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Antecedents to Creating Shared Value at Thai Waste-to-Energy Facilities

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ABSTRACT

In 2015, 1.2 billion people, or 16% of the global population, did not have access to electricity. Simultaneously, solid waste generation reached 200 million tons annually, and is projected to exceed 11 million tons per day by 2100. Solutions must hence be found, with Waste-to-Energy conversion a strong but controversial and costly contender. By use of cluster sampling, a sample of 361 individuals was obtained, from which a confirmatory factor analysis and structural equation model was undertaken using LISREL 9.1. All causal factors in the model were shown to have a positive influence on the creation of shared value of the Waste-to-Energy Power Plant and the local community, with 68% of the variance of the factor affecting the creation of shared value. Ranked in importance, the variables were government policy, the Waste-to-Energy operators and community participation, with a total score of 0.83, 0.37 and 0.36, respectively.

KEYWORDS

Advanced multivariate statistics, Confirmatory factor analysis methods, Corporate social responsibility, Energy policies, Structural equation model.

INTRODUCTION

Outside the United States capital of Washington D. C., an energy-from-waste plant has been operating since 1988, burning 350,000 tons of municipal waste per year at more than 1,700 degrees Fahrenheit (927 °C) and providing "clean burn" electricity to 20,000 homes, while feeding 23 MW of electricity into the grid [1]. This facility, however, is not alone in the United States, as in 2016 there were 86 Waste-to-Energy (WtE) facilities in the United States, providing 2,700 MW of clean electricity to an estimated 2 million homes.

In Singapore, the USD 473 million, TuasOne Plant is the sixth, newest, and largest WtE plant for the island nation and is designed to process 3,600 tons of waste per day, while generating 120 MW of energy. Expected to come online in 2019, Singapore is also

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achieving a recycling rate of 60%, landfilling only 2% and sending the remaining 38% for WtE [2].

Thailand, is also making inroads in WtE and has laid out the framework for the increase in production from the present 44.324 MW, to 160 MW of power and 100 ktoe of oil equivalent of thermal energy by 2021. The Thai 10-year (2012-2021) Alternative Energy Development Plan, aims to boost alternative energy usage to 25% of Thailand's total [3]. Of the current capacity, 22.23 MW are produced from gas at landfill waste, 20.06 MW from incineration and gasification, 2.034 MW from biogas generated through waste digestion.

In Pakistan, Safar *et al.* [4] stated that about 8.43% of Pakistan's present energy demand could be met from municipal solid waste. In Malyasia, Sadeghi *et al.* [5] indicated due to Malaysia's climate conditions, there is a significant effort being made in agricultural WtE conversion technologies in order to develop sustainability, with the main agriculture source for energy production potentially coming from palm oil biomass waste. Financial viability, efficiency and air pollution of incineration plants must be studied holistically, however, particularly due to its humid climate. However, in Malaysia, there is also an intense debate about waste-to-energy technologies, with each side making strong arguments for, or against the technologies.

However, when it comes to economic and environmental performance, it's often hard to exceed in one without impacting the other [2]. In the Philippines, WtE discussions are tense, as waste incineration is banned due to the Philippine Clean Air Act and the Ecological Solid Waste Management Act [6]. President Rodrigo Duterte, however, is considering the adoption of WtE facilities in the country and legislation was introduced in September 2017 to repeal the Clean Air Act, but some think this may not be such a good idea [7].

PROBLEM STATEMENT

In 2015, an estimated 1.2 billion people, or 16% of the global population, did not have access to electricity [8]. At the same time, solid waste generation rates are rising fast, on pace to exceed 11 million tons per day by 2100 [9]. WtE conversion, however, is a possible solution to both problems, and is now reported to be a USD 29 billion industry globally [10]. However, what constitutes "WtE", is an ongoing debate with many municipalities around the world wary of WtE implementation due to toxic incinerators being marketed as WtE Power Plants. This study therefore set out to explore how communities around five existing WtE Power Plants in Thailand perceived Government Policy (GP), their community's participation and the creation of shared value by the local WtE facilities.

LITERATURE REVIEW

At a very basic level, the success of a company or organization and the health of the communities around it, are closely intertwined. Therefore, the researchers chose to explore related theory concerning how a process of creating shared value and Community Participation (CP) affect WtE Power Plant operations. Additionally, how does GP, and the related multitude of regulations and laws contribute or hinder a WtE Power Plant's ability to operate successfully was additionally explored. The following discussion is an overview of these concepts.

