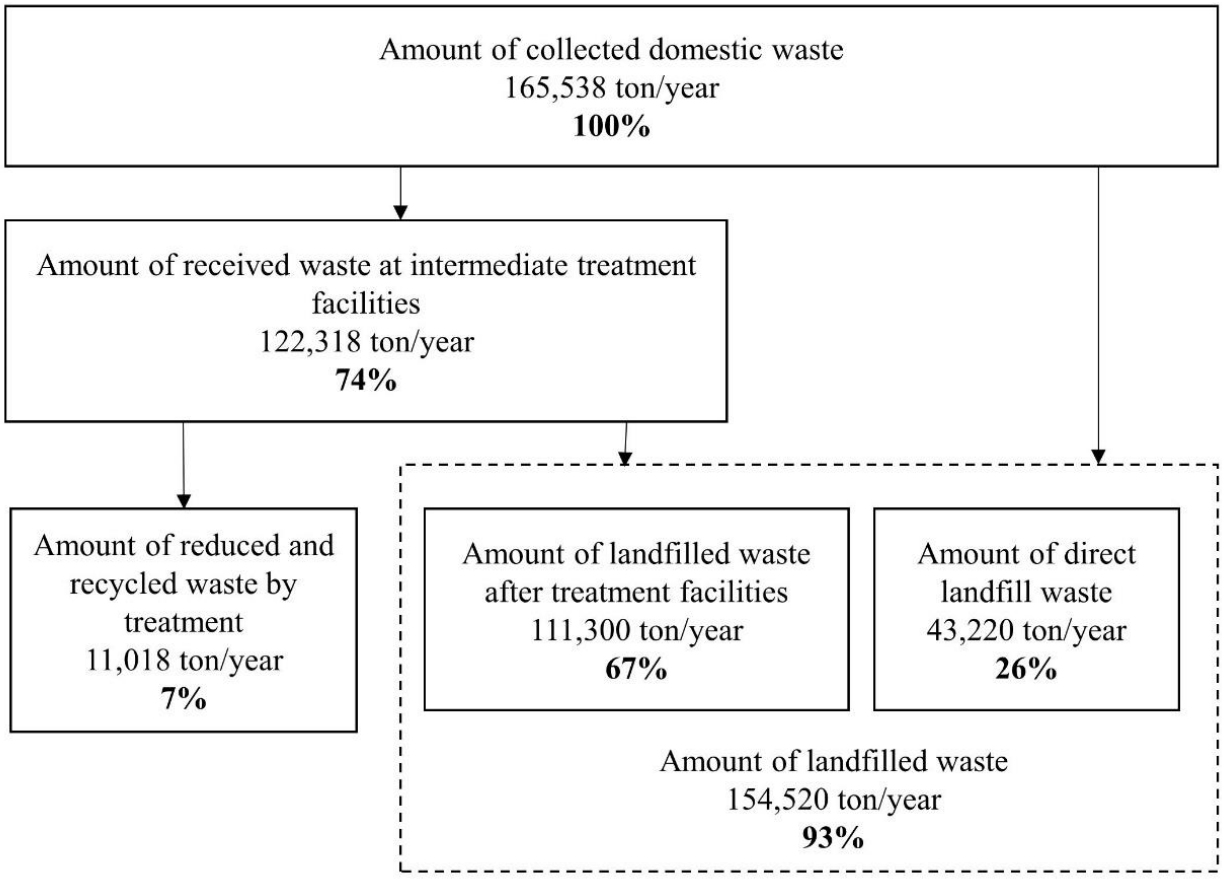

Figure 5. Waste disposal in Thua Thien Hue (Thua Thien Hue Provincial People's Committee, 2018)

The literature reviews and surveys uncovered two major waste-related problems in Thua Thien Hue:

- ✓ First, the waste treatment capacity of major landfilling facilities in the province is inadequate to handle the amount of waste forecast to be generated in the future.

- ✓ Second, a tremendous amount of waste disposed in landfills has been causing severe pollution (e.g., pollutions from landfill leachate and bad smell).

To solve these problems, the policy WMMP was developed by Thua Thien Hue Provincial Committee in 2016. CCP was conducted in Huong Xuan ward and Quang Tho commune in 2016 – 2017.

1.3. Research Objectives

The general aim of this dissertation is to use the knowledge of waste issues and methodologies to discover the factors influencing WSB based on the policy implementation, namely CCP in order to improve the waste management in rural areas in Vietnam. There are several steps to fulfill this aim: waste problems discovery, theories study, hypotheses proposal, framework establishment, results achieved and final policy implication.

This dissertation tries to contribute the solutions for waste management improvement by promoting waste separation behavior in rural areas, Vietnam in order to reduce the amount of waste entering to the environment, namely landfills and to prevent the pollution causing by landfills' overloading.

A case study for waste separation for composting is conducted in rural areas of Thua Thien Hue province, Vietnam where CCP was implemented. In order to promote the "soft" measures for waste separation improvement, this dissertation attempts:

(1) To identify factors influencing WSB with CCP:

(1.1) To investigate how the local authorities, assistance groups provided support to residents during CCP;

(1.2) To investigate how residents' feeling in conducting waste separation under the support of the local authorities and the assistance groups;

(2) To identify factors influencing WSB after CCP finished (without CCP), regarding livelihood activities and regional characteristics:

(2.1) To identify differences in WSB and waste separation performance between two types of households (livestock group and non-livestock group);

(2.2) To identify regional factors as new constructs associated with the theory of planned behavior influencing WSB in the chosen rural context.

1.4. Structure of The Dissertation

To achieve the objectives of the research, the contents of this dissertation are organized in seven chapters:

Chapter 1 presents an introduction of the research including general information about waste problems and treatment solutions proposed by the previous scholars in both academic studies and practical projects. This chapter mentions about the status of municipal solid waste management in Vietnam and in Thua Thien Hue province. Objectives of the research are introduced.

Chapter 2 introduces the literature reviews on theories applied in this research, theoretical framework is presented in this chapter.

Chapters 3 and 4 present the individual studies which have been conducted in order to fulfill the objectives presented in Chapter 1.

Chapter 5 concludes the discussions, major findings, and implications of this dissertation.

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CHAPTER 2. LITERATURE REVIEWS ON THEORIES

2.1. Institutional Analysis and Development (IAD) Framework

IAD analysis begins with identifying the resources that actors bring to a situation (Ostrom, 2011). A resource system is a 'stock variable' (e.g. a lake, a bridge or a park), and a resource unit is the element which is extracted from the resource system (Ostrom, 1990). This system, in the case of municipal solid waste management in Thua Thien Hue, is a public space such as a village road or a river bank. It is a man-made resource system different from a naturally occurring structure. Public spaces for the common good can be considered common-pool resources, following Ostrom's (2007) definition, which indicates that such assets are characterized by high costs of exclusion and subtractability. Let us discuss the issues of the non-excludability and subtractability of the common good in relation to the context of this study. Public spaces are non-excludable in that although a government can theoretically ban individuals from using them so that it can construct more landfills, this prohibition is impossible to enforce in actual situations. Public spaces are highly subtractable because their use leaves less room for other functions. The aforementioned allotment of land to landfill building, for example, reduces remaining available spaces and thereby potentially affects allocation for other uses, such as house, business or park construction. This decision also causes extraction from the resource system. In the same vein, the disposal of waste by locals in public spaces prevents others from having a pleasant avenue for enjoyment and living and adversely affects their health. These acts of appropriation constitute a removal of subtractable resource units from a resource system (Ostrom, 1990). For instance, if an excessive number of locals refuse to cooperate in separating waste to reduce the need for landfill-based disposal, then such dumping sites will need to be expanded, or people will be encouraged to throw garbage along a river bank or village road. Appropriation then becomes a problem. Because waste management is a case of public space being a common-pool resource, the IAD framework is a suitable lens from which to analyse such management.

The IAD framework has been widely applied in numerous studies on action or activity evaluation (Nigussie et al., 2018; Rahman et al., 2012; Zhang and Zhao, 2019). "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" (Imperial and Yandle, 2005).

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 (Polski and Ostrom, 1999). Human resources were specified 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 (Polski and Ostrom, 1999).
- ✓ 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" (Ostrom, 2011). 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" (McGinnis, 2011). 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 (Ostrom, 2005). In the 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 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]" (McGinnis, 2011). The payoffs obtained from 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" (Ostrom, 2005).

Figure 6 presents the IAD framework of Ostrom (2005) with action arenas as focal units of analysis. Action arena encompasses actors and action situations (Ostrom et al., 1994). Patterns of interaction flow logically and directly from an action arena in a rigorous IAD analysis (Polski and Ostrom, 1999). Outcomes are the results of each of the action situations of actors and are either observed (for empirical analysis) or predicted (for theoretical analysis), presented in Figure 7 (Ostrom, 2005).

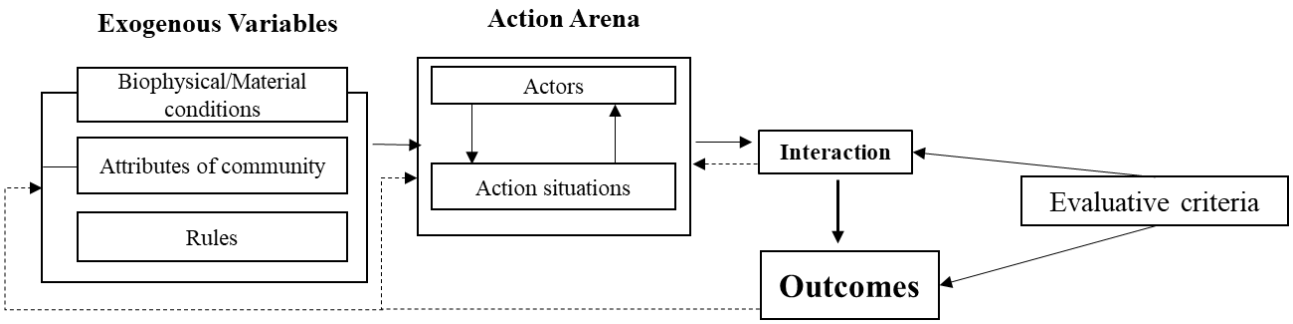

Figure 6. IAD framework for institutional analysis

Figure 7 presents the IAD framework of Ostrom (2005) in an internal structure of an action situation as a focal unit of analysis.

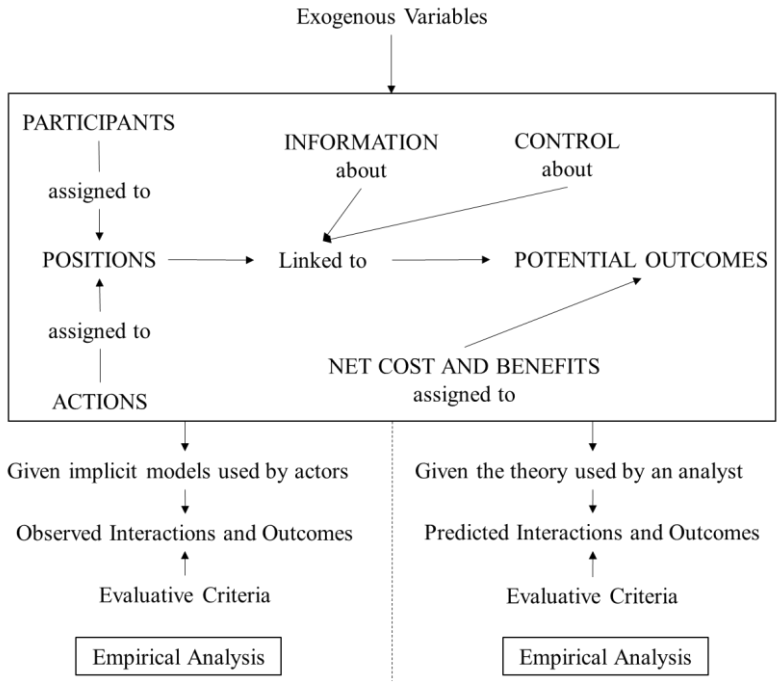

Figure 7. The internal structure of an action situation

In this research, IAD framework incorporated the self-determination theory and theory of planned behavior (presenting next sections) with an internal analysis to clarify the factors influencing the WSB with and without the practical project (CCP) in Thua Thien Hue province.

2.2. Self-Determination Theory (SDT)

SDT is a broad meta-theory that suggests people are inherently motivated to perform a given behavior (Deci and Ryan, 2000, 1985). It covers the encouragement of individuals to actively engage with the surrounding environment with which individuals have an interactive relationship (Ryan and Deci, 2002). SDT presents intrinsic motivation and types of extrinsic motivation. SDT states that motivation is a multidimensional concept that resides along a continuum (Figure 8), 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” (Gagné and Deci, 2005). 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 (Gagné and Deci, 2005). 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 (Deci and Ryan, 2008, 2000). The center of SDT is based on the basic psychological needs of autonomy, competence, and relatedness and their necessary role in self-determined motivation, well-being, and growth. SDT explains the critical impact of the social and cultural context in either facilitating or thwarting people’s basic psychological needs, perceived sense of self-direction, performance, and well-being.

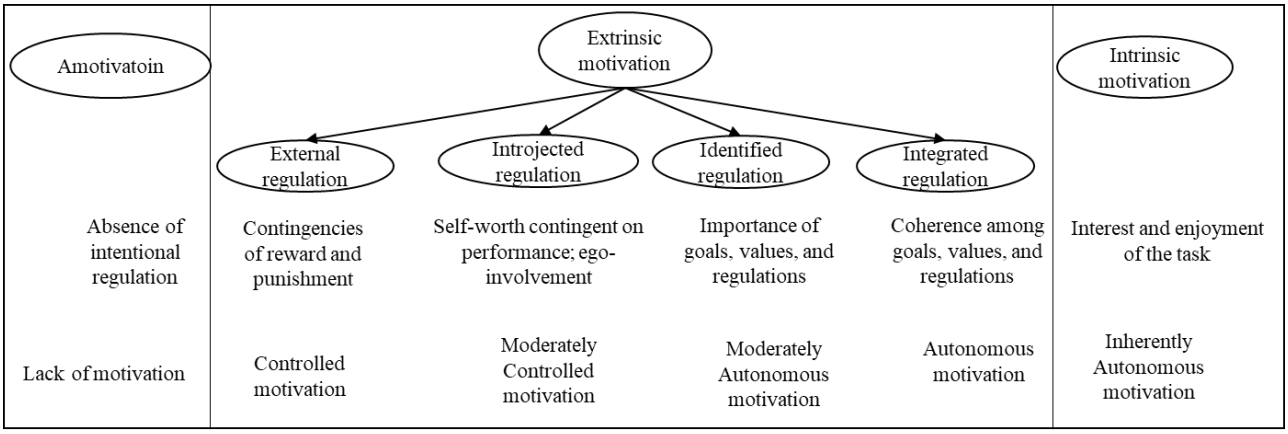

Figure 8. Self-determination continuum showing motivation (Gagné and Deci, 2005).

SDT has been applied in a great number of domains, especially in the context of pro-environmental behaviors. In fact, many studies have focused on the possibility of effects of self-determined motivation on various pro-environmental behaviors. Specifically, SDT has been studied in relation to distinct environmental behaviors such as household energy-saving behaviors (Joachain and Klopfert, 2014; Webb et al., 2013), recycling and purchasing behaviors (Pelletier et al., 1998; Villacorta et al., 2003), environmental activism (SGuin et al., 1998), employee green behaviors (Graves et al., 2013), and green information technology behaviors (Koo and Chung, 2014).

Although there is a number of SDT-applied studies on pro-environmental behaviors, there is still lack of studies discussing about the generation and process of self-determined motivation in general, intrinsic motivation in particular. In addition, integration of SDT into IAD framework for finding the factors influencing WSB in waste project has not been discovered yet. Hence, the policy implication (i.e., CCP) would be analyzed by applying the adapted IAD framework with SDT included.

2.3. Theory of Planned Behavior (TPB)

TPB, which is an extension of the theory of reasoned action (Ajzen, 1985; Fishbein and Ajzen, 1975) and one of the most effective psycho-social perspectives used to explain the manner by which people conduct themselves. This theory provides a method for investigating the factors influencing behavioral choices, a result of a conscious decision to act in a certain way. It is recognized as a tool for predicting a variety of behaviors on the basis of constructs that exhibit considerable effectiveness as variables in analysis (Ghani et al., 2013).

Three constructs used in TPB which are attitudes, subjective norms and perceived behavioral control to predict "intention" strongly. Ajzen (1991) assumes that "behavioral achievement depends jointly on motivation (intention) and ability (behavioral control)". Then, the prediction of behavior expressed with higher accuracy than previous models. The three constructs in TPB are as follows (Ajzen, 1991):

- ✓ Attitude toward the behavior which refers to an individual who has a favorable or unfavorable evaluation or appraisal of the behavior in question
- ✓ Subjective norm which is a social factor refers to the perceived social pressure to perform or not to perform the behavior
- ✓ Perceived behavioral control which determines the degree of difficulty with which an individual performs a certain behavior (Ajzen, 1991).

The TPB has been used in many studies of environmental behavior, especially household waste recycling behavior and waste prevention behavior (Bortoleto et al., 2012; Steg and Vlek, 2009; Tonglet et al., 2004). The TPB "is, in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behavior after the current variables of the theory have been taken into account" (Ajzen, 1991). Additional variables have been included in the model to enhance the explanation power (Bortoleto et al., 2012; Davies et al., 2002; Tonglet et al., 2004). TPB has been extending by adding the variables. Moral norm was added to the construct to TPB by the researches (Bortoleto et al., 2012; Botetzagias et al., 2015; Wan et al., 2017). Personal norm was one factor predicting waste prevention in the research of Bortoleto et al. (2012). Environmental awareness and environmental knowledge were added to TPB for the recycling behavior prediction (Ramayah et al., 2012). Accordingly, certain researchers can propose other variables as additional points of departure for predicting human behavior (Conner and Armitage, 1998), whereas others may eliminate perceived behavioral control given the difficulty of observing and measuring it (Zhang et al., 2017). For example, Nguyen et al. (2015) incorporated awareness as an additional variable in their analysis, whereas Zhang et al. (2017) examined perception to evaluate specific subjects taken by college students. Awareness pertains to an observer's consciousness and ability to discriminate among several possible stimulus states (Merikle, 1984), and perception is the process

whereby people organize and interpret sensory stimulations into meaningful information about their environment (Chambers Dictionary, 2018; Rao and Narayana, 1998). On the basis of previous studies and preliminary surveys, these constructs were also selected as additional determinants of WSB in the present research's exploration.

In waste management, many studies have applied TPB to find out the main factors influencing waste source separation and recycling behavior (Echegaray and Hansstein, 2017; Lo and Liu, 2018; Ma et al., 2018; Pakpour et al., 2014; Stoeva and Alriksson, 2017; Xu et al., 2017a; Zhang et al., 2016). Numerous studies have identified the influencing factors that require improvement in relation to WSB, including past behaviors or habits (Xu et al., 2017a), satisfaction with local facilities (Stoeva and Alriksson, 2017), incentives from markets and governments (Xu et al., 2017b), and trust between people and authorities (Nguyen et al., 2015). Among the previous constructs adding to TPB, the typical characteristic of a given region has not been added yet. The characteristics of rural areas which are features or quality of belonging typically to rural areas (attributes of community) in order to identify them are added in this research as a new construct of TPB in waste management.

In IAD framework, the behavior (i.e., WSB) is the outcome of the whole waste management system. The typical characteristics of rural areas were classified as the attributes of the communities. Therefore, the analysis following IAD framework was conducted completely in the design based on TPB.

2.4. Methodological framework

On the basis of success and failure of CCP, the adapted IAD framework was established based on the above IAD framework of Ostrom (2005) integrated SDT and TPB for analysis of a case study of waste management in Thua Thien Hue province (Figure 9). There are two studies conducted in this research with CCP and without CCP toward WSB. Through the adapted IAD framework, the study 1 focuses on procedure of resulting the outcomes of WSB for composting and the generation of psychological states (i.e., autonomous motivation) of the residents during CCP time. The relationship between the authorities and the residents, namely local authorities' support to residents influencing CCP's outcomes, was evaluated. Content analyses of qualitative and secondary data were conducted in this study. Without CCP, the study 2 focused on the socioeconomic factors, specifically regarding the typical characteristics of rural areas (i.e., attributes of communities), and psychological factors to

discover their influences on WSB. This study applied the quantitative approach by means of questionnaire surveys and field measurements. Data analysis by statistical description, an independent samples t-test and statistical modelling (i.e., multiple regression) produced the results of factors influencing WSB. Details of each study will be presented in the following chapters.

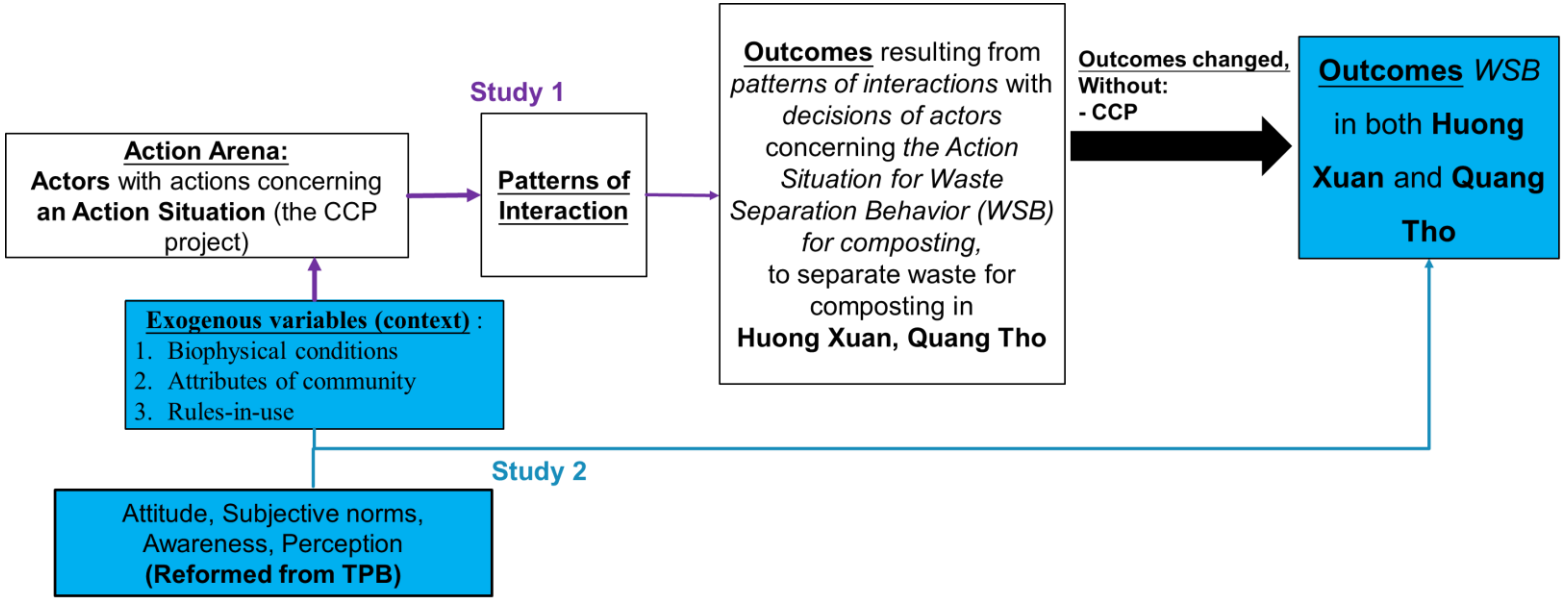

Figure 9. Theoretical Framework

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CHAPTER 3. AUTONOMOUS MOTIVATION FOR THE SUCCESSFUL IMPLEMENTATION OF WASTE MANAGEMENT POLICY: AN EXAMINATION USING AN ADAPTED INSTITUTIONAL ANALYSIS AND DEVELOPMENT FRAMEWORK

3.1. Introduction

As practical projects related to waste separation introduced in Chapter 1, as well as the success and failure of CCP in WSB for composting, this chapter presents the study on whether government policy implementation in waste management has been effective and how it influences on the success or failure of projects/programs. This study gathered data on 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 the practical projects, "hard" measures, such as appropriate infrastructure and equipment, are often useful in waste separation practices in developed countries (Shekdar, 2009), but many low-income countries, developing 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" (Hagger et al., 2014). Green-Demers et al. (1997) argue that autonomous motivation is correlated with a variety of pro-environmental behaviors (e.g., recycling and purchasing environmentally friendly products). Cecere et al. (2014) observed that waste prevention behaviors mainly depend on intrinsic motivation, which is classified as autonomous motivation (Gagné and Deci, 2005). However, none of the previous studies highlight or seek to explain project participants' motivations in terms of their felt experiences and ways their autonomous motivation can be generated. In addition, there is lack of studies on how the roles of the managers (e.g., local authorities) influence the generation of the participants' feeling in WSB in a specific project/program. This study fills these gaps in the waste management field.

To take into consideration the context in which the waste management project in question was implemented, this study included actors' roles, actions associated with waste management, and their outcomes. An institutional approach was applied based on Ostrom's IAD framework (2011), which constituted a unique tool used systematically in this case study. Various investigations of waste management policy have previously applied the IAD framework (Chenboonthai and Watanabe, 2018,

2019; Pires Negrão, 2014; Zhang and Zhao, 2019). In IAD analysis, interactions among actors are emphasized, especially how the results of individuals' actions influence outcomes (Chenboonthai and Watanabe, 2018, 2019). 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" (Ostrom, 2005).

Given the above approach, the current study's specific objectives were to:

(1) To examine the links between local authorities' supporters, groups providing assistance to residents during CCP's outcomes;

(2) To investigate how residents' autonomous motivation influenced the project's outcomes.

This studies' 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., CCP).

The results include lessons learned from 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 study based on the IAD framework is being conducted.

3.2. Materials and Methods

3.2.1. Adapted IAD Framework Establishment

On the basis of knowledge of IAD framework and SDT presented in Chapter 3, the adapted IAD framework is established as a tool to analyze CCP project. 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 supports that influenced autonomous motivation, which then generated the desired outcomes (Bronson, 2016; Fenton et al., 2014; Gagné and Deci, 2005; Zhou et al., 2019). Over time, 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 CCP and realize the study objectives. Figure 10 illustrates the incorporation of the aforementioned concepts into the adapted framework.

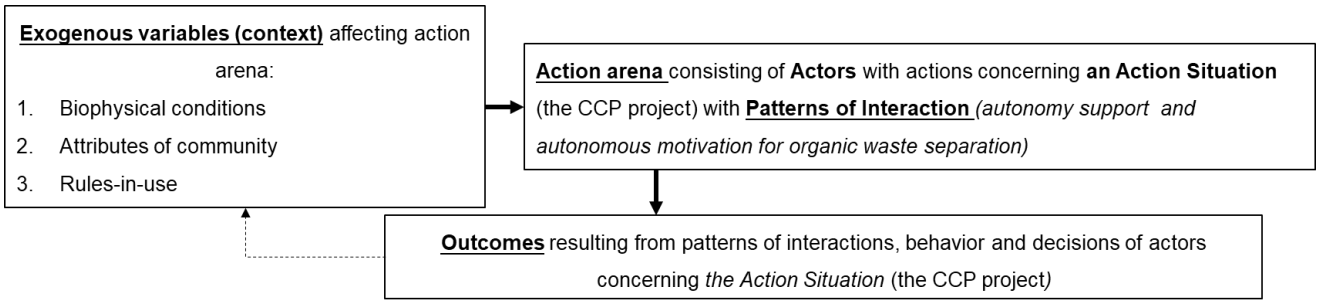

Figure 10. Adapted IAD framework for analysis

3.2.2. 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 the empirical study on CCP, the feature that initially appealed 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 (Deci and Ryan, 1985). The residents received the autonomy supports from the assistance groups, which was presented by listening to and understanding the actors' perspective, providing feedback (dissemination), encouraging self-initiation, and avoiding control (Deci and Ryan, 1985; Gagné and Deci, 2005; Ryan and Deci, 2000). Autonomy supports 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 (Gagné and Deci, 2005). The autonomy supports 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, this study's first hypothesis was developed as follows (Figure 11).

- ✓ Hypothesis 1: More autonomy supports of the authorities and assistance groups will lead to more autonomous motivation among residents to join in organic waste separation for composting.

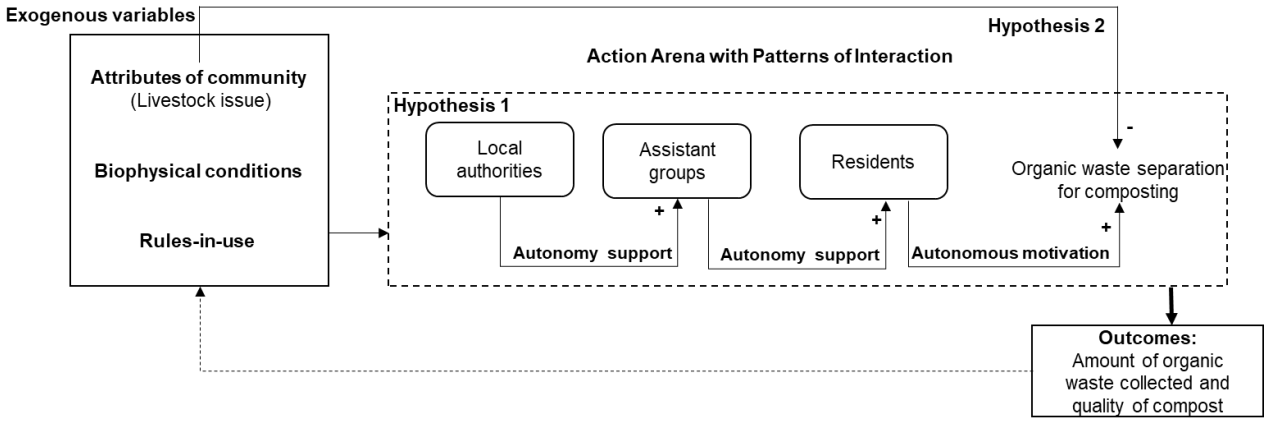

Figure 11. Hypotheses in CCP analysis

For a long time, food waste has been commonly used to feed animals (Westendorf, 2000), 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 (Nguyen et al., 2015). 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 (Figure 11 above):

- ✓ Hypothesis 2: Communities that have more households raising livestock will be less motivated to separate waste for composting.

3.2.3 Methods: Secondary and Primary Data Collections

3.2.3.1. Secondary Data: Literature Review and Quantitative Data

To obtain the information required by the adapted IAD framework to conduct an analysis of CCP, data were collected from the WMMP, reports, and materials released during CCP, and the Vietnam Waste Project's final reports. The materials that were reviewed are shown in Table 2.

Table 2. Sources of information regarding CCP

Documents	Sources (Organizations)	For the Adapted IAD Framework
Thua Thien Hue Province Municipal 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 data: Socioeconomic data were collected through survey in February and March 2018 in Huong Xuan and Quang Tho. These data were used to conduct an analysis of community attributes, which are parts of the adapted IAD framework.

3.2.3.2 Primary Data: Qualitative Data

Following Yin's recommendations (2003), 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 study context in question, in particular the participants' psychological states during CCP. The IAD framework is a tool that was applied for the 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.

3.2.3.2.1. Participants and sampling procedures

To analyze CCP based on the adapted IAD framework, a purposeful sampling method was applied

to invite the relevant participants to interviews. Even before 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 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 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" (Carolyn and Palena, 2006). 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). 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 3.

Table 3. Residents participating 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 CCP was invited to the interview. In total, 20 individuals joined in the in-depth interviews. Table 4 summarizes the interviews in greater detail.

Table 4. 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

3.2.3.2.2. 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 (Verma et al., 2016). These interviewees were questioned about issues related to waste management, WSB, the composting situation, and the waste collection system in specific localities. The other interviewees were asked about how they joined CCP, as well as their understanding of the project

participants' performance, especially their feelings and experiences connected to CCP. The objective was to answer the main study question: What are the main factors influencing CCP's success? Details about the questions are shown in Table 5.

Table 5. 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 CCP conducting in your locality?	Record words by using a note taker (Carolyn and Palena, 2006; Richards, 2015)
Others	1. How would you describe the procedure for joining CCP? 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 CCP implementation? 4. How do you feel about CCP? 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.	

In order to gain a deeper understanding of the information provided by CCP participants, the guidelines of Carolyn and Palena, (2006), Ryan et al. (2009), and Barbour (2008) were applied; 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 the authors 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.

3.2.3.2.3. 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 (Hsieh and Shannon, 2005; Sandelowski, 2000). In addition, observations were extracted from field notes (Merriam, 2009) taken to describe the relevant conditions in Huong Xuan and Quang Tho. Next, the most important content was summarized into descriptive memos (Strauss and Corbin, 1998).

Segments of text were then marked according to the participants' meaning by coding key phrases. Focusing on the types of motivation (Gagné and Deci, 2005), the study data was organized as shown in Table 6. Thick descriptions were applied to provide more "detailed background information [that] tells about an event(s) [sic], and relates how persons experience that event" (Strauss and Corbin, 1998).

Table 6. 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.".

3.2.4. Methods: Data Trustworthiness

3.2.4.1. Literature Review

To confirm the data's reliability further, the data sources' provenance and credibility were checked. The document review (Table 2) was conducted by Japanese and Vietnamese waste management experts and approved by the Thua Thien Hue Provincial People's Committee (Thua Thien Hue Provincial People's Committee, 2016a). Thus, the data's reliability was guaranteed by these sources' credibility.

3.2.4.2 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 (Babazadeh et al., 2018; Chenboonthai and Watanabe, 2018). 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 the study lies in the following: "Quality refers to the what, how, when, and where of a thing – its essence and ambience. Qualitative study thus refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things" (Bruce, 2001).

After collecting the data and conducting data analysis, the results were organized following the adapted IAD framework. The structure is shown in Table 7.

Table 7. 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	Secondary data: Literature review and primary data: Qualitative data
Action arena	Actors	
	Action situation with patterns of interaction	

3.3. Results

3.3.1. Description of CCP

Huong Xuan and Quang Tho were selected as recipients of 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. 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 (Expert Team, 2016). As indicated in 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 8.

Table 8. 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	Local authorities and expert team
(4) Disseminating information on CCP	Local authorities with assistance
(5) Collecting organic waste and bringing it to the compost bin	Waste collectors
(6) Checking the composting process	Waste collectors and village
(7) Harvesting compost products and distributing it across the	Village leaders
(8) Monitoring and evaluating project activities	Expert team
(9) Organic waste separation at home	Residents

This research focuses on waste separation implementation and thus directed the efforts toward Activities 3 to 7 and eliminated Activities 1, 2, and 8, which were instead conducted by the expert team. Figures 12–15 show examples of CCP's activities in the local sites.

Figure 12. Village leader and waste collector with residents - Activity 4

Figure 13. Village leader and waste collector collecting organic waste in Huong Xuan - Activity 5

Figure 14. Village leader and waste collector working in a compost bin in Huong Xuan - Activity 6

Figure 15. Compost bin in Huong Xuan (Project Management Unit and Expert Team, 2018).

Eighty households in Huong Xuan and 100 households in Quang Tho were selected to join 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 9 shows the context of CCP in Huong Xuan and Quang Tho.

Table 9. Context of 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 (Thua Thien Hue Provincial People's Committee, 2016) 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)	(Project Management Unit and Expert Team, 2018)
Compost bins	1	1	
Buckets for each household	2	2	
Human resources	Local authorities with assistance groups (social organizations, village leaders, waste collectors) and residents		

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 (Figure 16). Then, the local authority appointed Mr. D (a Huong Xuan resident), with his consent, as an organic waste collector for July to December 2017 (Figure 17). This time period was the second period of CCP.