Government Policy

The People's Republic of China (PRC) in February 2005 made one of largest state-sponsored commitments toward renewable energy, as the country adopted the Renewable Energy Law which encompassed directives addressed to the management of

solid wastes. By 2013, the PRC was operating 166 WtE plants, converting over 30% of the nation's Municipal Solid Waste (MSW) to energy [11].

Under Thailand 4.0 [12], renewable energy has been stated to be a key foundation in the quest for the use of innovation in the reduction of imported fossil fuels according to the government's 2015 Power Development Plan (PDP 2015). Government policy statements have also indicated that fossil fuels are not only economically and ecologically unsustainable, they also expose the Kingdom to the unpredictability of global commodity markets [13].

As a component of PDP 2015, the Thai government also released the Alternative Energy Development Plan 2015 (AEDP 2015), which prioritized power generation from waste, biomass and biogas, increasing alternative energy capacity from 7,279 MW in 2014 to 19,635 MW in 2036 [13].

This is consistent with a World Bank study in which it was stated that because solid waste management is highly visible and affects residents' perception of government functionality, government and its political representatives are also stakeholders [14]. Research from Nigeria supports this as it was stated that the establishment of a WtE facility was overwhelming (92.8%) viewed as a benefit to the community, when compared to the existing burning of waste in open landfills. The researchers also stated that community acceptability is additionally conditional on the promotion of it through community education, advocacy, and social marketing [15].

This was consistent from a United Kingdom (UK) study in which Pidgeon *et al*. [16] went on to explain the difficulties of science communication challenges involved when designing and conducting public deliberation processes on future energy system issues of national importance, although resource intensive, national-level deliberation is possible and can produce useful insights both for participants and for science policy.

Park [17] examined renewable energy related regulations, programs and financial incentives in 48 US states existing between 2001 and 2010. From this, it was stated that authoritative approaches are more likely to be effective in the governmental intervention toward a pre-existing market, although information instruments and citizen participation became important in the power industry in the 2000s.

Yi and Feiock [18] also indicated that renewable energy development in the US is influenced by regulatory institutions, party affiliations, legislative professionalism and the policies they implement.

MacArthur [19], however, took a more positive view on Canadian and Danish citizen engagement in policymaking and indicated that it represents an increasingly popular mechanism for both civic rejuvenation and environmental policy innovation. The research stated that it empowered the public and led to the design and implementation of more effective solutions to complex social and environmental problems.

From the above theories and scholars' concepts of GP, the following three items were therefore placed into the research framework, which included:

- Policy Formulation (PF);
- Policy Implementation (PI);
- Troubleshooting (TR).

From this, the following hypotheses were developed:

- H1: GP positively influences WtE Power Plants;
- H2: GP positively influences CP;
- H3: GP positively influences Creating Shared Value (CSV).

Community Participation

According to Thailand's Department of Alternative Energy Development and Efficiency [3], in order to promote energy-from-waste production, the government needs to run community campaigns to promote community participation, waste sorting

activities, and knowledge sharing with municipals, communities, the general public, and students to enhance understanding of waste management for environment and energy purposes.

This is consistent with research from Sadeghi *et al*. [5], which determined that one important parameter in increasing incineration plants efficiency is waste sorting at the source, which requires increasing the community's awareness and change in their attitudes concerning the environment.

In research concerning solid waste disposal in Uganda, it was established that because of the lack of public participation in solid waste management, the best way to start dealing with the problem was for the local government to educate the people concerning the value of proper waste disposal, while also involving them in the initial planning process [20].

From the above theories and scholars' concepts of CP, the following four items were therefore placed into the research framework, which included:

- Information (IN);
- Listening (LI);
- CP;
- Community Empowerment (CE):
  - H4: CP positively influences WtE Power Plants;
  - H5: CP positively influences CSV.

Waste to Energy Power Plant

Energy recovery from the combustion of MSW is a key part of the non-hazardous waste management hierarchy, which ranks various management strategies from most to least environmentally preferred [21].

According to the USEPA model, from the most preferred method to the least preferred are as follows:

- Source reduction and reuse;
- Recycling/composting;
- Energy recovery;
- Treatment and disposal.

The European Commission [22] modified this model somewhat and discussed:

- Prevention;
- Preparing for re-use;
- Recycling;
- Other recovery;
- Disposal.