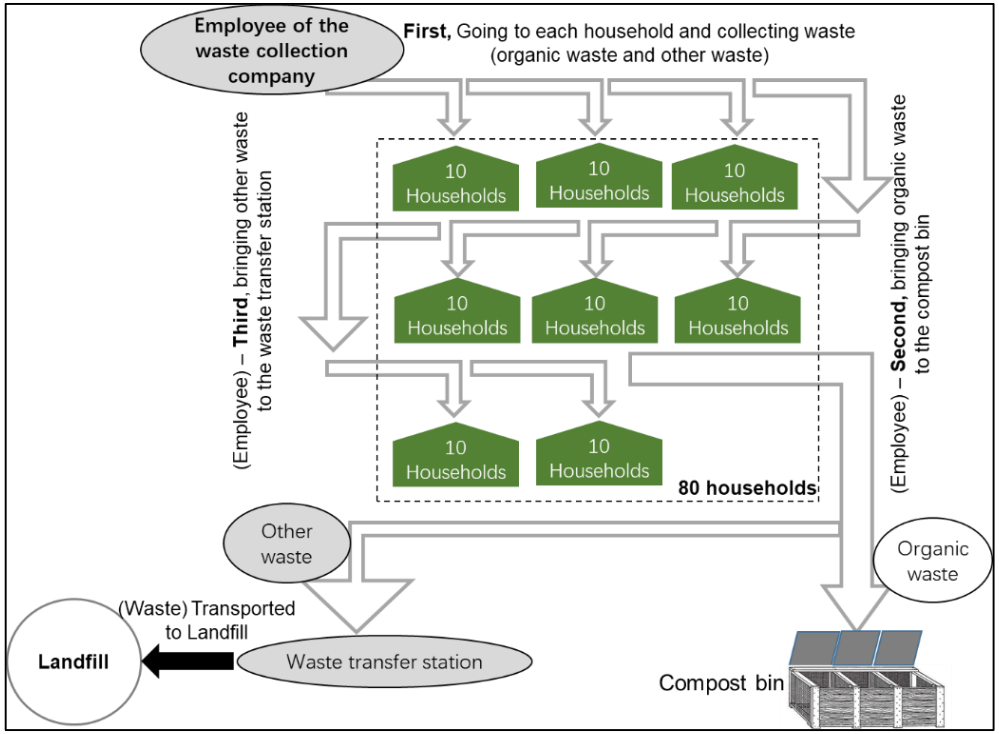

Figure 16. Waste collection system in Huong Xuan in the 1st period

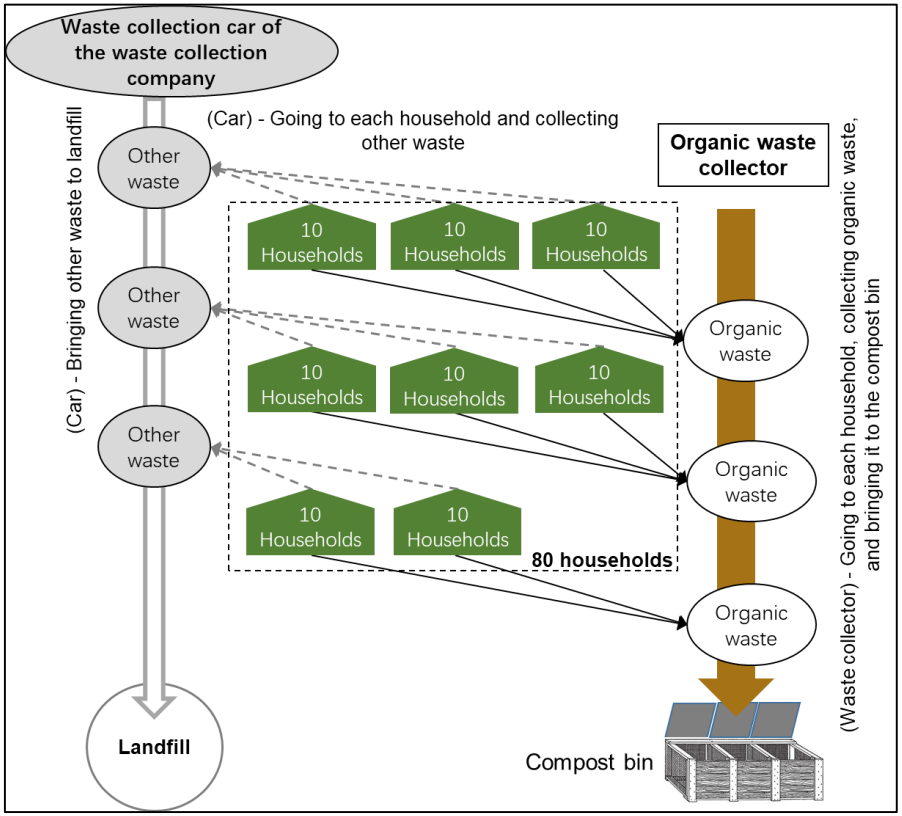

Figure 17. Waste collection system in Huong Xuan in the 2nd period

In Quang Tho, the waste collector hired by the local authority agreed to collect organic waste separately and bring it to the compost bin (Figure 18). But because she collected only a small amount of waste, the local authority decided to expand the number of households involved in CCP from 100 to 270 in July 2017, starting the second period of CCP in Quang Tho (Figure 19).

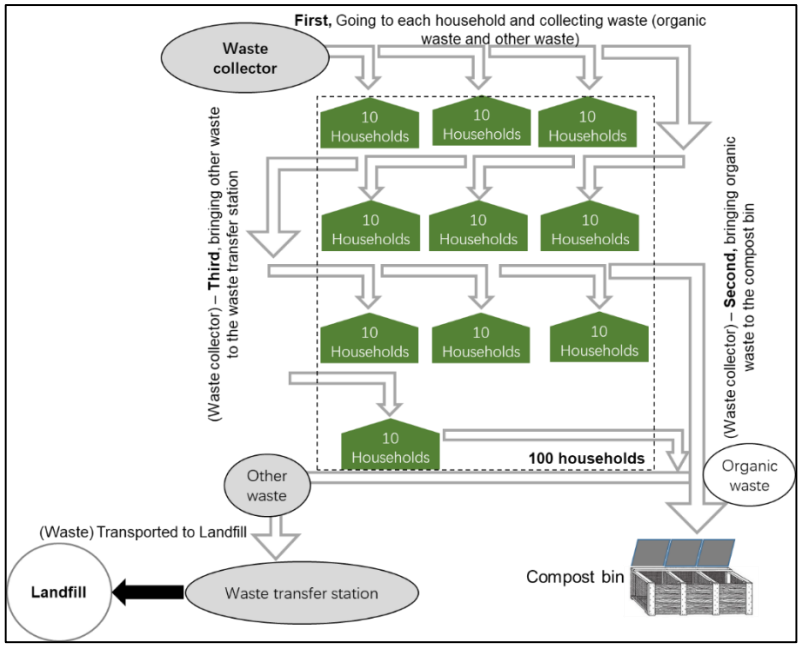

Figure 18. Waste collection system in Quang Tho in the 1st period

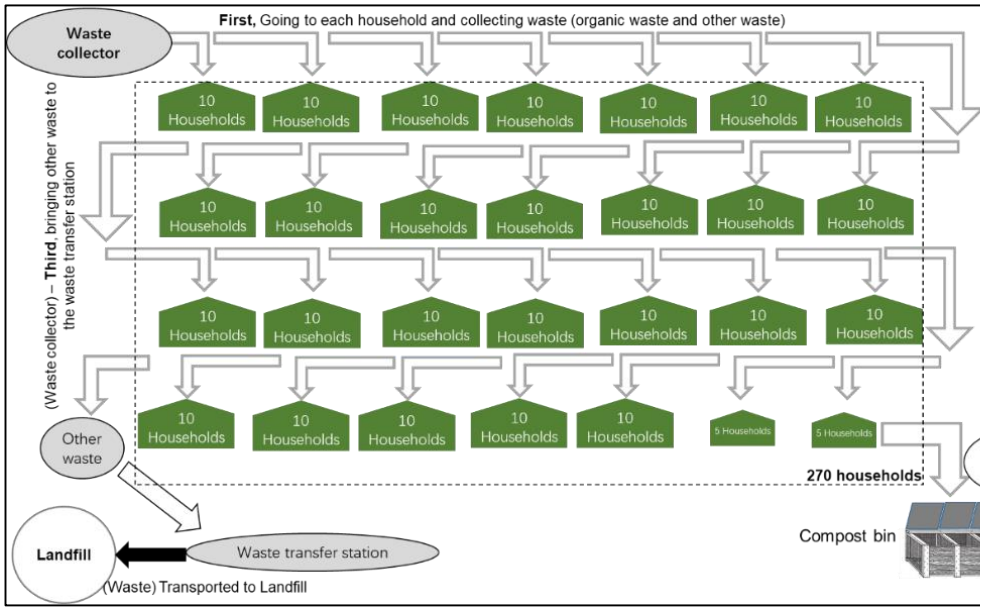

Figure 19. Waste collection system in Quang Tho in the 2nd period

3.3.2. CCP Outcomes

Based on the results of CCP, its outcomes were re-arranged and compared between two communities, Huong Xuan and Quang Tho.

There are two criteria for evaluation of CCP's outcomes: (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 (Figure 20). 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.

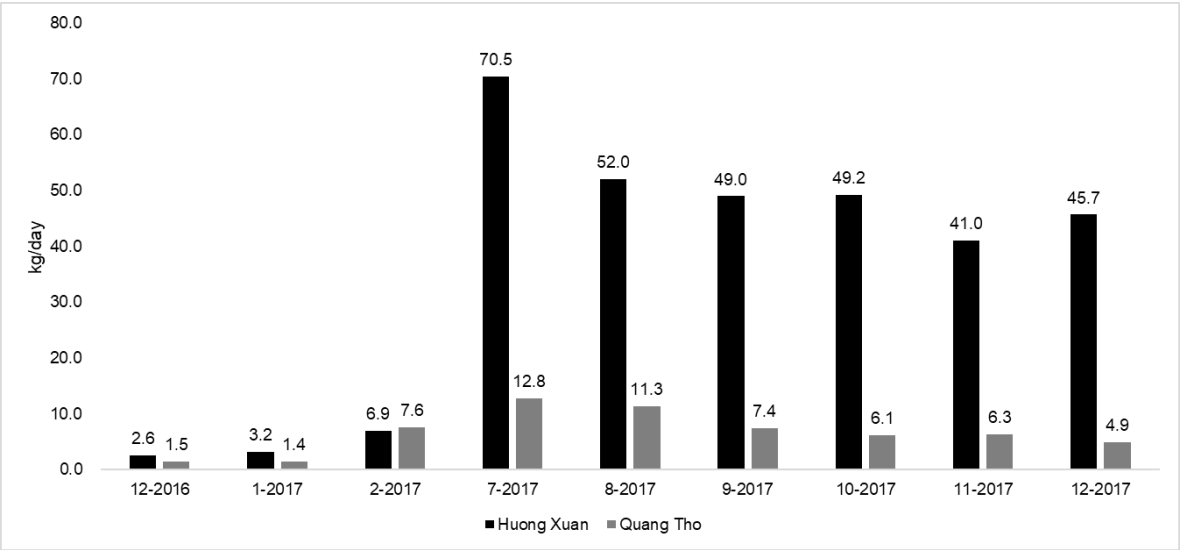

Figure 20. Amounts of organic waste collected in Huong Xuan and Quang Tho (Project Management Unit and Expert Team, 2018).

This final report (Project Management Unit and Expert Team, 2018) also reflected that in Huong Xuan “the quality of compost produced was very good. It was used as agricultural material in the community” (Figure 21). Mr. D (the organic waste collector) and Mr. V (the village leader) used the compost for their own vegetation farming, and both expressed satisfaction with the output. By contrast, in Quang Tho, “composting went poorly” (Figure 22) (Project Management Unit and Expert Team, 2018).

Figure 21. Image of the compost bin with organic waste in Huong Xuan (Project Management Unit and Expert Team, 2018)

Figure 22. Image of the compost bin with organic waste in Quang Tho (Project Management Unit and Expert Team, 2018)

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 CCP, as shown in Table 10. 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 10. 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 = waste generation per household * average number of households (kg/day) = 0.88*80 (Data from WMMP (Thua Thien Hue Provincial People's Committee, 2016))
	From July 2017, Average organic waste collected for composting per day of collection (A1)	51.2 (kg/day of collection) (SD = 10.2)	A1 = Mean (average organic waste per day of collection collected in the 2nd period) Experts' evaluation (2018) Standard Deviation was calculated based on the monthly data in Figure 20 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 (A2)	21.9 (kg/day) (SD = 4.37)	$A2 = A1 * 3/7$ (Organic waste is collected three times a week (Project Management Unit and Expert Team, 2018))
Percentage of reduction in organic waste disposed of landfill (R)		31.1% (SD = 13.3)	$R = \frac{A2\ (kg/day)}{E\ (kg/day)} * 100$
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 (VND/day) Waste management cost per kg is 712 VND (Data book (Thua Thien Hue Provincial People's Committee, 2018)).
	Prices of compost product (B2)	43,800 VND/day (SD = 8,700)	B2 = A2 * 0.2 * 10,000 (VND/day) One ton of organic waste produces around 20% of end-product compost (Center for clean air policy, 2013). Market price in 2017 (interview: 10,000 VND/kg)
	Total benefit	59,400 (VND/day) (SD = 11,800)	B = B1 + B2 (VND/day)
Net benefit (NB)		49,400 (VND/day) (SD = 11,800)	NB = B – C (VND)
Cost–benefit ratio (CBR)		5.94 (SD = 1.18)	CBR = B/C

Calculations followed the guidelines of Boardman et al. (Boardman et al., 2014) and were based on the monetized impact.

3.3.3. Exogenous Variables

The biophysical conditions are described in the Table 9 in the Section 3.3.1 in this chapter; thus, the attributes of the community and rules-in-use are presented as follows:

3.3.3.1. Attributes of the Community

Investigating community attributes is notoriously difficult (Polski and Ostrom, 1999), but endeavoring to accomplish this task yielded valuable information on the basic socio-economic characteristics of Huong Xuan and Quang Tho (see Table 11). After conducting 298 questionnaires in these two communities, the statistical description analysis was conducted. 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 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 11. Huong Xuan and Quang Tho attributes

Categories	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

3.3.3.2. Rules-in-Use

The reviews of the documents listed in Table 2 along with the guidelines of Ostrom's (2005) are 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" (Ostrom, 2005). Rules-in-use were analyzed to understand their influence on the action arena explored in this work (see Table 12). In CCP, the three positions in place were that of a manager, a supporter and a doer. Management in 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 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 CCP.

Table 12. 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 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 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 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 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.	

Rules-in-use can be perceived as the prime explanation for how the behaviors of actors produce different outcomes (Hess and Ostrom, 2005; Polski and Ostrom, 1999). This idea was further clarified by Ostrom (Ostrom, 2005), 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 WSB in Huong Xuan and Quang Tho. Table 12 lists the rules-in-use applied during CCP. Changes in the rules divided CCP into two periods: before and after July 2017 (1st and 2nd periods).

3.3.4. 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 CCP and their explanation of the project participants' performance levels during CCP. The descriptions also included the information gathered from the literature review.

3.3.4.1. 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 CCP. The local authorities, assistance groups, and residents, who interacted with one another and generated the actual outcomes, were analyzed in this study.

3.3.4.2. Action Situation with Patterns of Interaction

(1) 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 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.

(2) 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 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.

(3) Types of motivation in interaction among assistance groups and residents

Analyses were conducted of the data drawn from in-depth interviews with 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 CCP, the most important activity is the involvement of women, who are the key persons separating waste at home (Expert Team, 2017). 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) (Expert Team, 2017).

He also spoke about the difficulty of convincing people to cooperate in 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 CCP was bringing to his community: "Although I know it is very difficult to carry out 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 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 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 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 supports. In Quang Tho, the five interview participants shared the same opinion regarding the autonomy supports from the chairwoman of the women's union, the waste collector, and the village leader. Table 13 summarizes the comparison of insights into the autonomy supports from the local authorities and assistance groups in Huong Xuan and Quang Tho. In accordance with the guidelines offered by Deci and Ryan (Gagné and Deci, 2005; Ryan and Deci, 2002), types of motivation were clarified based on each participants' responses in Table 14.

Summaries of CCP analysis by the adapted IAD framework were presented in Tables 15 and 16.

Table 13. Comparison of autonomy supports 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[1]	Yes: 5/5	Yes: 5/5	Yes: 5/5	-	Yes: 5/5	No[5]: 5/5
Provide information (dissemination)	Yes	Yes	Yes: 5/5	Yes: 5/5	Yes: 5/5	No[3]: 5/5	Yes: 5/5	No[5]: 5/5
Encourage initiative	Yes	Yes	Yes: 5/5	Yes: 5/5	Yes: 5/5	No[4]: 5/5	Yes: 5/5	No[5]: 5/5
Avoid control	Yes	No[2]	Yes: 5/5	Yes: 5/5	Yes: 5/5	-	Yes: 5/5	No[5]: 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 14. Types of motivation according to SDT in Huong Xuan and 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 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.” 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 CCP, they participated in separation with happiness and pleasure.	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.” 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.	Absence of intentional regulation—Lack of motivation—Amotivation

Table 15. CCP analysis in Huong Xuan

Set of actors	Local authorities	Assistance groups	Residents
Positions	Managers	Supporters	Doers
Participants	Officers working in the people's committee	Social organizations, village leader, waste collector Change: One organic waste collector joined CCP(July–December 2017)	80 households
Allowable actions	Made decisions on CCPmanagement: Supported waste collector financially (300,000 VND/month) and verbally (encouragement) support	Waste collector and village leader disseminated information to each household, provided autonomy supports to residents Chairman of farmer's association encouraged the residents to participate in CCPP	Cooperated with assistance groups and local authorities Conducted waste separation at home
Information available	Disseminated CCPinformation to assistance groups and residents via meetings	Waste collector and village leader provided CCPinformation to residents via informal channel (talking)	Received information from local authority in grassroots courses and meetings; Obtained information from assistance groups (waste collector and village leader)
Control	Positive and full impact on CCPoutcomes by making the decisions (focusing on autonomy supportsing to assistant group)	Positive and full impact on CCPoutcomes by autonomy supportsing the residents	Positive and full impact on CCPoutcomes because of waste separation
Cost and benefits	Labor cost: Increased workload for the local authority, subsidization of waste collector Benefits: Reduced the amount of organic waste disposed to landfills, saved money for waste treatment, improved environmental cleanliness	Labor cost: Increased workload for social organization, waste collector, village leader Benefits: Waste collector received the financial support from local authority, compost for use	Cost: Labor cost from separating waste Benefit: Helped clean the surrounding environment, improved interaction among residents closer, autonomous motivation generation for waste separation
Potential outcomes	Increased organic waste collection instead of disposal to landfills Cleaner environment Enhanced the involvement of residents in waste separation		
Observed outcomes	Amount of organic waste collection higher in Huong Xuan than Quang Tho Cleaner surrounding environment in Huong Xuan compared with Quang Tho (observation) Involvement in organic waste separation for composting greater in Huong Xuan than Quang Tho (as evidenced by organic waste collected)		

Table 16. CCP analysis in Quang Tho

Set of actors	Local authorities	Assistance groups	Residents
Positions	Managers	Supporters	Doers
Participants	Officers working in the people's committee	Social organizations, village leader, waste collector	100 households (December 2016–June 2017) Change: 270 households (July–December 2017)
Allowable actions	Made decisions on CCP management: No financial support for collector, verbal support given to assistant group, expanding the number of households joining CCPP	Village leader forgoing CCP participation Waste collector neglected dissemination Chairwoman of the women's union encouraged each household to separate waste Lack of autonomy supports for residents	Cooperated with assistance groups and local authorities Conducted waste separation at home
Information available	Disseminated CCP information to assistance groups and residents via meetings	No information dissemination from waste collector and village leader to residents Chairwoman of women's union aided dissemination through information channel (talking)	Received information from local authority in grassroots courses and meetings Obtained information from assistant group (chairwoman of women's union)
Control	Negative and full impact on CCP outcomes owing to decision making (focusing on expanding the number of households)	Negative and full impact on CCP outcomes by non-autonomy supportsing the residents	Negative and full impact on CCP outcomes given non-participation in waste separation
Cost and benefits	Labor cost: Increased workload for the local authority Benefits: not clear	Labor cost: Increased workload for social organizations, waste collector Benefits: not clear	Cost: Labor cost from separating waste Benefit: Not clear
Potential outcomes	Increased organic waste collection instead of disposal to landfills Cleaner environment Enhanced the involvement of residents in waste separation		
Observed outcomes	Amount of organic waste collection lower in Quang Tho than Huong Xuan Involvement in organic waste separation for composting lower in Quang Tho than Huong Xuan (as evidenced by organic waste collected)		

3.4. Discussion

The analyses' results validated the hypotheses developed for this study. The findings highlight that autonomy supports 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.

3.4.1. Autonomy supports 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 (Deci et al., 1999; Deckop and Cirka, 2000), 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. The results are consistent with those of Ryan et al. (Ryan et al., 1983), 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. (1997), but Fan et al. (2019) 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, the study explored and categorized assistance groups and residents' motivations according to the SDT classifications (Gagné and Deci, 2005) (see Table 14 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 supports

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 (Gagné and Deci, 2005). The village leader and waste collector's autonomous motivation subsequently translated into the autonomy supports for the residents.

3.4.2. 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, the second study (presented in Chapter 6) proved that livestock is a positive influence on the WSB of residents in rural areas. In this study, the autonomous motivation was emphasized to lead 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.

3.4.3. 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 supports 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 supports 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" (Wilts et al., 2016).

According to Ostrom (Ostrom, 2005), 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 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 CCP. The two changes in rules generated the starting point that led to the differences in outcomes between the communities (Figure 20 above).

In addition, at the beginning of 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 supports (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 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 supports and changes in rules (Figure 23). 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.

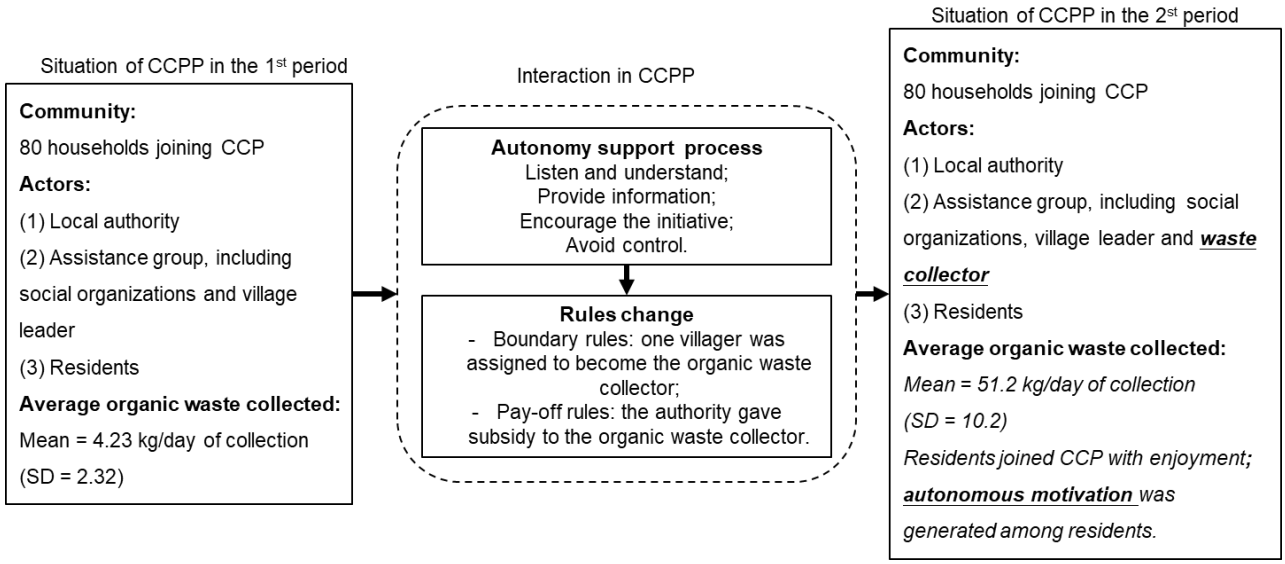

Figure 23. CCP in Huong Xuan in two periods

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 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. 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. The calculation showed the proportion of benefits that can be received from 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). The local authorities should 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 study needs to examine this important finding further.

3.5. Conclusions

Valuable lessons were learned from CCP's success. Important links were identified between autonomy supports 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 supports of one village leader and one waste collector via their autonomous motivation to the residents significantly contributed to CCP's success. The details highlighted by the classification of motivations provide a lesson in how to promote autonomous motivation, which positively influences residents' WSBs.

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 for using organic waste for composting.

The adapted IAD framework with SDT facilitated a better understanding of the roles played by the village leader and waste collector in 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 supports provided by the local leader, which have not been discovered in the previous studies in rural areas in Vietnam. Focusing on these individuals would promote the autonomous motivation of residents to separate waste, not regarding livestock or non-livestock communities.

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CHAPTER 4. WIN-WIN OUTCOMES IN WASTE SEPARATION BEHAVIOR IN RURAL AREAS

4.1. Introduction

Completing the study 1, its results of autonomy supports of the local authorities for autonomous motivations of the residents during CCP are important in encouragement of the residents in WSB for composting. However, the situation of WSB was changed significantly after several months since CCP finished. WSB for composting almost ceased but WSB for other activities (i.e., for livestock raising) kept going on. This study continues to find out the other factors influencing WSB after CCP completion.

As presented the waste problems and treatment solutions in Vietnam in Chapter 1, the provincial government of Thua Thien Hue follows the common goal pursued in the entire Vietnam given that waste treatment in major landfilling and composting facilities in the province is ineffective and insufficient to handle the amount of waste forecast to be generated in the future (Thua Thien Hue Provincial People's Committee, 2016). The difficult challenge confronting researchers and practitioners in this regard is how to improve WSB. Numerous studies have identified the influencing factors using TPB that require improvement in relation to WSB (Nguyen et al., 2015; Stoeva and Alriksson, 2017; Xu et al., 2017a, 2017b).

In this study, the typical characteristics of rural areas are concentrated in WSB because the livelihood activities in this area influenced the waste behavior of the residents after CCP completion. Studies on rural areas emphasize the special characteristics of local lifestyle. For example, residents of rural communities are extensively involved in livestock raising as their primary source of income. In Thua Thien Hue, livestock activities, including cultivation and livestock-related services, account for 32.08% of the total gross output of the province (Thua Thien Hue Statistics Office, 2018). Such socioeconomic attributes distinguish rural localities from other territories and therefore mean that rural residents behave differently from individuals living in non-rural regions. Previous studies delved into socioeconomic factors as determinants of WSB (Ekere et al., 2009), but this study expands the coverage of such works by treating the following rural features as socioeconomic factors: livestock raising (the number of pigs and chickens raised), ownership of a rural garden (areas covered by gardens), and money saved from using waste for livestock. These factors were then used as bases for

estimating the waste separation performance of Thua Thien Hue residents, especially after CCP completion.

In conducting this study, the following objectives were pursued:

(1) to identify differences in WSB and waste separation performance between livestock and non-livestock groups in Huong Xuan ward and Quang Tho commune;

(2) to introduce new constructs (typical characteristics of rural areas) associated with the TPB for the purpose of determining the factors that influence WSB in rural areas of Thua Thien Hue.

By probing into the WSB-related socioeconomic factors that are specific to rural areas, this study is expected to contribute insights that can be used as guidance in optimizing waste treatment and management systems.

4.2. Methodology

4.2.1. Sampling and Questionnaire Distribution

Random and purposive sampling methods were carried out in accordance with the guidelines provided by Hair et al. (2010). The sample was then divided into a livestock group, which consisted of households that raise pigs or chickens or both, and a non-livestock group, which comprised households that do not raise either pigs or chickens. Data were collected through survey administration, with the preliminary stage conducted in August and September 2017 to unravel the socioeconomic, WSB, and waste management situations in the study site and to establish cooperation with the authorities of the two village groups. The questionnaire package for the final survey was designed on the basis of the preliminary survey results and the influencing factors for waste separation that were used in previous studies (Knussen et al., 2004; Nguyen et al., 2015; Tonglet et al., 2004). The questionnaire has five sections consisting of 32 items to be rated on a 5-point Likert scale (Figure 24, Tables 17 and 21).

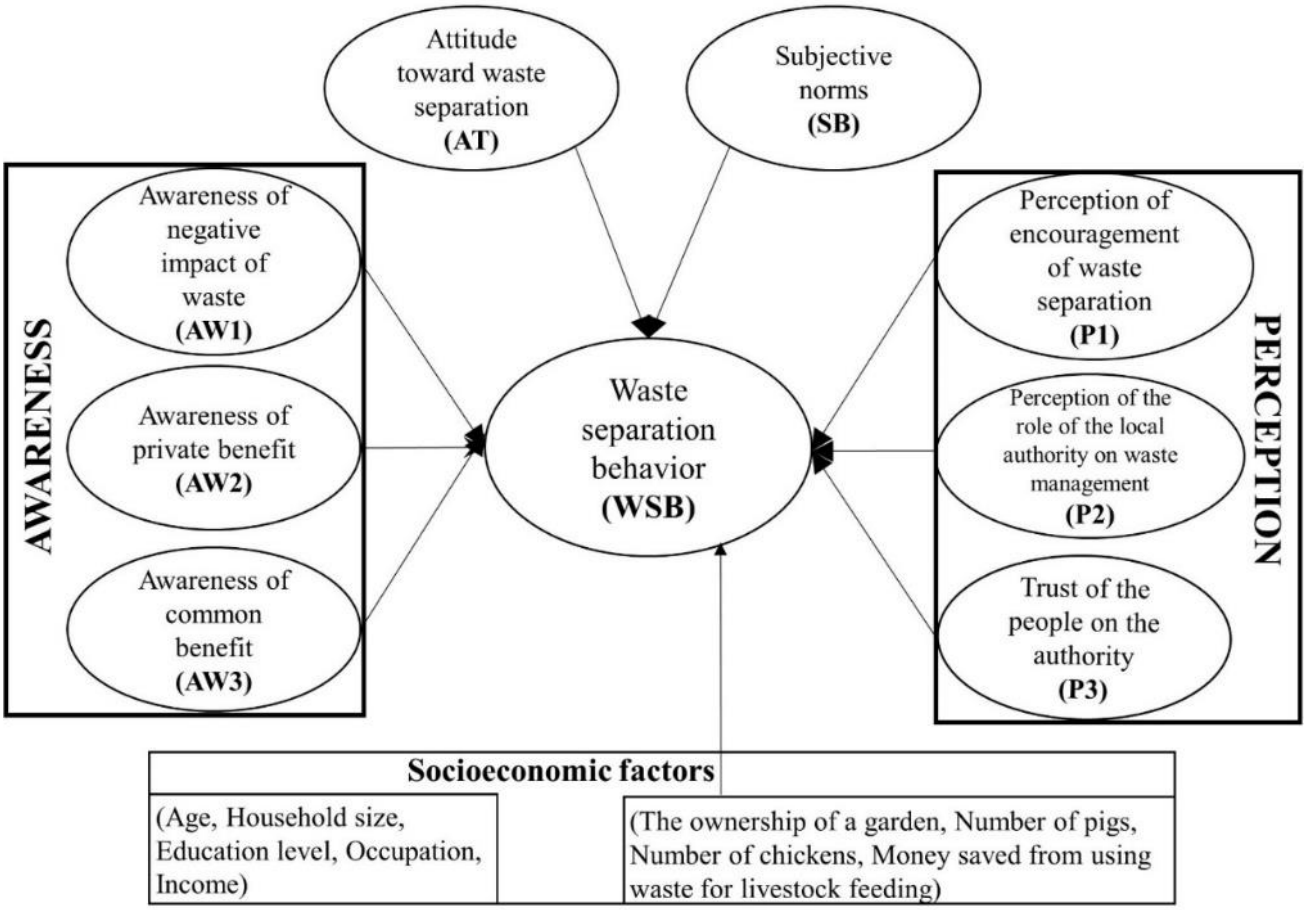

Figure 24. Five sections of questionnaires

The final survey was administered in February and March 2018 to collect primary data, and 298 questionnaires were successfully completed. As evaluated against the number of constructs used to develop the instrument, the number of completed questionnaires is acceptable according to the 5:1 rule: “five observations are made for each independent variable in the variate” (Hair et al., 2010).

Table 17. Content of questionnaire

Items		Description of measurements and units	References
The survey was conducted primarily through a face-to-face interview with each household, which is defined as people living together and building a common economic unit. The interviews involved the household heads[3] or sub-household heads[4], who represent the households. WSB was regarded as the cumulative behaviors of an entire household.			
Socioeconomic factors	Age	Current age of respondent	Hoffmeyer-Zlotnik and Wolf (2003), Nguyen et al. (2015), Tonglet et al. (2004), and Zhang et al. (2017)
	Household size	Number of people in household	
	Educational level	Level of schooling (national education system)	
	Occupation	Current occupation (occupational category)	
	Income	Household income is calculated by the sum of all income of persons who live in the same household. Three main types of income were considered (VND[5]): - Income from earnings: Salary or profits - Income from transfers from various sources (e.g., remittances from abroad) - Income in kind: Non-cash goods The representative of a household is able to provide exact information on the income of each person in the household. This is common in Vietnamese society, where a "community culture" is prevalent, and the relationships in a household are very close and mutually dependent (Vietnam Online, 2018).	
	Ownership of a garden	Interview and observation (m^2)	
	Number of pigs/chickens raised	Interview and observation (heads)	
	Money saved from using waste	Average measurement by respondent (measured in VND)	
Constructs	Attitudes, subjective norms, awareness, and perception	Agreement indicated on a 5-point Likert scale (1 = "strongly negative" to 5 = "strongly positive"). More details are provided in Table 21.	

[3] A household head refers to a person whose name is in the family record book which is issued by government.

[4] A sub-household head pertains to the wife, husband, or oldest child of the household head.

[5] 1 USD = 23,000 VND

4.2.2. Hypotheses and Data Analysis

Descriptive statistics were used to describe the socioeconomic characteristics of the study site, and Cronbach's alpha was used to confirm the internal consistency of the category variables in one factor group. An independent samples t-test were performed to determine differences in attitudes toward waste separation, concern for subjective norms, awareness and perceptions regarding waste and waste separation, and WSB between the livestock and non-livestock groups.

From the preliminary survey, the following data were obtained:

- ✓ Residents who raise livestock have been using waste as feed at the small-scale household level. On the basis of their needs, they implement waste separation voluntarily at a greater rate than do residents who do not engage in livestock farming. Previous study indicated that using food waste as animal feed is one way of reducing the amount of waste dumped in landfills and enhancing waste management (Kim et al., 2011).
- ✓ For the entire community, the ownership of a garden and the number of pigs and chickens raised were measured in terms of a range of values (i.e., from zero to very large; Table 18) on the basis of common characteristics and a practical scale.

Categories of garden areas and number of pigs/chickens raised.

Table 18. Categories of garden areas and number of pigs/chickens raised

Items	Categorical range				
	Zero 1	Small 2	Medium 3	Large 4	>Large 5
Garden (Ga, m2) – Category of gardens (C-Ga)	0	$0 < Ga \leq 50$	$50 < Ga \leq 100$	$100 < Ga \leq 500$	Ga>500
Number of pigs (Pi, head) – Category of number of pigs raised (C-Pi)	0	$0 < Pi \leq 2$	Pi = 3	$3 < Pi \leq 5$	Pi>5
Number of chickens (Chi, head) – Category of number of chickens raised (C-Chi)	0	$0 < Chi \leq 10$	$10 < Chi \leq 50$	$50 < Chi \leq 100$	Chi>100

In Thua Thien Hue, organic waste is popularly known as being of two kinds. One is "rác hoai

được" ("decomposed waste"), which consists of mostly tea leaves, fruit peels, and garden waste and is used for natural composting in gardens. The other is "đồ ăn dư" ("food waste" or "food leftovers"), which is typically used as livestock feed.

In rural areas, households that raise livestock are more likely to have positive attitudes toward waste separation than are households that do not raise such farm animals. Therefore, the hypothesis 1 formulated for this study is presented in Table 19.