It is important to note that for level 3 (recycling), anaerobic digestion of organic waste is suggested where the digestate is recycled as a fertilizer. At level 4 (other recovery), waste incineration and co-incineration operations with a high level of energy recovery along with the reprocessing of waste into materials that are to be used as solid, liquid or gaseous fuels is suggested. At the bottom of their upside-down pyramid, is level 5 (disposal), which consists of waste incineration and co- incineration operations with limited energy recovery along with the utilization of captured landfill gas.

WtE facilities can also generate a renewable energy source and reduce carbon emissions by offsetting the need for energy from fossil sources and reduce methane generation from landfills [1, 13]. In the European Union (EU), however, the EU Waste Acceptance Criteria (WAC) introduced strict limits on leaching that are difficult to achieve [23], but in spite of this, waste incineration has grown steadily and since 1995, the amount of municipal waste incinerated in the EU-27 has risen by 32 million tons or 100%, which in 2015 accounted for 64 million tons. Thus, municipal waste incineration has thus risen from 67 kg per capita to 127 kg per capita [24].

Where WtE processes are opted for, there is a need to ensure that the most efficient techniques are used, which thus far include [22]:

- Co-incineration in combustion plants;
- Co-incineration in cement and lime production;
- Waste incineration in dedicated facilities;
- Anaerobic digestion.

This process includes the upgrading of the biogas into bio-methane for further distribution and use (e.g. injection into the gas grid and transport fuel).

From the above theories and scholars' concepts of WtE Power Plants, the following four items were therefore placed into the research framework, which included:

- Waste Incinerator Pollution Control (WIPC);
- Ash and Dust Handling (ADH);
- Noise Pollution Control (NPC);
- Waste Water Quality (WWQ).

From this, the following hypothesis was developed:

- H6: WtE Power Plants positively influence CSV.

Creating Shared Value

According to Wójcik [25], CSV is a conceptual response to deficiencies in Corporate Social Responsibility (CSR), with CSV proponents seeing business activity through the value creation in both the economic and social dimensions. Porter and Kramer [26], would agree with this and further stated that instead of companies putting a wedge between their business and society, they could instead create "shared value" by generating economic value in a way that also produces value for society by addressing its challenges. Specifically, firms can do this in 3 ways: by reconceiving products and markets, redefining productivity in the value chain and building supportive industry clusters near their locations.

Therefore, energy poverty is one of the most obvious issues in CSV where energy companies can add value to society. And according to the World Energy Outlook report [8], an estimated 1.2 billion people, or 16% of the global population, do not have access to electricity.

In a report from the Singapore Environment Institute, components of CSV were discussed as the "5 Rs". These "Rs" are [27]:

- Refuse – Avoid buying unnecessary waste;
- Return – Return packaging materials to suppliers;
- Reduce – Reduce waste at the source;
- Reuse – Reuse everything that is possible;
- Recycle – Recycle any remaining waste streams.

This is consistent with European legislation in which 60% of all packaging put on the market had to be recovered. As a result, the landfilling rate compared with municipal waste generation, in the EU-27 dropped from 63.8% in 1995 to 25.3% in 2015 [24].

From the above theories and scholars' concepts of CSV, the following three items were therefore placed into the research framework, which included:

- New Product Invention (NPI);
- New Production Norms (NPN);
- Cooperative Groups Development (CGD).

Conceptual framework

Based on the above hypotheses and review of the literature, the researchers have developed Figure 1 conceptual framework which includes the causal relationships between GP, CP, WtE and CSV.

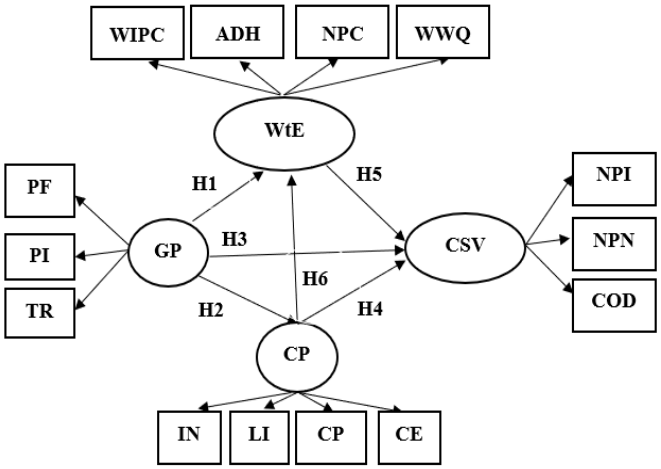

Figure 1. Conceptual framework

METHODS

The sample population or unit of analysis for this research included questionnaires obtained by cluster sampling between November-December 2016 from 361 community residents in five areas around existing waste management power plants at the Phuket Municipality's Waste Disposal Center (2 plants-140 respondents), at the Amata Nakorn Industrial Estate in Chonburi Province (74 respondents), in Saraburi Province (74 respondents) and the Bangpoo Industrial Estate in Samutprakarn Province (73 respondents).