Table 19. Hypothesis 1 for the comparison of the livestock and non-livestock groups

Factors	Mean	Comparison	Mean
AT - Attitudes toward waste separation	Livestock group (N = 206)	>	Non-livestock group (N = 92)
SB - Subjective norm		>	
AW1 - Awareness of the negative impact of waste		>	
AW2 - Awareness of private benefits		>	
AW3 - Awareness of common benefits		>	
P1 - Perception of encouragement of waste separation		>	
P2 - Perception of the role of local authorities in waste management		> or =	
P3 - Trust		> or =	
Decomposed waste		>	
Food waste		>	

WSB was used as the dependent factor, and two multiple regression models were developed to determine the weight effects of factors that potentially influence the WSB of the locals in each sample group. The general multiple regression model used for the two groups is:

$$WSB = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + ... + \beta iXi + \beta nXn + u$$

where WSB denotes waste separation behavior, Xi represents independent variables, β0 is the intercept, βi stands for the coefficients of the independent variables, and u is a random error. The constructs established in this work were the independent variables, which are presented along with the hypothesis 2 for each group in Table 20.

Description of variables used in the two models and the hypothesis 2.

Table 20. Description of variables used in the two models and the hypothesis 2

Livestock Model		Non-livestock Model	
Predictor variables	Expected sign	Predictor variables	Expected sign
AT	+	AT	+
SB	+	SB	+
AW1	+	AW1	+
AW2	+	AW2	+
AW3	+	AW3	+
P1	+	P1	+
P2	+	P2	+
P3	+	P3	+
C-Ga	+	C-Ga	+
C-Pi	+		
C-Chi	+		
Mo (money saved from using waste)	+		

4.3. Results and Discussion

On the basis of the sampling methods, common method bias (CMB) was verified using Harman's single factor score, in which all items are loaded onto one factor to test whether CMB exists. The first items explain 27% and 40% of the variances in the livestock and non-livestock models. This explanation reflects that CMB is not a major concern in this study (less than 50% of the cut-off point) (Doty and Glick, 1998; Podsakoff et al., 2003).

4.3.1. Respondents' Socioeconomic Characteristics

Section 5.3.2.1 in Chapter 5 presented the brief description of socioeconomic characteristics in each community. This section shows the detailed description of the whole survey (in both communities). The ages of the respondents ranged from 28 to 89 years, with the middle age group of 40 to 59 years accounting for 53.7% of the sample. The educational level of the respondents was low, with 89.3% being unable to reach secondary schooling. The household size was one to nine people per household, with households that have four to six members accounting for 62.4% of the sample. The total monthly income of each household ranged from 1 to 15 million VND, and the high-income earners were mostly concentrated in the livestock group (Figure 25).

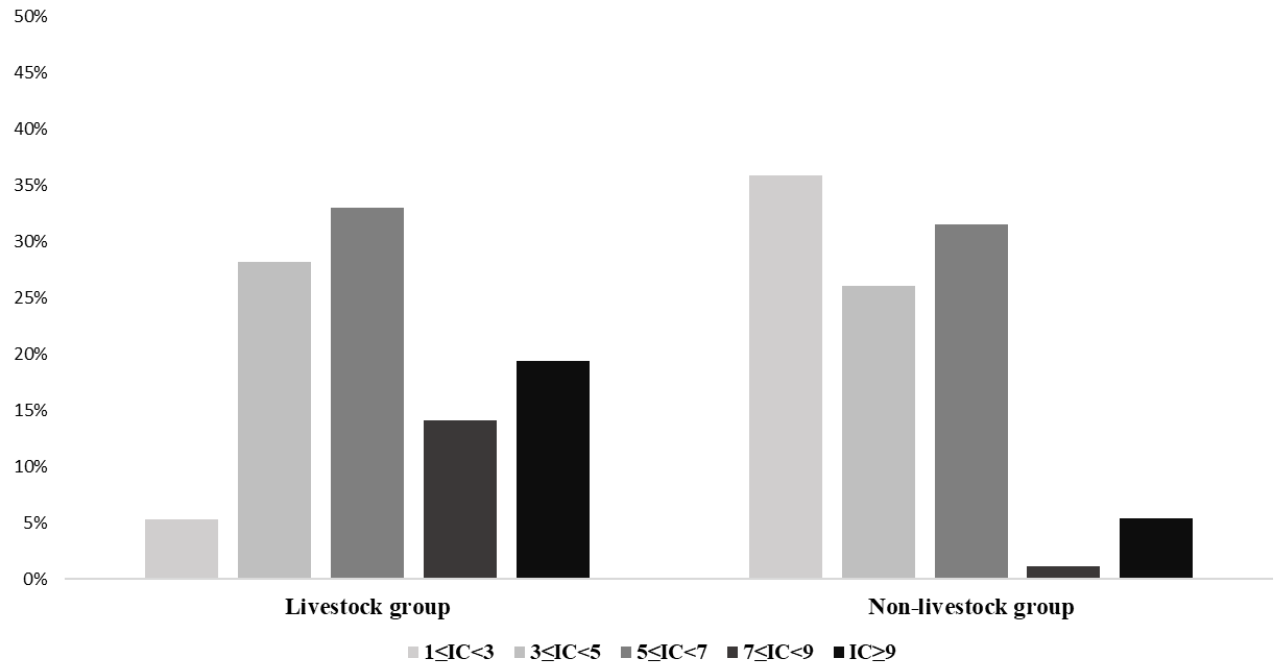

Figure 25. Income range (IC, Mil. VND) of the two groups

Residents of the study site engage in five principal economic activities (Figure 26). The percentage of residents who raise livestock is 69%, with livestock income contributing considerably to the total income of each household (mean = 28.4%, Figure 27). The livestock group implements waste separation and uses waste as livestock feed. Figure 28 presents the contribution of WSB (money saved from using waste as livestock feed, ranging from 0 to 0.2 million VND6) to the total income from livestock. Residents of Thua Thien Hue own large gardens (spanning 15 to 2500 m2), which is an advantage for people living in rural areas compared to urban areas.

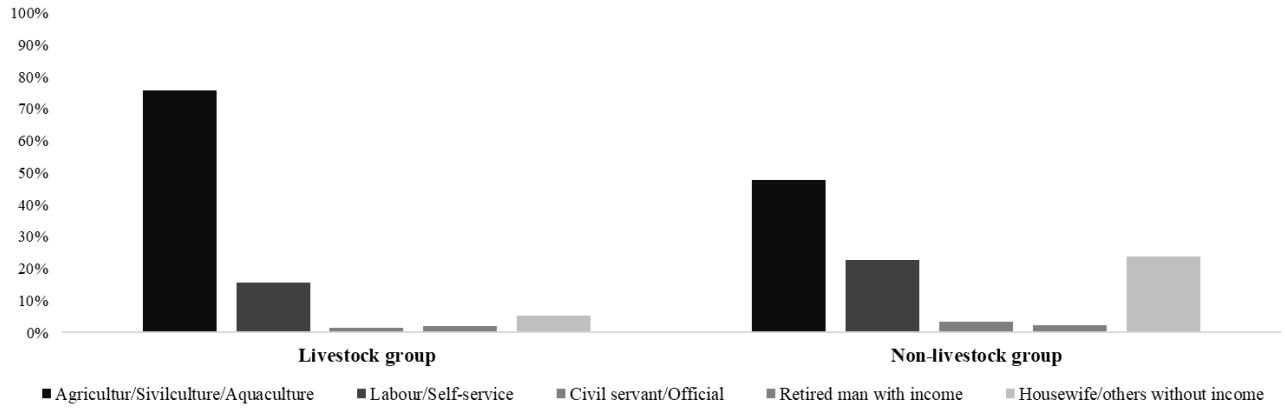

Figure 26. Occupational categories of the two groups

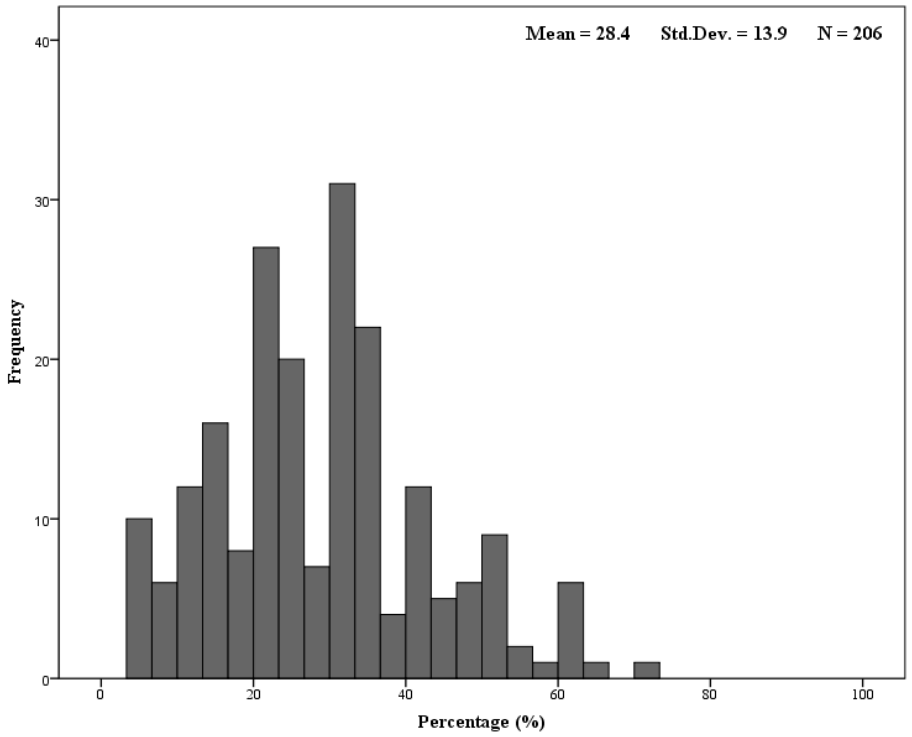

Figure 27. Contribution of livestock income to total income in each household

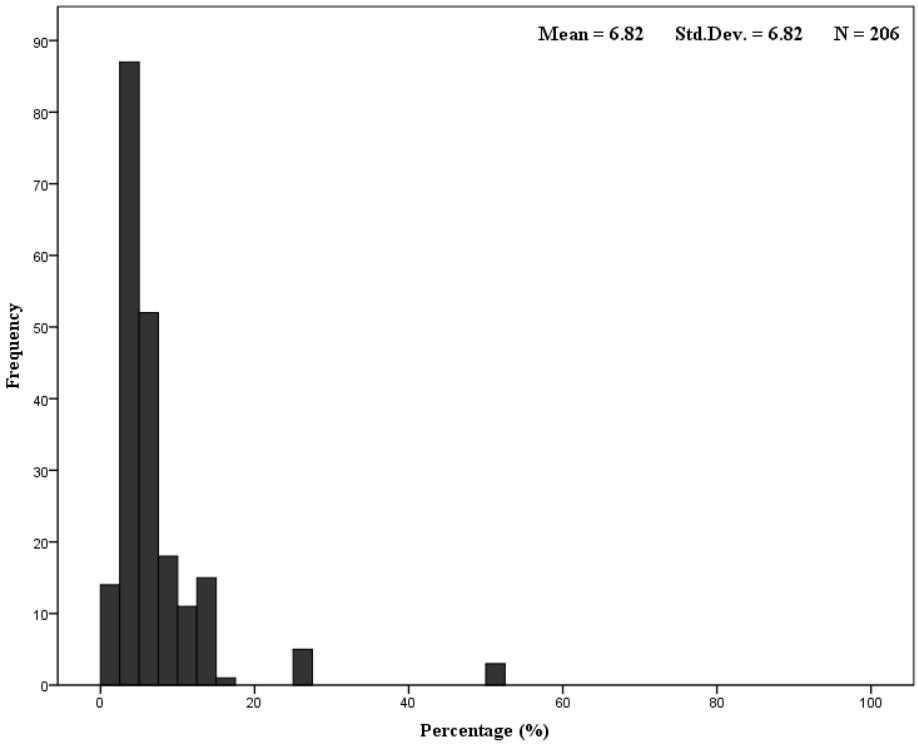

Figure 28. Contribution of money saved from waste separation to livestock income

4.3.2. Results of Reliability Coefficient Analysis and Independent Samples T-Test

An acceptable reliability coefficient must be higher than 0.7 (Ghani et al., 2013; Nguyen et al., 2015; Tonglet et al., 2004), which most of the variables in this work exceed (Table 21). As shown in Table 21, the coefficients of AW3 and P2 are lower than the recommended value, but these are acceptable given that variables with low reliability coefficients have also been used in the literature (Nguyen et al., 2015).

Table 21.Reliability coefficients of the variables with group factors

Variables	Factor group	Cronbach's alpha
AT	1. Waste separation at source is useful. (a) 2. It is necessary to carry out waste separation. (a) 3. I am interested in carrying out waste separation. (a)	.922
SB	1. My family members support me in my practice of waste separation. (b) 2. My neighbors support me in my practice of waste separation. (b) 3. Social organizations support me in my practice of waste separation. (b)	.807
AW1	1. I think that the over-generation of waste and disposal in landfills will cause serious environmental problems. (a) 2. I think that the waste problem poses a threat to my health and my family. (a) 3. I think that the risks associated with waste problems are true and serious. (a)	.774
AW2	1. Waste brings economic benefits. (a) 2. I have already saved money from my WSB. (c)	.795
AW3	1. I think that waste separation reduces negative effects on the environment. (a) 2. I think that waste separation helps reduce the disposal of waste in landfills. (a)	.698
P1	1. I feel that the surrounding environment is cleaner after waste separation. (a) 2. When waste separation is satisfactorily conducted, I believe that waste treatment fees can be reduced. (a)	.840
P2	1. Local authorities provide information on waste separation. (a) 2. Local authorities manage waste very well. (a) 3. Local authorities organize many activities focused on waste issues. (a) 4. Local authorities support facilities for carrying out waste separation. (a)	.676
P3	I trust in the waste management capabilities and policies of local authorities. (a)	*
WSB	1. Decomposed waste (d) 2. Food waste (d)	.778

*: Single statement

5-point Likert-scales for measured issues:

a: Strongly disagree, disagree, considering, agree, strongly agree

b: Strongly unsupportive, unsupportive, unsure, supportive, strongly supportive

c: Never, seldom, sometimes, often, always

d: Never separate (0 day), seldom separate (1 or 2 days per week), sometimes separate (3 or 4 days per week), regularly separate (5 or 6 days per week), always separate (7 days per week)

The data were prepared for comparison multiple regression tests, and a normality test was conducted. Table 22 shows that the skewness and kurtosis values obtained in the normality test fall between –2 and +2, thereby confirming that all the variables are normally distributed (Field, 2009; Gravetter and Wallnau, 2014; Trochim and Donnelly, 2006). The independent samples t-test was used to compare the two sample groups in terms of the variables and determine whether a significant difference exists between their mean values (Gaur and Gaur, 2009). The comparison of the mean and standard deviations of the dependent and independent variables with their p-values is presented in Table 22.

Table 22. Summary of survey responses to Likert-scale questions and p-values from the independent samples t-test

Factors		Total number of respondents (N = 298)		Livestock group (N = 206)		Normality test		Non-livestock group (N = 92)		Normality test		p-value
		Mean	S.D	Mean	S.D	Skewness	Kurtosis	Mean	S.D	Skewness	Kurtosis	
AT - Attitudes toward waste separation		3.69	1.41	4.55	.44	–.94	.67	1.77	.98	.86	–.07	.000
SB - Subjective norm		4.27	.70	4.62	.26	–.16	.15	3.47	.67	–1.25	.64	.000
AW1 - Awareness of the negative impact of waste		4.07	.58	4.35	.46	–.62	–.38	3.43	.40	.92	–1.18	.000
AW2 - Awareness of private benefits		2.95	.83	3.26	.59	.33	.96	2.27	.84	–.00	–1.34	.000
AW3 - Awareness of common benefits		3.46	.82	3.84	.50	–.11	.24	2.63	.83	–.56	–.53	.000
P1 - Perception of encouragement of waste separation		3.37	1.09	3.94	.58	.29	–1.1	2.09	.97	–.08	–1.36	.000
P2 - Perception of the role of local authorities in waste management		3.44	.34	3.44	.34	.01	–.52	3.46	.34	–.76	–.10	.686
P3 - Trust		4.60	.53	4.60	.52	–.71	–.81	4.63	.53	–1.15	.36	.616
C-Ga – Category of gardens		-	-	-	-	–.80	–.21	-	-	.60	–.74	-
C-Pi – Group of pigs		-	-	-	-	.96	.72	-	-	-	-	-
C-Chi – Group of chickens		-	-	-	-	-.75	.78	-	-	-	-	-
Mo – Money saved from using waste		-	-	-	-	1.19	1.13	-	-	-	-	-
WSB												
WSB	Decomposed waste	3.18	1.28	3.72	.93	–.74	.93	1.97	1.25	.80	–.49	.000
	Food waste	3.12	1.33	3.92	.60			1.34	.49			.000

4.3.2.1. Attitudes Toward Waste Separation

The respondents were asked to indicate their attitudes toward waste separation using the words "useful," "necessary," and "interesting." The mean attitudes toward waste separation is significantly higher among the livestock group than among the non-livestock group ($p < 0.001$, Table 22). In particular, the majority of the livestock group respondents (61.2%) strongly agreed with the statement "waste separation at source is useful." This finding can be explained by the group's livelihood activities as 69% of the households feed organic waste to pigs or chickens or both. Locals who feed livestock in this manner exhibit a strong passion for the use of waste for the animals that they rear. Among the livestock group respondents, 55.3% strongly agreed with the statement "it is necessary to carry out waste separation,"7 and 77.2% expressed strong interest in conducting waste separation.

4.3.2.2. Subjective Norms

A significant difference was found between the livestock and non-livestock groups with respect to the perception of support from family members, neighbors, and social organizations in the implementation of waste separation. Specifically, the respondents in the livestock group show greater concern for subjective norms than do the respondents in the non-livestock group ($p < 0.001$, Table 22). The majority of the livestock group respondents strongly agreed that they derive support from their family (97.6%) and their neighbors (73.8%), whereas none of the respondents in the non-livestock group have perceptions of support. The findings on the livestock group are consistent with those of Zhang et al. (2015), who reported that families' expectations regarding waste separation are higher than those of neighbors and the community.

4.3.2.3. Awareness of Waste and Waste Separation

The locals were asked about their awareness of the negative impact of waste through statements related to "serious environmental problems," "threats to the health of people and families," and the "truth about and seriousness of waste." The mean responses of the respondents reflected high awareness of the adverse effects of waste to humans and the environment (Table 22), indicating that the entire study community shares such awareness. The locals' awareness in this regard also pointed to their concern about the environment, which is a very important factor for waste separation (Tadesse, 2009). The mean awareness of the negative impact of waste is higher among the livestock group than

among the non-livestock group ($p < 0.001$, Table 22).

Similarly, the locals were asked about their awareness of the positive impact or benefits of waste and waste separation. For the purposes of this study, these benefits were classified into two types: (1) personal, individual benefits perceived as "economic benefits from waste" and "value of money saved" and (2) common, shared benefits recognized through the elimination of "negative effects on the environment" and "disposal of waste in landfills." A significant difference in the awareness of positive effects was found between the livestock and non-livestock groups ($p < 0.001$, Table 22). Most of the respondents in the livestock group stated that both private and common benefits can be derived from waste and waste separation (mean > 3.0, Table 22), whereas the majority of respondents in the non-livestock group do not share this sentiment (mean < 3.0, Table 22), although their awareness of common benefits is higher than their awareness of private benefits.

The comparison of the awareness of private benefits (AW2) and common benefits (AW3) within each group showed that the mean of AW3 is higher than that of AW2 in both groups. This finding can be explained by the tendency of the respondents to view the value of common benefits as being greater than the worth of private benefits. It is also consistent with the perceptions of the livestock group, wherein the money saved from the use of waste contributes minimally to the total income earned from livestock farming (Figure 27). In the non-livestock group, people emphasize concern for the more general and macro-level benefits of waste separation because they do not recognize or receive money from waste.

4.3.2.4. Perception

An important difference was found between the livestock and non-livestock groups as regards the perception of encouragement of waste separation. The respondents were asked to indicate agreement with statements about a "cleaner environment" and "treatment fees" after waste separation. The mean perception is higher among the livestock group than among the non-livestock group ($p < 0.001$, Table 22). The evaluation of the difference between the perception of encouragement of waste separation (P1) and the awareness of common benefits (AW3) within each group reflected the absence of a significant difference among the respondents in the livestock group (±0.1) but the presence of such difference among the respondents in the non-livestock group (±0.54). This result is attributed to the

issues to which the people in each group directed concern. That is, the non-livestock individuals regard the more general and macro-level benefits of waste separation ("reduces the negative effects of waste" and "reduces the disposal of waste in landfills") as more important than the encouragement of waste separation ("the surrounding environment is cleaner" and "waste treatment fees can be decreased"), as determined on the basis of their evaluation of the current waste separation ability/performance in the study site.

The independent samples t-test revealed that no difference exists between the groups in terms of perceptions regarding the role of local authorities (P2, $p = 0.686$) in waste management. The respondents were asked to express agreement with statements associated with information, organization, support, and management from local authorities and statements related to the trust (P3, $p = 0.616$) that the locals have in waste management policies (Table 22). The results indicated that the locals trust local authorities, as evidenced by agreement of 98% of the respondents with the statement "I trust in local authorities' waste management capabilities and policies." These findings also confirmed the effective interaction between the locals and authorities.

4.3.2.4. Waste Separation Behavior

Waste separation is an uncommon practice, and many projects related to this activity failed to build up WSB among people (Zhang et al., 2012). In rural areas examined in this work, however, the inhabitants engage in waste separation. First, decomposed waste is "regularly and always separated" by 54% of the respondents, and only 18.8% have never carried out such task. The livestock group practices waste separation to a significantly greater extent than does the non-livestock group ($p < 0.001$, Table 22). Because they raise chickens in their gardens, the households belonging to the livestock group dispose of decomposed waste in these areas to improve soil quality in the gardens (cao nương[6]) and provide feed for the chickens. They stated that they engage in this act because it is "natural" and "easy to do." The in-depth interviews showed that the locals do not recognize this habit as constituting WSB, but this behavior nevertheless represents "win–win outcomes," wherein the activity enables the use of waste both for economic and environmental purposes.

Second, food waste is "regularly and always" separated by 54% of the respondents, whereas 20.5%

[6] Local Vietnamese language

have never separated this kind of waste. The mean of food-related WSB is significantly higher among the livestock group than among the non-livestock group ($p < 0.001$, Table 22). Although "sorting at source is not a habit in Vietnam" (Truong, 2018), voluntary waste separation is the norm in Thua Thien Hue.

4.3.3. Multiple Regression Analyses of Independent Variables and Factors Influencing WSB in Each Group

Pearson's correlation coefficient was used to measure the strength of association between the independent and dependent variables (Table 23), after which such relationship was re-tested using the multiple regression models. The data for these tests were prepared (see Section 6.2), and then the variable selection was analyzed to reduce the number of independent variables to a manageable few. However, the hypothesis 2 that was based on the rural features situation indicated that all independent variables can be selected for testing. Therefore, the ENTER method of variable selection was adopted, after which the regression was set up and run. Assumptions of normality and independence were investigated. The results of the normality test are shown in Table 22. Multi-collinearity was examined on the basis of extracted variance inflation factors (VIFs) (Table 23). All the VIFs are less than 10, indicating that the independent variables exhibit acceptable multicollinearity (Hair et al., 2010).

The results of the multiple regression models indicated that four factors (attitude, awareness, perception, and socioeconomic factors) significantly affect waste separation performance in the livestock group, whereas only two factors (perception and socioeconomic factors) influence WSB in the non-livestock group.

In both groups, the ownership of a garden (C-Ga) is a significant and powerful socioeconomic determinant of WSB. For the non-livestock group, the multiple regression model was tested with and without the aforementioned variable. The difference in adjusted R-squared values explains the substantial importance of the C-Ga predictor (Table 23). In the study site, gardens are seen as both a place of storage and a convenient avenue for WSB. In response to the in-depth questions regarding this matter, the residents with large gardens (more than 100 m2) expressed feeling very comfortable throwing decomposed waste into their gardens. This behavior differs from but does not conflict with that observed by Ghani et al. (2013), who recounted that their study's participants also frequently

engaged in waste separation but that they disposed of their garbage in food waste bins at their homes and that convenience did not factor importantly in this behavior.

In the two groups, the trust of the locals in authorities (P3) is positively correlated with perceptions of WSB, consistent with the results of Nguyen et al. (2015) and Le et al. (2017). This result means that the respondents, whether raising livestock or not, tremendously trust local authorities, who are highly engaged in waste separation initiatives. It also confirmed that the residents perceive waste management by local authorities as effective. As verified in this work, trust in waste management initiatives is "a positive driving force behind the behavior" (Le et al., 2017).

In the livestock group, all the socioeconomic factors introduced in this work are significantly correlated with WSB, as hypothesized. The category of number of pigs raised (C-Pi) positively affects the locals' WSB; the greater the number of pigs raised, the more likely the residents perform waste separation. By contrast, the category of number of chickens raised (C-Chi) exerts a partially positive influence on WSB as only households that raise a small number of chickens tend to separate waste. This finding represents the actual situation in the studied rural areas, where chickens are raised (in garden group 2 or 3, up to 50 heads of chickens; Table 18) for household consumption, as a hobby, or to have some use for food waste. The amount of money saved from using waste (Mo) positively affects WSB; the greater the amount of money saved from waste usage, the higher the tendency of residents to engage in waste separation. This result implies that waste usage is considered a priority driver of the locals' WSB and aligns with the argument of Barr (2007) that "there is some fundamental value-based nature to some waste management behavior at least."

The two TPB-related constructs introduced in this work—awareness and perception—play equally important roles in the WSB of the livestock group. The awareness of the negative impact of waste (AW1) has a significant and positive correlation with WSB, indicating that the respondents with high awareness of such adverse effects (whether they raise livestock or not) have a greater tendency to practice waste separation. This contrasts with the results of Nguyen et al. (2015), who found that the awareness of consequence does not significantly influence the intention to engage in waste separation. This incompatibility in results can be partially explained by the difference in study contexts—one was conducted in a capital city where there is a good-quality waste treatment system, and the other was carried out in rural areas where waste abounds given the lack of treatment facilities. The findings,

however, are consistent with those of other studies (Ebreo and Vining, 2001; Tadesse, 2009) that discovered a positive relationship between the awareness of waste's environmental effects and waste separation. Verma et al. (2016), for instance, claimed that the lack of waste separation at source is due to the lack of environmental awareness among locals.

The Pearson's correlation analysis showed that the perception of encouragement of waste separation (P1) is non-significantly correlated with WSB (Table 23), and the multiple regression analyses indicated that P1 is negatively and significantly correlated with WSB. The partial correlations between P1 and WSB, as controlled by AT, AW1, P3, C-Ga, C-Pi, and Mo, were analyzed (Figure 29). The analysis reflected a p-value of 0.027 (non-significant) for the correlation between WSB and P1, denoting that such correlation is unaffected by AT, AW1, P3, C-Ga, C-Pi, or Mo. The correlation between P1 and WSB can be influenced by other variables. Furthermore, obtaining a high adjusted R-squared (>0.563) for the improvement of model prediction of WSB may necessitate considering other factors that contribute to effective WSB prediction. In the survey, certain phenomena were difficult to determine, such as the experience of livestock raising or family tradition.

Attitudes toward waste separation (AT) is significantly and positively correlated with WSB in the livestock group, indicating that livestock farmers who have positive attitudes regarding waste separation deliberately implement such practice. The positive attitudes were measured on the basis of their opinion that waste separation is useful and necessary and their interest in this activity. This result is consistent with the explanation of Ajzen (1991) about the TPB; the author averred that if individuals have positive attitudes toward a program, then their behaviors will be consistent with such attitudes. This finding was also confirmed by Le et al. (2017), who conducted their study in Hoi An, a city in central Vietnam. Contrastingly, attitude is not an influencing factor for WSB in the study of Nguyen et al. (2015), who conducted their study in the capital of Vietnam. The current study also differs from study carried out in Beijing, where residents exhibit negative attitudes toward WSB (Yuan et al., 2016). This difference can be explained by the type of study setting. The entirety of Vietnam is characterized by differences in economy and society between large and small cities and urban and rural areas. It is also very different from the rest of the world; as stated by Yuan et al. (2016), the remarkable characteristics of a metropolis such as Beijing include "highly-educated residents" with high income. Such attributes may influence attitudes.

Table 23. Pearson's correlation and results of multiple regression analyses

Independent variables	Pearson's correlation	Multiple regression analysis results for the livestock group (1)			Collinearity statistics	Pearson's correlation	Multiple regression analysis results with C-Ga for the non-livestock group (2)			Collinearity statistics	Multiple regression analysis results without C-Ga for the non-livestock group (3)			Collinearity statistics
		β	t	Sig.	VIF		β	t	Sig.	VIF	β	t	Sig.	VIF
(Constant)		–1.170	–1.599	.111			–1.246	–1.382	.171		.017	.012	.990	
AT	.419**	.275	2.663	.008	2.638	.466**	.059	.708	.481	4.152	.541	4.631	.000	3.121
SB	.294**	.199	1.552	.122	1.396	.181^{ns}	–.005	–.076	.94	1.788	.031	.270	.788	1.784
AW1	.157*	.403	5.278	.000	1.537	.253**	.229	.803	.424	1.532	–.195	–.427	.670	1.507
AW2	.347**	–.06	–.762	.447	2.769	.248*	–.044	–.583	.562	3.378	–.165	–1.356	.179	3.314
AW3	.193**	.005	.075	.94	1.246	.030^{ns}	–.031	–.487	.627	2.142	–.284	–2.893	.005	1.898
P1	.027^{ns}	–.326	–5.051	.000	1.797	.274**	.022	.345	.731	2.541	.025	.240	.811	2.541
P2	.125^{ns}	.000	.005	.996	1.166	.068^{ns}	.13	1.097	.276	1.291	.228	1.199	.234	1.284
P3	.328**	.320	5.241	.000	1.281	.178**	.168	2.079	.041	1.596	.329	2.549	.013	1.550
C-Ga	.436**	.230	8.913	.000	1.219	.852**	.394	11.591	.000	1.575				
C-Pi	.422**	.121	2.667	.008	2.198									
C-Chi	.078^{ns}	–.157	–2.872	.005	1.883									
Mo	.385**	4.218	3.463	.001	3.187									

*Correlation is significant at the .05 level (2-tailed), **Correlation is significant at the .01 level (2-tailed), ns Non-significant

(1) R = .767, R-squared = .589, Adjusted R-squared = .563, N = 206

(2) R = .873, R-squared = .762, Adjusted R-squared = .736, N = 92

(3) R = .610, R-squared = .372, Adjusted R-squared = .311, N = 92

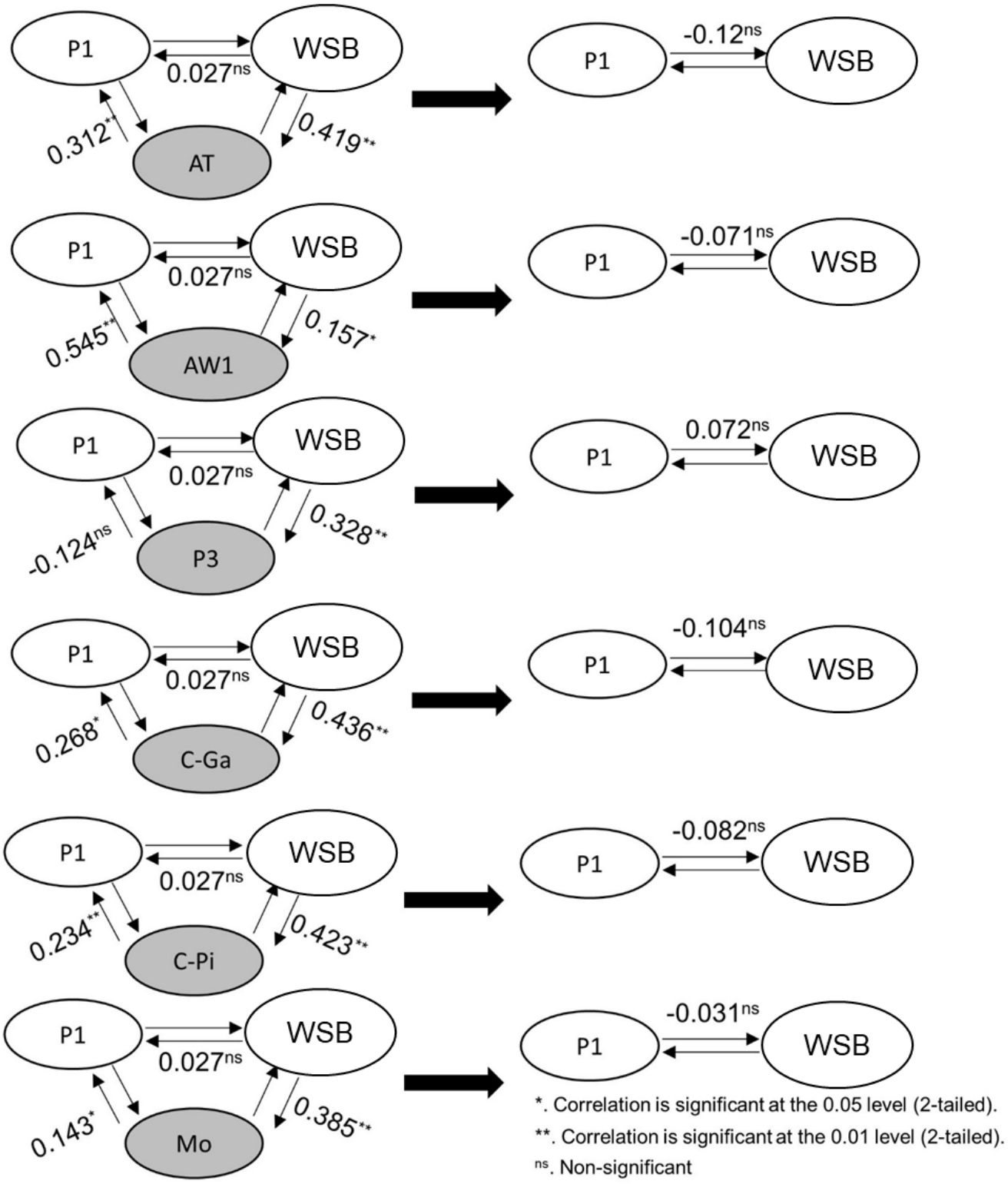

Figure 29. Partial correlation between P1 and WSB, as determined by other variables, and the effects of these variables

4.4. Conclusion

Back to the normal situation, without CCP, the differences between the livestock and non-livestock groups reflected the truth of the waste separation situation in Thua Thien Hue, Vietnam. As previously stated, the livestock group exhibits more positive attitudes toward waste separation, greater concern for subjective norms, a higher awareness of waste and waste separation, a stronger perception of encouragement of waste separation, and higher waste separation performance than does the non-livestock group. No difference exists between these groups on the matter of perceptions regarding trust in local authorities and their role in waste management. These findings shed light on the potential contribution of the factors that influence the WSB of the livestock group to the overall waste separation performance in the province.

The other findings affirmed that the TPB constructs introduced in this work effectively represent WSB in the study site. In both groups, the ownership of a garden and trust in local authorities are instrumental to potential for WSB. In particular, the presence of gardens remarkably explains the WSB of the non-livestock group. Meanwhile, trust seems to be a basic factor for improving WSB given the predilection of rural residents for close relationships in the community. In the livestock group, the socioeconomic factors (the number of pigs and chickens raised, money saved from using waste) and the two newly introduced constructs (awareness, perception) all significantly determine WSB. The number of pigs raised directly and positively affects the locals' WSB, and money saved from using waste serves as "leverage" and as a mediating factor. Although the amount of money saved is small, this factor positively and significantly contributes to WSB. In contrast to the number of pigs raised, the number of chickens raised exerts a partial positive influence on WSB, underscoring the need for a new approach to encouraging and supporting waste separation in households that do not raise chickens or rear many such animals. The results showed that awareness directly and positively determines WSB, whereas the findings regarding the role of perception in this respect were inconclusive and require further confirmation. The original TPB construct—attitude—was confirmed to play an important role in determining WSB.