Sample and data collection

The research method used a 63-item instrument to assess the four constructs in the CSV model. All questionnaire items used a 7-point agreement scale response format [28]. The questionnaire was administered to 361 individuals who were community residents in five areas in which waste management and power generation facilities were operating. The questionnaire was developed from the literature review and related theory and was constructed as a tool to measure concept definition and practice (Table 1).

Table 1. Summary of latent and observed variables

Latent variables	Observed variables (Figure 1)
GP	PF PI TR
CP	IN LI CP CE
WtE Power Plant	WIPC ADH NPC WWQ
CSV	NPI NPN CGD

Five experts determined the reliability of the questionnaire so as to ensure that the responses collected through the instrument were reliable and consistent. The five experts included the:

- Managing Director of Pracharat Samakkhi Petchaburi (Social Enterprise) Limited;

- Dean of Faculty of Engineering, Southeast Asian University;
- Secretary-General, Association for the Prevention of Global Warming;
- Director, Office of Natural Resources and Environment, Phitsanulok Province;
- Senior Executive Vice President, SPCG Public Company Limited.

A trial assessment of 25 questionnaires was conducted prior to the actual survey to determine questionnaire reliability and consistency. The reliability value was calculated by using Cronbach's Alpha (α) [29] to ensure internal consistency within the items. According to Best and Kahn [30], when interpreting α, it ranges from 0 to 1 and a value of ≥ 0.70 reflects good reliability. According to the pre-test, α averaged 0.836, indicating reasonable reliability [31].

Furthermore, the survey questionnaire was divided into two parts, with Part 1 consisting of four items concerning the community resident's personal information (Table 2), while Part 2 consisted of the actual questionnaire concerning the resident's views about the survey items. For this, Part 2 measured 59 items and was divided into four parts, with government policy consisting of 11 items, CP with 16 items, WtE with 12 items, and CSV with 20 items. Scale measurement made use of a 7-level Likert type agreement scale [28], with 1 indicating the resident strongly disagrees with the item's statement, while 7 indicated the resident strongly agreed with the item's statement. Therefore, from the seven levels of frequency, the interpretation of these responses was calculated by using the following formula:

$$\text{Interval} = \frac{\text{The highest score} - \text{The lowest score}}{\text{The number of interval}} \quad (1)$$

which was calculated for seven levels of frequency detailed in Table 2.

Table 2. Likert scale interpretation

Mean range	Likert scale interpretation
6.14-7.00	7 – I agree strongly
5.28-6.14	6 – I agree
4.42-5.28	5 – I somewhat agree
3.56-4.42	4 – I am not sure
2.70-3.56	3 – I somewhat disagree
1.84-2.70	2 – I disagree
0.00-1.84	1 – I strongly disagree

Statistical analyses overview

To test the proposed research model, the researchers adopted the survey method for data collection, whose hypotheses were examined by use of Linear structural relations (Lisrel) 9.1 for the collected data [32]. Measurement and data collection implies an evaluation of the measurement model, which for the study included:

- The individual item reliabilities;
- The model's convergent validity;
- Discriminant validity.

Individual item reliability was examined by looking at the loadings, or correlations, of each indicator on its respective construct. For reflective indicators, it is generally accepted that items must have a factorial load (λ) of 0.707 or above and all values have been statistically significant ($|t| \geq 1.96$), representing convergent validity of scales. This threshold implies that there is more variance shared between the measures and their constructs than there is error variance. The initial analysis indicated that elimination of some items would enhance the fit indices, with standardized residuals indicating significant cross loadings for several items being deleted if they exceeded 2.0. Reliability for the derived scale scores was also measured via internal consistency coefficient α [29].