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CHAPTER 5. DISCUSSIONS AND CONCLUSIONS

5.1. Discussions

There are three orientations: autonomous, controlled, and impersonal. The strong autonomous orientation results from ongoing satisfaction of all three psychological needs: autonomy, competence, relatedness. Meanwhile, the strong controlled orientation results from some satisfaction of the competence and relatedness needs but a thwarting of the need for autonomy. The difference between autonomous and controlled motivation is "autonomy" (Deci and Ryan, 2008a). In addition, these three psychological needs are influenced by social factors, especially autonomy and competence are completely determined by the social environment (Ryan et al., 2009). They promote the motivation of behavior. The social factors influence the behavior motivation indirectly, through these three psychological needs (Deci et al., 1991).

5.1.1. Residents in WSB Context

Three psychological needs of the residents in both Huong Xuan and Quang Tho were investigated based on the social environment, namely the culture of the rural areas and the conditions of CCP:

Relatedness: In the rural areas in Vietnam, the residents have the relatives' relationship. A Vietnamese village is a complex of many social organizations. One of these is the clan. The connections in the village belong to occupations, religious beliefs, neighbor borders, village administrative units, and relatives' relationship. Of which, kinship is the most sustainable. It can be said that the first village community is a collection of families (Phan, 2006). On the basis of this condition, the relationship among residents can be seen as a natural relatedness without any effort to establish compared to the residents who live in the urban areas. It inherits from the Vietnamese village culture (see Table 24). This is an advantage for many activities conducting in Vietnamese villages in the rural areas in Vietnam. With their nature relatedness, this psychological need is *"a free gift"* for them if they join in any activity of the project.

Autonomy: "Autonomy is a critical psychological need. It denotes the experience of volition and self direction in thought, feeling, and action. It refers to the perception of being self-governed rather than controlled by external forces" (Legault, 2016). "Thus, the autonomy orientation describes the tendency for behavior to be initiated and regulated by events internal to one's sense

of self and by events in the environment that are interpreted as informational" (Deci and Ryan, 1985). In Vietnamese villages, it is not too difficult to satisfy the autonomy of the residents. First, autonomy is itself an inherited characteristics of Vietnamese villages. The residents already have this psychological type since the villages were formed (see Table 24). Living in the villages in Vietnam, the residents feel and satisfy their autonomy need as the nature of Vietnamese village. It is due to their culture. Second, CCP gave them the satisfaction by giving them freedom to choose. There is no punishment for the households who didn't conduct WSB for composting. If they conducted this action, it was not from any pressure or threat, it was from their volition.

Community and autonomy are the two basic characteristics of the rural areas' villages of Vietnam, which constitute the nature of the relatedness and autonomy of the villagers in the society (see Table 24). Community is the association of members living in one village. Everyone is influenced by each other. This relationship is positive and extrovert. The result of community characteristics is a collective autonomous village: the villagers know each other very well. Each small village has its own informal law, so-called *"phép vua thua lệ làng",* which means "king's law is less important than village's law" (Them, 1999).

Table 24. Characteristics of Vietnamese village.

	Community characteristics	Autonomy characteristics
Function	Bring the villagers together	Determine the independence of the village
Nature	Extrovert	Introvert
Symbol	Temple gate, banyan tree	Bamboo
Effects	- Solidarity spirit - Equal democratic lifestyle	- Independent spirit - Diligent spirit - Self-sufficient lifestyle

*Competence: "*Competence is the psychological need to exert a meaningful effect on one's environment. It refers to the innate propensity to develop skill and ability, and to experience effectance in action" (Legault, 2017a). On the basis of the review of the organic waste separation, it is not too difficult for the residents to separate organic and non-organic waste. This is explained by their experience. First, the high rate of livestock raising households in the rural areas proves

about the understanding of organic waste, especially food waste. This is not new knowledge for the residents. Therefore, organic waste separation would be a familiar concept to them. It belongs to their experiences regarding their livelihood activities. When the residents conduct the organic waste separation, it cannot be said that they could feel awkward due to their lack of ability to separate. At least, they have the background knowledge of organic waste based on their experience of using food waste for their livestock raising. Second, information and knowledge can be shared among the residents due to their closeness in the same village. Third, CCP provided the information during courses to enhance their knowledge of organic waste for separation for composting. Therefore, the competence need could be satisfied for the residents.

In sum, on the basis of the culture of the rural areas as well as the conditions of CCP, all the psychological needs for the residents were given (Figures 29 and 30). Specifically, there is no rule of punishment in CCP. In CCP, the residents have freedom to choose whether they conduct WSB under the encouragement of the local authorities and assistance groups. This means that whenever they choose to act, they act volitionally, with their sense of their choice. Meanwhile, they feel satisfied about their autonomy because "autonomy means to act volitionally, with a sense of choice" (Deci and Ryan, 2008b). However, why did CCP fail in Quang Tho and cease in Huong Xuan after December 2017? Beyond the factors that were discovered, what motives initiated the failure?

In this case, SDT seems not enough to explain about the situations in both Huong Xuan and Quang Tho. In Huong Xuan, although it was successful in the later half year 2017, the residents were difficult to persuade to join CCP in the beginning. On the other hand, if we evaluate WSB in the view of win-win outcomes, we can see the success of waste separation in Quang Tho: for reducing waste entering to the landfill and for saving money for their livestock raising. It can be said that the failure of CCP in Quang Tho is the failure of the local authorities who accepted CCP for composting as their project. Again, CCP gave the freedom to choose, from the beginning for the local authorities.

In the book of Capitalism and Freedom, Milton Friedman (2002) wrote "Since the household always has the alternative of producing directly for itself, it needs not enter into any exchange unless both parties do benefits from it". In this case, the households who raised livestock did not recognize any profits from waste separation for composting. On the contrary, they use their waste for their livestock and get direct benefits. They did not join in waste separation for composting. They had an alternative for doing their own choice, because "In order for men to advocate anything, they must in

the first place be able to earn a living" (Friedman, 2002). This is consistent with the hierarchy of needs of Maslow (McLeod, 2020). They, the villagers in Quang Tho, conducted their behavior with organic waste separation to meet their physiological needs first. In this case, the profit coming from using waste for their livestock would bring them money that is indirectly satisfies needs of food and water. The research underlined the attributes of community by proving the role of livestock raising activity as an important activity influencing WSB. Specifically, attitude toward waste separation, subjective norm, awareness of private and common benefits, perception of encouragement of waste separation and waste separation behavior performance in the livestock group are all higher than those of the non-livestock group. Hence, livestock raising activity is closely associated with waste and waste separation's issues more than non-livestock activity. Specially, in the livestock group, the amount of money saved from using waste and the number of pigs raised are factors increasing the waste separation performance of the local people. Besides improvement of waste separation program, support of the livestock raising activity and optimization of using waste should be considered as an effective integration of economics and waste management policies. WSB is for composting, however, it is not appropriate in the community with a high livestock raising rate. The failure of CCP in Quang Tho was caused by a disparity between the local authorities' evaluations of waste management and the reality, indicating a lack of proper understanding of the residents, and lack of autonomy supports, leading to lack of autonomous motivation of WSB for composting of the residents, then resulting in low WSB. As previously explained, the strategy of policy implementation did not completely serve the residents' needs, composting means "*nothing*" for the livestock households. It can be said that the local authorities disregarded demands associated with the value that waste presented to livestock feeding. This oversight resulted in the promotion of activities that did not suit the practical situation in the livestock community. A critical point which must be considered is related to the demands of the locals, who did not profit directly from voluntarily carrying out waste separation for composting. The explanation in this case is to separate waste for their livestock raising which can help them satisfy the physiological needs (i.e., indirect way via saving money from waste use, Figures 29 and 31). From these basic physical needs, they conducted their waste separation with their satisfaction of basic psychological needs under the condition of CCP and the background of village culture. Of course, this action also meets their satisfaction of the three psychological needs described in SDT, especially autonomy without any punishment. Their choice is to separate waste for livestock raising, not for

composting for CCP. However, the problem in waste management in the livestock groups is to think of the type of organic waste other than food waste for livestock raising. Food waste separation for livestock raising is not enough requirement for the effective waste management. The other types of organic waste (i.e., non-food waste) is the source of pollution if it enters to the landfill. In fact, 84% of municipal waste is easily biodegradable organic waste in Thua Thien Hue province (Thua Thien Hue Provincial People's Committee, 2016). Of which, food waste is one component of the organic waste, for example only 38% of household waste is food waste in Hoi An, Vietnam (Hoang et al., 2017). Besides using food waste for livestock, other types of organic waste could be used for composting instead of entering to the landfill. Thus, there should make the policy to encourage the livestock group to separate waste for composting besides their WSB for their own livestock raising. Therefore, we recommend the soft methods for all the people who live in the rural areas in Vietnam.

5.1.2. Autonomy and Autonomy Support from Village Leader and Waste Collector to Residents in WSB

In SDT, autonomy is the most important part out of the three psychological needs in addition to relatedness and competence (Deci and Ryan, 2000; Gagné and Deci, 2005). Autonomy does not mean "independence", it is the voluntarily dependence of a person on the others (Ryan et al., 2005). According to Weinstein et al. (2012), there are three facets of the concept of autonomy: (1) Authorship/Self-congruence regarding the view of the individual experience of their behavior and fully assents to their actions; (2) Interest-taking referring to self-awareness; (3) Absence of external and internal pressure. Deci et al. (1994) claimed that there should be three interpersonal conditions necessary for individuals' autonomy: (1) providing a meaningful rationale, referring the verbal explanations that can encourage the individuals to understand the situation; (2) acknowledging the behavior's perspective, regarding the limiting of conflicts' feeling of others; (3) conveying choice rather than control with avoiding the conveying of "shoulds", "musts", and "have to's", instead by using the freedom of choice in communication in the phrasing. These communications are likely to convey autonomy support. The communications must help the listeners feel choice about doing the activity rather than feel enforcement. "But how, exactly, is the basic need for autonomy satisfied? Autonomy-supportive contexts facilitate the development and satiation of the need for autonomy by

offering choice and opportunity for self-direction. They nurture inner motivational resources, offer explanations and rationales, and use informational language rather than directives or commands. Autonomy supportive people work to align activities with the other person's interests and preferences" (Legault, 2016). This means that the assistance groups must learn how to convey the free choice communication to the residents. They should utilize the advantages of the nature of autonomy of Vietnamese villages, then promote the autonomy in waste separation behavior of the residents with rational comminutions.

An advantage found in this research is that the residents highly trust authorities—a possibility that was already confirmed by 98% of the survey respondents in expressing confidence in the waste management policy implemented in Thua Thien Hue. Trust between residents and local authorities is essential to the future success of waste management (Nguyen et al., 2015). This is a good basis for the local authorities processing their autonomy supports to the residents for the future success of waste management by faithfully supporting the village leader and waste collector.

5.1.3. Support from Local Authorities to Village Leader and Waste Collector

Regarding the three psychological needs of the village leaders and the organic waste collectors, the conditions of the rural areas and CCP already meet their three psychological needs. There is the same explanation of psychological needs of the residents. Legally, there is no pressure or punishment on the village leaders or waste collectors who don't join CCP. The evident is the village leader in Quang Tho did not join actively in CCP, then there was no punishment for him. They have freedom to choose to join CCP. However, the village leaders and the waste collectors could meet some trouble related to the relationship with their neighbors if their neighbors refuse to conduct WSB. Now the conflicts might appear. This reason made the village leader (Mr. V) feel "*headache*" as he reported.

CCP and the conditions of the rural areas provide the autonomy need for the participants automatically. Then, what is the autonomy support from the local authorities? Is the autonomy support from the local authorities necessary? Yes, it is! Because "Motivational autonomy is critically related to interest and engagement with the task at hand. Similarly, dispositional autonomy is related to psychological well-being – presumably because those high in dispositional autonomy tend to be self-congruent in their feelings, thoughts, and actions; that is, they select goals, activities, and courses of

action that are consistent with their fundamental needs and preferences. This process facilitates growth and self-integration (i.e., self-concordance or self coherence), and instead of perceiving their self-worth as contingent upon social approval and meeting expectations, autonomously functioning individuals feel free to express who they really are." (Legault, 2016). Although there is the autonomy nature which can meet the autonomy need for the village leaders and the waste collectors, they are still controlled "*softly*" by the local authorities. The village leader in Huong Xuan works under the People's Committee of Huong Xuan ward. The waste collector in Quang Tho is the employee of the People's Committee of Quang Tho commune. More or less, they need real support from the local authorities. Otherwise, they can fulfill their task with their reluctant sense. In this case, the autonomy need could not be fully met to their desire. The success of CCP in Huong Xuan sheds light on the potential factors for improving WSB. Those are autonomy supports (i.e., financial and verbal support). From a broader perspective, the role of local authorities was noticed by their autonomy supports. This is how they generated the autonomous motivation of the village leader and waste collector for their working of CCP. Their autonomous motivation is important to continue to generate the autonomous motivation of the residents for conducting waste separation with happiness and enjoyment, leading to its success in Huong Xuan. In this case, there is an agreement with the statement of Nigussie et al. (2018) "the participation should be voluntary, not compulsory". This finding is very important for waste management improvement and very helpful for the policy makers to notice about the roles of the assistance groups.

From our analysis, we provided the explanation about WSB of autonomous motivation generated by the village leader and the waste collector in Huong Xuan. The village leader and the waste collector are the elements who initiated the residents' behavior with their autonomous motivation in WSB. The important roles of these "heroes" must receive attention.

(1) Village leader – the representative of the community:

Some studies mentioned about the waste management improvement by highlighting the roles of organizations more than any persons, such as the important role of the private sector in waste management improvement (Ahmed and Ali, 2006), the significant role of NGOs in promoting waste sorting behavior among the people (Arantes et al., 2020). In this research, the village leader, one specific person, is the key to open the "heart" of the community in WSB. This is proven by the success of CCP in Huong Xuan. In this community, the village leader, with his efforts, helped and encouraged

the residents to enjoy conducting the organic waste separation. However, he and his companion – the organic waste collector – must stop their working due to the ceasing of the support of the local authorities. This situation happened reasonably. He himself could not bear all the responsibility of the two-persons working. Therefore, the authorities are responsible for the success or the failure of the waste policy implementation in the state of having effective solutions for waste management.

(2) Waste collector:

"Waste collection is known as a stressful and physically demanding job in low/middle income countries" (Ziaei et al., 2019). Waste collectors are faced with a variety of occupational health and safety hazards such as physical, mechanical, biological, and psychosocial (Zolnikov et al., 2018). In the study of Ziaei et al. (2019), "waste collectors reported low level of decision latitude and social support". Meanwhile, waste collectors play a key role in the waste collection system. In CCP, the waste collector is significant in the duties of waste collection and CCP's information dissemination. Attention should be paid to the waste collector as the authorities of Huong Xuan had done in the period of July - December 2017. One of the reasons of the failure of CCP in Quang Tho is the discontent of the waste collector. In fact, lack of financial support for the waste collector in Quang Tho is one reasonable failure reason leading to her unproductive working "as a man's income increases [s]he finds [her]himself activiely wishing for and striving for things that [s]he never dreamed of a few years before" (Maslow, 1970). Combining with the waste collector's love of her village, income support can help the waste collector actively work for better environment for her village. According to Maslow (1970), before having the desires of psychological needs such as belongingness and love needs, man must fulfill their basic needs such as physiological needs and safety needs (Figure 30). He claims "it is quite true that man lives by bread alone – when there is no bread." In the case of the waste collector in Quang Tho, she must be both a waste collector and a farmer. She works very hard for her family life. Her salary in 2017 was 2.5 millions VND per month (equivalent to 108 USD per month) which just meets the monthly average income per capital in rural areas (General Statistics Office, 2017). Interviewing her, she indicates that her desire of financial support was necessary. In fact, satisfying the basic needs is very important for the potential to meet the higher needs of everyone (Maslow, 1970). Regarding the organic waste collector in Huong Xuan, he must cease his job due to suspension of financial support after December 2017. It is very hard for him to continue this task without thinking of his living demands. He is not rich enough to work without any payment.

Therefore, it is practically necessary to show high appreciation with special treatment for the village leaders and the waste collectors, *"the heroes"*, such as monthly financial subsidy and verbal encouragement. *"Soft method"* in this case is to focus on human resources – human-center. In the waste management system, there is still lack of attention to the true key persons who contribute their efforts and their heart to helping the environment improved. They live among the community so that they understand the practical situation more than anyone else. Financial support is to help them to meet the basic needs according to Maslow pyramid (Saul, 2020). Working in waste management, even only as a supporter, takes their time and their efforts so that they deserve to receive the tangible support as the autonomy support. In addition, they should be equipped by knowledge of waste and waste-related issues such as pollutions, health caused by pollutions in order to help the people enhance the awareness of waste problems.

Therefore, waste management policymakers should not only focus on hard factors such as infrastructure but *"show favoritism"* to the key persons, especially in the low level management such as village leaders, waste collectors and care about the residents' needs and feeling.