Qualitative data analyses

Sample size suggestion usually depends on the complexity of the specified model, but typically ranges between 5 to 20 questionnaires per observed variable, with overall sample size preferred to exceed $n = 200$ cases [33]. Therefore, from the above and other reviewed theory, a ratio of 20:1 was deemed to be reliable. Thus, the study's sample size of 361 individuals for 14 observed variables ($14 \times 20 = 280$) was deemed to be highly reliable. All surveys were conducted face-to-face from 09.00-20.00 at the resident's home or local place of business. Deep interviews were also conducted with 10 executive level individuals from 3 April to 1 May 2016.

Confirmatory Factor Analysis

To access the measurement models, a Confirmatory Factor Analysis (CFA) is used followed by Structural Equation Modeling (SEM) to examine the general fit of the proposed model with data and to identify the overall relationships among these constructs [34]. Wong [35] also noted that for marketing research, a significance level of 5%, a statistical power of 80%, and R^2 values of at least 0.25 are considered normal. Standard modelling accepts the proposed model if the p value is higher than 0.05, and if the x^2/df ratio is less than 2 [36]. This is consistent with Kline [37] and Ullman [38] which also indicated that the relative Chi-square (x^2) should be less than two. Additionally, another common reported statistic is to use the Root Mean Square Error of Approximation (RMSEA), as a measure of goodness-of-fit in SEMs [39] and to measure the discrepancy per degree of freedom [40].

Hooper *et al.* [41] indicated that items with low multiple R^2 values (≤ 0.20) should be removed from an analysis as this is an indication of very high levels of error. Hair *et al.* [31], used higher criteria and suggested that the R^2 values should be greater than 0.25.

RESULTS

The respondents' characteristics (n-361) are presented in Table 3. After compilation of the data, it was determined that 50.14% were male, and 49.86% were female, with the majority or 34.90% between the ages of 31-40.

Table 3. Respondents characteristics ($n = 361$)

Respondents' characteristics	Frequency	[%]
Sex		
Male	181	50.14
Female	180	49.86
Total	361	100.00
Age		
less than or equal to 25 years	72	19.94
Between 26-30	109	30.19
Between 31-40	126	34.90
Over 41 years old	54	14.96
Total	361	100.00
Profession/Occupation		
Government service	11	3.05
Tradesman	52	14.40
Worker/Freelancer	164	45.43
Entrepreneur	20	5.54
Student	72	19.94
Monk	14	3.88
Other	28	7.76
Total	361	100.00
Educational level		
Junior high school	49	13.57
High school education	79	21.88
High-vocational certificate	64	17.73
BA/BS degree	132	36.57
Graduate school	25	6.93
Other	12	3.32
Total	361	100.00

Respondents' information (n = 361)

Table 4 shows that the factors that affect CSV, which includes:

- WtE Power Plant;
- CP;
- GP.

Interpreted results from the 7-point survey ranged from 4.71-4.83 [28].

Table 4. Mean and standard deviation and survey interpretation

Latent variables	Standard mean ($\bar{x}$)	Standard Deviation (SD)	Interpretation
CSV	4.79	1.26	I somewhat agree
WtE	4.73	1.22	I somewhat agree
CP	4.71	1.32	I somewhat agree
GP	4.83	1.35	I somewhat agree

Confirmatory Factor Analysis results

CFA analysis of the dependent and independent variables was built on the conceptual framework derived from the study of relevant documents and scholarly research (Figure 2 and Figure 3). By analysing the confirmatory components with the LISREL 9.1 program, x^2 was determined not to be statistically significant ($p > 0.05$), x^2/df was ≤ 2.00, RMSEA ≤ 0.05 and Standardized Root Mean square Residual (SRMR) ≤ 0.05. The Goodness-of-Fit Index (GFI) was also indicated to be 0.995, which shows good fit as it is higher than the suggested 0.90 by Hooper *et al.* [41]. Also, the value for the Adjusted Goodness-of-Fit Index (AGFI) was 0.986, which indicates a well-fitting model as its value is also greater than 0.90.