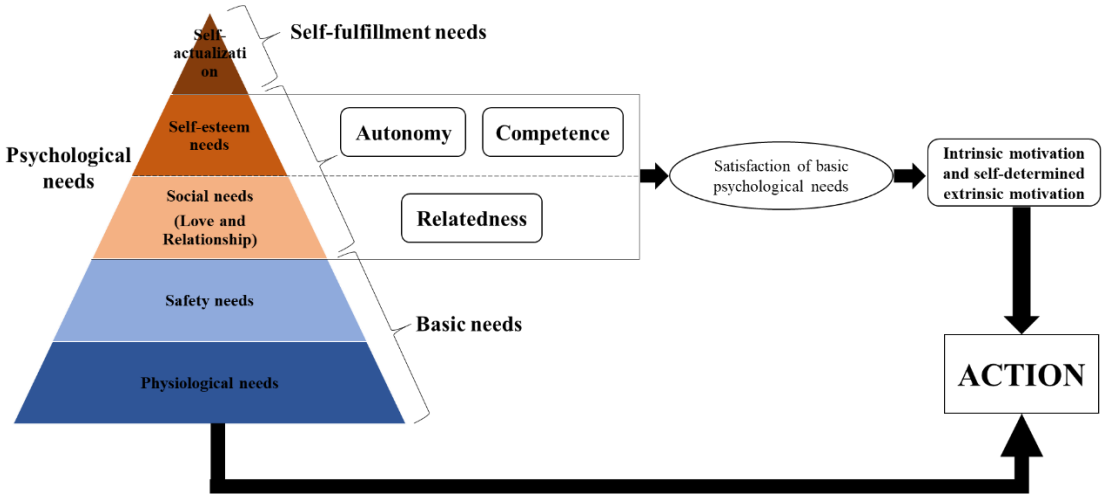
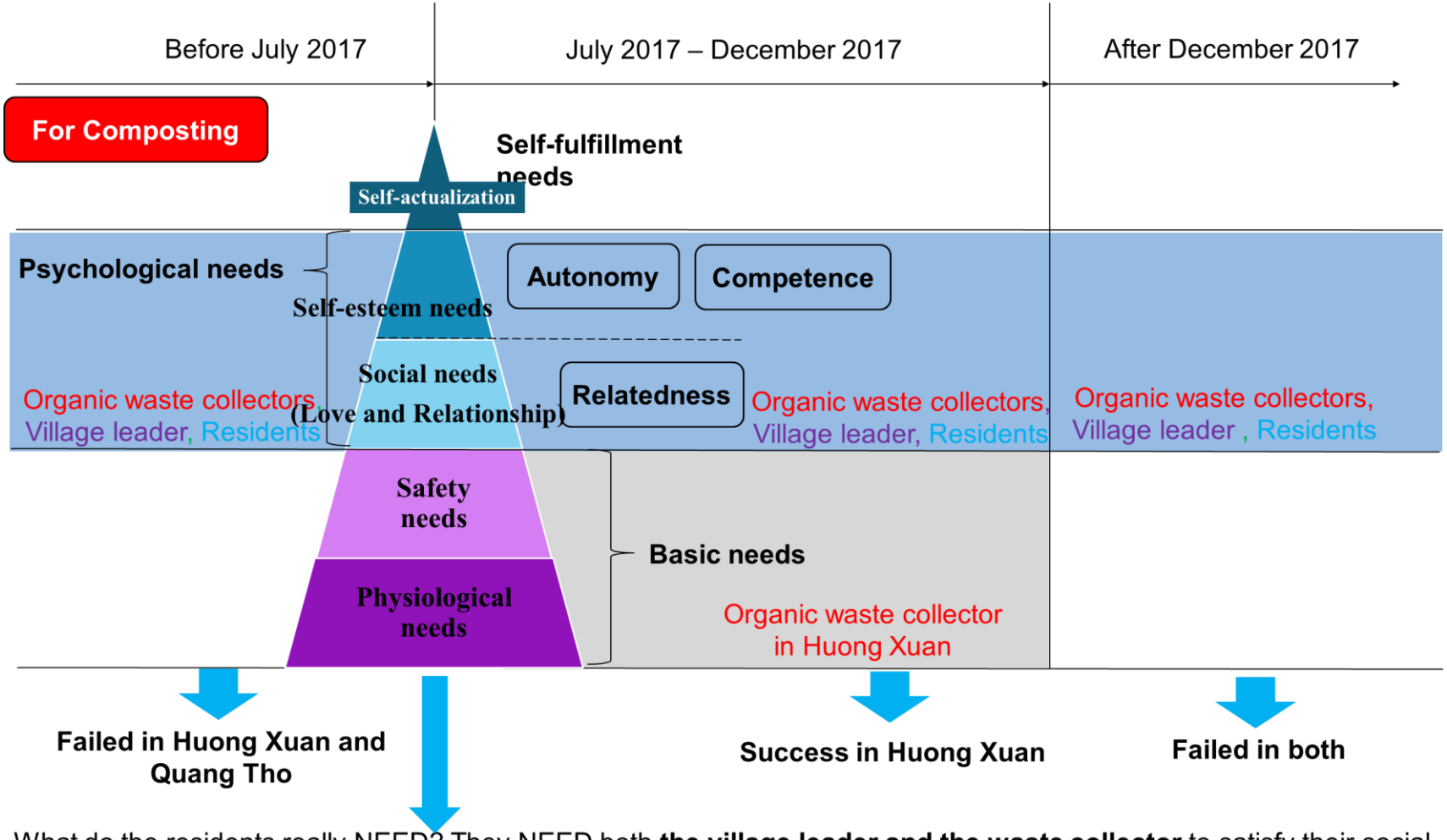


Figure 30. Needs for human, integration of SDT and Maslow's hierarchy modified from the knowledge of Legault (2017b) and Maslow (1970)

Furthermore, the above discussion gave the simple explanation of the satisfaction of the basic needs for the organic waste collector in Huong Xuan. Although CCP and the conditions of Vietnamese village culture provided the village leaders, waste collectors and residents all the psychological needs, the point is *"what do they really need?"* From the analysis result, the organic waste collectors need to satisfy the basic physiological need first. They can work for CCP with his efforts under his satisfaction

of the psychological needs (i.e., autonomy, competence and relatedness). Then, they with their autonomous motivation can encourage the residents to separate waste with their autonomous motivation. About the residents, on the analysis results, they need the waste collectors and the village leaders. These people brought them the real psychological needs, specifically social needs (e.g., relatedness). Figures 31 and 32 show the presentation of needs brought by CCP for composting and for livestock raising respectively.



What do the residents really NEED? They NEED both **the village leader and the waste collector** to satisfy their social needs (e.g., relatedness) in WSB.

What does the waste collector NEED? He NEEDs **the physiological support financially** to satisfy his basic needs in WSB.

Figure 31. Needs brought by CCP for composting

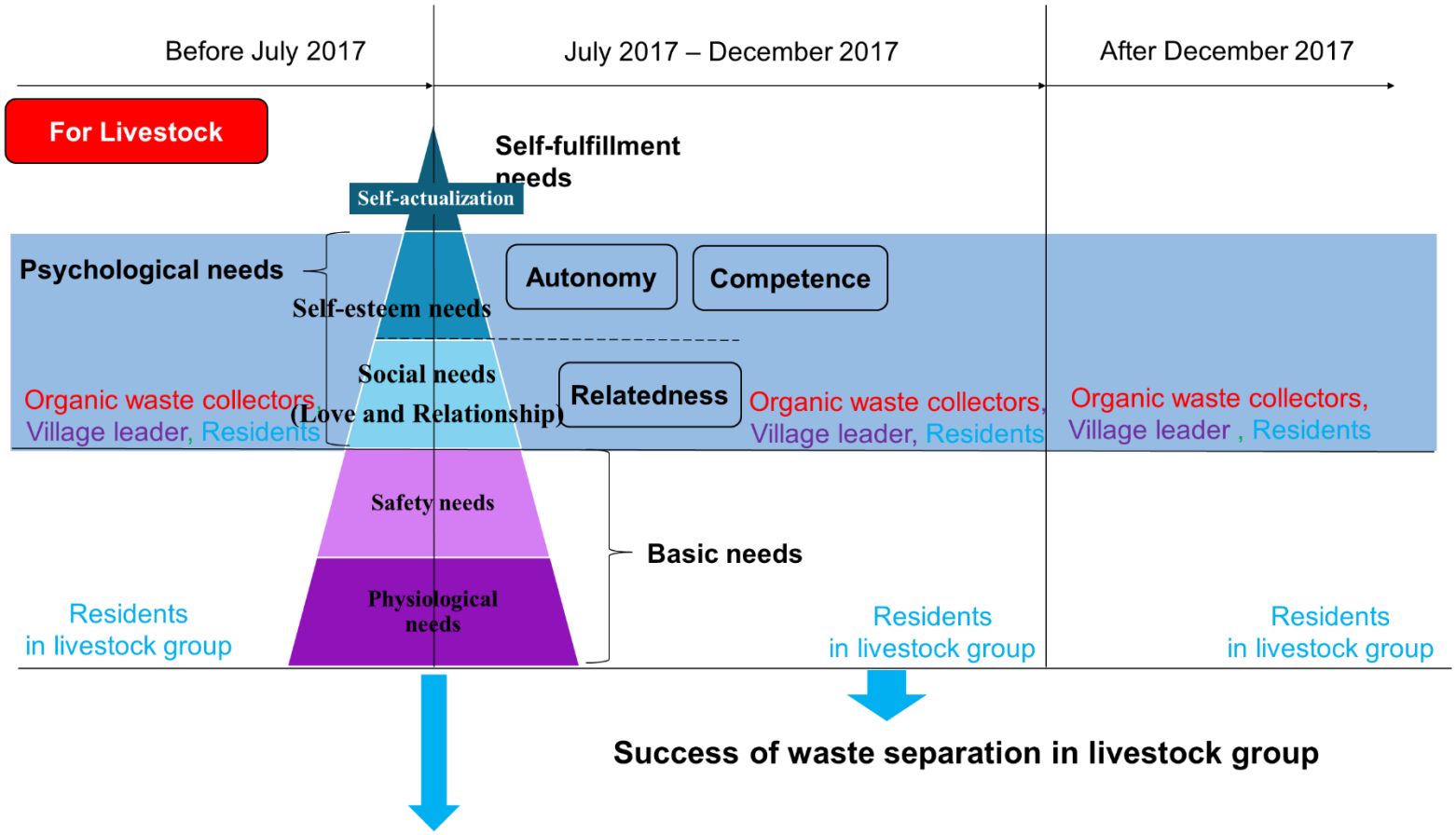


Figure 32. Needs brought by livestock raising

5.1.4. Notable Recommendations

From the above discussions, human-centered support is necessary in the waste management, with:
(1) Providing the autonomy satisfaction to the residents and the assistance groups (the village leaders and waste collectors);
(2) Concerning the basic needs of these participants.

The public-private partnership could be a good approach for the future long-term benefits in waste management. The local authority is the representative of the government one the public side. The assistance group might be the private side. Their working serves the residents. According to Forsyth (2005), "public–private partnerships in environmental policy should not simply be viewed in instrumental terms as means of providing environmental infrastructure and services, but also as sites where norms of environmental concern and political accountability are formulated and replicated.". Hence, the government should consider this approach.

5.2 Propositions

This dissertation sheds light on the situation of rural areas in waste management. Four objectives were obtained to contribute insight to waste management in Vietnam and all over the world.

Core findings:

First, autonomy supports given by the local authorities and assistance groups decided the autonomous motivation of the residents in WSB. This is the key success factor of the waste practical project.

Second, the roles of village leader and waste collector are very important in the project waste implementation.

Third, the importance of livestock raising in WSB: in the livestock group, attitude, subjective norm, awareness of waste and waste separation, and perception of encouragement of waste separation and waste separation performance are all higher than those of in the non-livestock group.

Fourth, rural areas or undeveloped locations were affirmed to value waste separation, which is a

voluntary action in these regions because of their engagement in livestock raising activities. Contributory to this engagement, as well, are special rural characteristics, such as a sense of community (close, open-hearted, and trusting relations among people) and the inheritability of lifestyle.

The results of this research are summarized and presented in Figure 33.

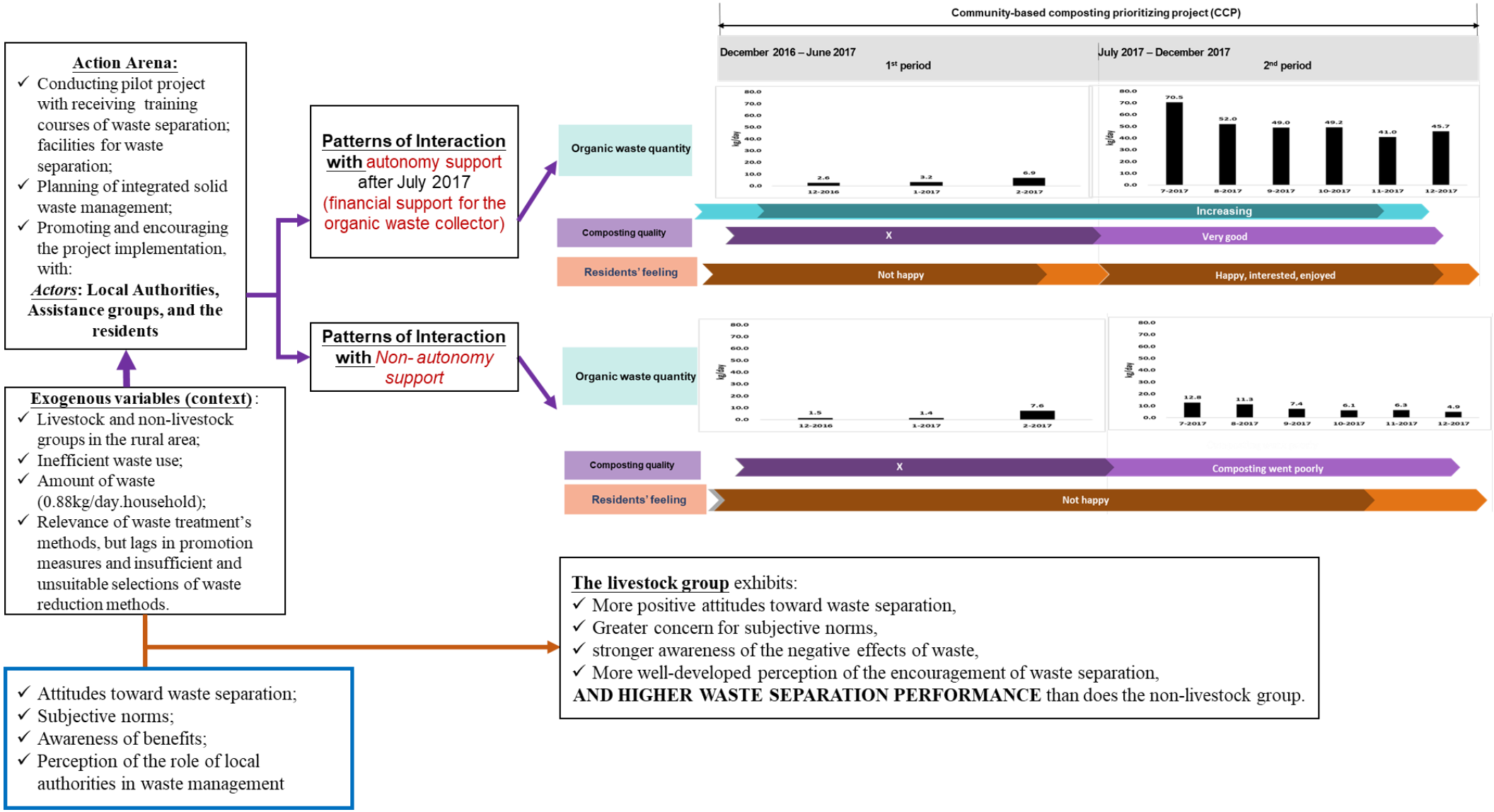


Figure 33. Results of the research

Theoretical contributions:

First, the successful introduction of integration of SDT and TPB into IAD framework was used to analyze the policy implementation, the waste-related projects, and the waste management in order to determine the "soft" factors influencing the success of this type of project.

Second, new constructs were successfully introduced to TPB, which are the characteristics of rural areas: livestock raising and garden ownership.

Practical contributions:

Waste management based on community could contribute to waste management improvement for the managers. Management from theory (i.e., policies) to practice (i.e., practical projects) should be carefully pondered. In rural areas, the managers should think of more appropriate solutions based on the actual situations. It is clear to see that benefit is essential for the people, especially money is very important to the poor people in the poor areas. Money saved directly from waste separation positively impacts the people's WSB. Based on this practical situation, the policy makers should focus on ways to increasingly encourage the people's WSB in livestock areas. One potential approach for the best practice of municipal solid waste management is to shift attitudes regarding waste toward a resource or income generation approach. The authorities might consider supporting households for their livestock raising by funding them for increasing their number of livestock (e.g., number of pigs) along with awareness enhancing campaigns. From this view, a "win-win outcome" might be created, both for the environment and for humans.

This dissertation especially proposed an approach in waste management in the undeveloped locations in developing countries where there is a lack of material conditions for waste management (e.g., limitation of technology or finance for supporting livestock raising). It is the focus of autonomous motivation of the residents by autonomy supports to the key persons in the waste management system. Sadly, autonomous motivation and autonomy supports had been rarely mentioned in waste management. The key persons (i.e., village leaders, waste collectors) can generate the autonomous motivation of the residents. They themselves could be the knot which can help to solve the "tangle" of waste problems in rural areas in developing countries.

The findings could be of interest to:

- ✓ Policy decision makers, who are trying to improve polices for better managing waste in Vietnam.
- ✓ Local authorities, who directly manage the projects/programs regarding waste management and need to know about how to fulfill the waste-related projects/programs successfully.
- ✓ Social organizations and waste collectors, who directly implement the waste-related projects/programs, and who want to show their desire to fulfill their task successfully.
- ✓ Waste-related issues scientists and researchers, who are seeking solutions for improving the WSB and waste management.

5.3 Recommendations for Future Research

Although this research was carried out with the efforts of the authors, there are limitations which are suggested for future studies. The suggestions are as follows:

There are not many studies of waste in rural areas, especially the factors influencing WSB. Besides the socioeconomic characteristics related to the typical characteristics of rural areas, other characteristics of these areas might be new constructs in TPB, which impact the waste-related behavior such as community nature, relationship among the rural people, and inheritability of their ancestors. In addition, this research could not cover all factors that influence WSB. Future studies should incorporate these factors as additional constructs in a TPB-based analysis of engagement in waste separation.

The comparison in this research was restricted within a rural area. Other researchers can expand this work by comparing WSB of rural and urban residents to ascertain specific conditions that are conducive to improving waste separation and waste management in an entire country.

This dissertation conducted a prototype model (i.e., comparison of livestock and non-livestock groups) in rural areas in Vietnam, a developing country. It should be extended in rural areas in other developing countries and in developed countries.

Future research should apply the approach of the adapted IAD framework with SDT in analysis of waste-related projects in other regions (e.g., urban areas) in other countries (e.g., developed countries) with different social conditions.

The case study in this dissertation offers insights on paying attention to key actors (i.e., waste collectors and village leaders) in waste management in Vietnam. This attention should be considered in another country.

Village leaders and waste collectors are the key actors in project success. Future studies should emphasize the characteristics of village leaders and waste collectors in searching for the appropriate key actors for successful projects.

Finding other factors influencing project success should be identified in the future studies.

New approaches for public-private partnership should be studied for future application in waste management.

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