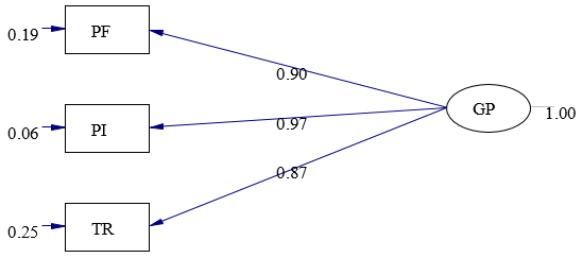

Figure 2. Confirmatory factor analysis of the external latent variable government policy $x^2 = 0.00$, $df = 0$, p value = 1.000, RMSEA = 0.000

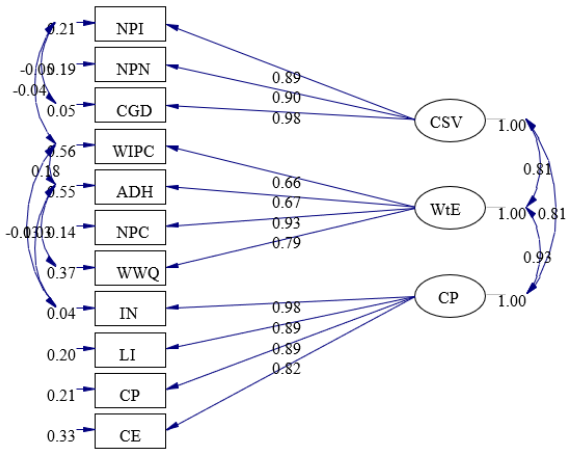

Figure 3. Confirmatory factor analysis of the internal latent variables $x^2 = 9.92$, $df = 23$, p value = 0.99175, RMSEA = 0.000, SRMR = 0.09, GFI = 0.995, AGFI = 0.986

Convergent model analysis

From the LISREL 9.1 analysis of the data, and the measurement of the four constructs and their hypotheses, it was determined that there was a good model fit with the empirical research data. Also, to assess the validity of a test, convergent validity and discriminant validity were used. In structural equation modelling, CFA is usually used to access construct validity [32]. Hair *et al*. [31] and Byrne *et al.* [36] indicated that factor loadings or regression weight estimates of latent to observed variables should have values greater than 0.50, which indicates that all the constructs conform to the construct validity test and validity convergence.

Results in Table 5 show that the x^2 value was 34.04, which had 44 degrees of freedom (*df*). Therefore, the ratio between x^2 and the *df* was equal to 0.774 when tested, which showed statistical significance as it was ≥ 0.05, which confirms the model's hypotheses are not different from the empirical data. Further confirmation was established as the results of the GFI equaled 0.987, and the AGFI equalled 0.969 [42]. The RMSEA was equal to 0.000. The SRMR was equal to 0.013. As SRMR is an absolute measure of fit, a value of zero indicates a perfect fit with a value of < 0.05 indicating a good fit [40].

Table 5. Criteria and theory of the values of Goodness-of-Fit (GOF) appraisal

Criteria index	Criteria	Values	Results	Supporting theory
x^2	$p \geq 0.05$	34.04	passed	[43]
x^2/df	≤ 2.00	0.774	passed	[36]
GFI	≥ 0.90	0.987	passed	[31]
AGFI	≥ 0.90	0.969	passed	[42]
SRMR	≤ 0.05	0.009	passed	[40]
RMSEA	≤ 0.05	0.000	passed	[40]
α	≥ 0.70	0.836	passed	[29]

The validated results are detailed in Table 6 and Table 7, as well as Figure 4.

Table 6. The correlation coefficient between latent variables (below the diagonal), reliability of latent variables (ρ_C) and the Average Variance Extracted (AVE)

Latent variables	CSV	WtE	CP	GP
CSV	1.00			
WtE	0.718	1.00		
CP	0.762	0.807	1.00	
GP	0.768	0.724	0.874	1.00
Construct reliability (ρ_C)	0.945	0.852	0.942	0.937
AVE (ρ_V)	0.852	0.595	0.803	0.832
$\sqrt{\text{AVE}}$	0.923	0.771	0.896	0.912

[*] Sig. ≤ 0.01

Table 7. Results of hypotheses testing

Hypotheses	Coef.	*t*-value	Results
H1: GP positively influences WtE Power Plants	0.02	0.22	Rejected
H2: GP positively influences CP	0.92	20.59[**]	Supported
H3: GP positively influences CSV	0.49	4.47[*]	Supported
H4: CP positively influences WtE Power Plant	0.90	7.65[**]	Supported
H5: CP positively influences CSV	0.03	0.19	Rejected
H6: WtE Power Plant positively influences CSV	0.37	3.25[**]	Supported

[*] Sig. < 0.05
[**] Sig. < 0.01 Critical ratios (*t*-values) more than 1.96 are significant at the 0.05 level
SE = Standard Error, CR = Critical Ratio (*t*-value)

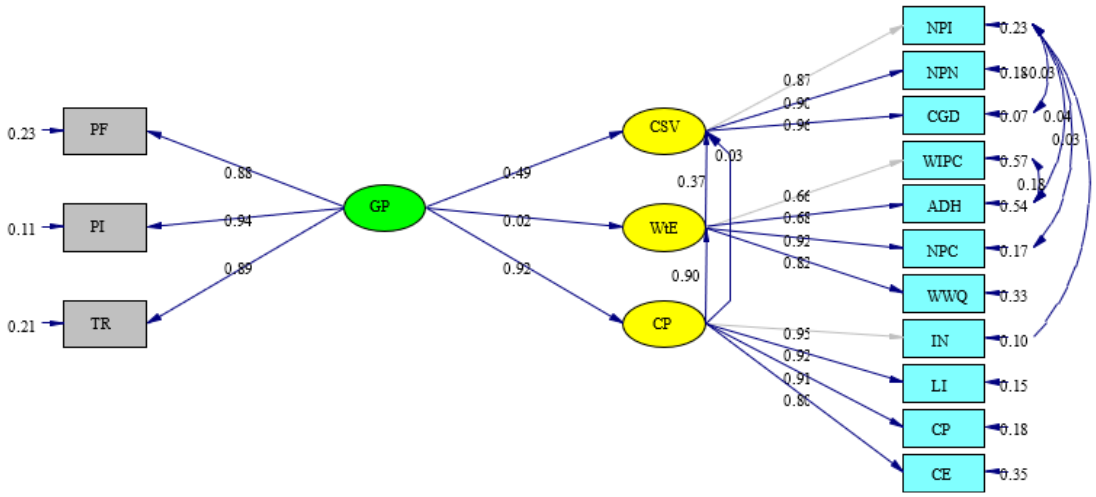

Figure 4. SEM final model with values from estimates (n = 361), x^2 = 34.04, df = 44, p value = 0.860, RMSEA = 0.000, SRMR = 0.013, GFI = 0.987, AGFI = 0.969

Table 8 shows the Direct Effect (DE), Indirect Effect (IE) and Total Effect (TE) of each construct. CSV is influenced by the direct and positive contribution of government policy the greatest, due to the total effect value of 0.83.

Table 8. Standard Coefficients of Influence on Causal Modeling of CSV by Community Waste Management Power Plants in Thailand

Dependent variables		Independent variables			
		R^2	GP	WtE	CP
CSV	DE	0.68	0.49**	0.37**	0.03
	IE		0.34**	-	0.33**
	TE		0.83**	0.37**	0.36**
WtE	DE	0.71	0.02	-	0.90**
	IE		0.82**	-	-
	TE		0.84**	-	0.90**
CP	DE	0.84	0.92**	-	
	IE		-	-	
	TE		0.92**	-	

* Sig. ≤ 0.05
** Sig. ≤ 0.01

Structural Equation Modeling results

Both Hooper *et al.* [41] and Hair *et al.* [31] discussed low R^2 values (≤ 0.20 and ≤ 0.25, respectively) and suggested that they be removed from the analysis as this is an indication of high error rates. The SEM results (Figure 4) showed that the model met the required criteria as the Chi-squared index was not statistically significant, p = 0.86, RMSEA = 0.00, GFI = 0.99, AGFI = 0.97 and SRMR = 0.01. All causal factors in the model were shown to have a positive influence on the shared value of the waste management power plant and the local community, with 68% of the variance of the factor affecting CSV (R^2). Ranked in importance, the three latent variables were GP, WtE Power Plant and CP, with a total score of 0.83, 0.37 and 0.36, respectively.

DISCUSSION

Results from the study showed that hypothesis H1 was not supported, and in Thailand, GP had an overall negative impact on WtE Power Plants. Contribution to this rejection was the lowest scores from the survey in which the observed variables dealing with PF, PI and TR, were calculated at 4.79, 4.82 and 4.90, respectively. Interpretation of the results seems to indicate that responsible agencies, at least in the eyes of the

community, have little ability for problem resolution. This is supported by research from Pornavalai [13], in which it was stated that policymakers need to balance aggressive renewable energy development, along with the welfare of the community and its citizens.

Hypothesis H2, however, was supported, which showed that GP has a direct positive impact on CP. This, however, is a tricky conclusion as what is defined as 'positive' to one group or interest, might be interpreted as a negative to another. There is no doubt that waste management power plants act a catalyst for community participation, but in countries were activist voices are allowed to be heard (such as the Philippines, the PRC and Malaysia), community participation can take on a negative tone (environmental issues and cost, etc.) when viewed by government or commercial interests [6, 44].

Results from the study also supported hypothesis H3 and showed that GP was determined to have had a direct (0.83) and positive effect ($p \leq 0.01$) on CSV. This is supported by research from the Singapore Environment Institute in which it was stated that companies need to go beyond focusing on customer-centric solutions, and instead work proactively with government and industry bodies to create and meet new standards [27]. Also, Cheng and Hu [45] suggested that the WtE incineration industry is expected to experience significant growth and make greater contribution at supplying renewable energy in the PRC, partially due to government policies and financial incentives.

CP positively influences the WtE Power Plant (H4). Supporting this is research from the World Bank in which it was observed that community participation in the implementation of Municipal Solid Waste Management (MSWM) projects promises great success [14]. Additional hypothesis support comes from the City of Amsterdam which in 1992 created Afval Energie Bedrijf (AEB), a waste-to-energy enterprise owned by the city that operates as a self-contained entity. AEB's mission since the beginning has been to recover as much energy and materials as possible from municipal waste while protecting the environment. The results have been stunning, with AEB officials stating that the negatives associated with incineration had been overcome and that state-of-the-art incineration offered many tangible benefits for local citizens [46]. Also, it is imperative that locals are aware of the waste management process and allowed to be involved in the discussions and decisions regarding the treatment of their waste.

Hypothesis H5, however, was rejected. It seems in Thailand CP has a negligible influence on the CSV, as this influence is perceived as coming from GP. Support for this comes from H6's support in which the plant operators are perceived as the ones responsible by the community residents for CSV.

Concerning the WtE Power Plant and its effect CSV, H5 was supported. Supporting this was the survey's highest mean score (item seven) of 5.03, which stated: "I think waste power plants provide cheap electricity to the community". Additionally, in a global Frost & Sullivan report on WtE plants, it was stated that WtE plants not only serve as a waste utilization and disposal solution, but as an alternative source of green energy generation [10].

Kramer and Pfitzer [47] also suggested that CSV has become an imperative for corporations, but the greatest impediments to this promise of social and economic progress are the internal barriers that prevent companies from taking action. This is consistent with an Organisation for Economic Co-operation and Development (OECD) [48] analysis in which participants identified lack of mutual trust, asymmetry of information and insufficient collaboration and co-ordination among all actors involved, as major impediments to in-country shared value creation.

CONCLUSIONS

The research results showed that all the causal factors in the model were shown to have a positive influence on the creation of shared value for Thai WtE power facilities. Ranked in importance, the variables were GP, the waste to energy operators and CP.

Within ASEAN, WtE facilities is a hotly debated topic, with countries such as the Philippines currently outlawing it. Therefore, the uniqueness of this study must be emphasized, as the sample population came from 361 Thai community residents in five areas around operational WtE Power Plants on the island province of Phuket, at the Amata Nakorn Industrial Estate in the seaside province of Chonburi, in central Thailand's Saraburi Province and the Bangpoo Industrial Estate in Samutprakarn Province between November-December 2016. To the author's knowledge, there is no similar study in English on operational WtE facilities in Southeast Asia.

Therefore, the importance of the findings is significant.

It should also be mentioned that GP to the community respondents has the greatest effect on creating shared value. This included items such as PF, PI and the ability to resolve a problem. The researchers interpreted these results as communications being a key to success.

However, recently in Thailand, local protests over coal power plant construction were met with harsh and swift action by local authorities and the army. The researchers do not see this as having any positive effect on future discussions concerning any type of power plant, whether it is coal, solar, or WtE. There must therefore be open dialogue for the successful design, construction and operation of any form of community based power facility.

There must also be a mechanism for supporting and backing up the communities in managing their projects after their implementation. Research also shows that companies should develop their ability to enhance holistic and systemic thinking that incorporates the planetary boundaries, local environmental boundaries and social foundations. Once again, from numerous studies and reports from around the world, WtE conversion is a complex and expensive process if conducted properly. It seems, however, that what constitutes legitimate WtE conversion, compared to the toxic waste incineration merchants, is at the heart of the matter in many localities. It is therefore the study's conclusion that waste, along with its associated disposal environmental impact, will increase as an economy grows. Converting this waste into domestic energy makes sense, but only with the use of modern and innovative technologies, along with an educated and environmentally aware community, supported by the WtE Power Plant's regulatory and government officials.

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