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Solving global problems: Waste to power while creating stakeholder shared value

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Abstract: In 2015, an estimated 1.2 billion people, or 16% of the global population, did not have access to electricity. At the same time, solid waste generation rates have risen fast, reaching 30 million tons in 1980, 200 million tons today, and projected to exceed over 11 million tons per day by 2100. The waste from cities alone is already enough to fill a line of trash trucks 5,000 kilometers long every day. Solutions, therefore, must be found, with Waste to Energy (WtE) conversion a strong contender, which presently represents a $29 billion industry globally. By use of cluster sampling, a sample of 361 individuals was surveyed by use of a 63-item, Likert-type agreement scale questionnaire on the study's four constructs. A confirmatory factor analysis was run prior to the structural equation model, with analysis undertaken by use of LISREL 9.1. All causal factors in the model were shown to have a positive influence on the creation of shared value (CSV) of the waste management power plant and the local community, with 68% of the variance of the factor affecting CSV (R2). Ranked in importance, the three latent variables were government policy (GP), the waste management power plant (WMPP), and community participation (CP), with a total score of 0.83, 0.37 and 0.36, respectively.

JEL Classifications: I28, L22, L24, L26, L32, L88

Keywords: Community participation, corporate social responsibility, energy policies, government policy, stakeholders

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1. Introduction

In 2015, the International Energy Agency [IEA] estimated that 1.2 billion people, or 16 % of the global population, did not have access to electricity (World Energy Outlook, 2016). At the same time, the World Bank (2013) reported that solid waste generation rates are rising fast, on pace to exceed 11 million tons per day by 2100. Waste to Energy (WtE) conversion, however, is a possible solution to both problems.

Proof of this comes from Sweden, in which it is reported that 99 percent of household waste is recycled, and in some months the Swedes have to import waste to have enough waste to convert to energy (Fredén, 2017). Currently, about 50 percent of all Swedish household waste is burnt and turned into energy. This however is not enough, and in 2014 Sweden imported 2.7 million tons of waste from other countries to convert into energy.

In Singapore, the $473 million, TuasOne Plant is the sixth, newest, and largest energy-from-waste plant for the island nation. The facility is designed to process 3,600 tons of waste per day, while generating 120 megawatt (MW) of energy. Expected to come online in 2019, Singapore is also achieving a recycling rate of 60 percent, landfilling only 2 percent, and sending the remaining 38 percent for WtE (Clay, 2016).

Thailand has also made significant progress in the development and operation of WtE facilities. Government officials have outlined plans to increase current production from 44.324 MW to 160 MW of power by 2021. The Thai 10-year (2012-2021) Alternative Energy Development Plan also aims to boost alternative energy usage to 25 percent (Department of Alternative Energy Development and Efficiency, 2017). 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 fermentation.

In Pakistan, Safar, Bux, Aslam, Ahmed, & Li (2016) stated that 8.43 percent of Pakistan's present energy demand could be met from municipal solid waste. Siddiqui (2016) confirmed the many advantages of WtE in a case study for Pakistan's first Special Economic Zone in the 'Date Capital of the World', Khairpur, and another analysis for the nation's 22 million citizen mega capital, Karachi, where plastic waste clogs the city's drainage canals.

In Malyasia, Sadeghi, Fazeli, Bakhtiarinejad, & Sidik (2014) discussed Malaysia's unique climate conditions, and the efforts being made in sustainable agricultural WtE conversion technologies. As in Pakistan's Khairput, the main energy sources were the harvesting waste from palm oil biomass. Concerns voiced however, included the financial viability, efficiency, and air pollution of incineration plants, particularly due to the nation's humid climate.

However, when it comes to economic and environmental performance, it's often hard to exceed in one area without impacting the other (Clay, 2016). In the Philippines, waste-to-energy discussions are tense, as waste incineration is banned due to the Philippine Clean Air Act and the Ecological Solid Waste Management Act (Geronimo, 2017). President Rodrigo Duterte however, is however trying to repeal these laws and adopt WtE facilities in the country (Pascual, 2017).

What constitutes "WtE" is therefore an ongoing debate with many municipalities around the world wary of WtE implementation due to toxic incinerators being marketed as WtE power plants. Governments are at odds with local communities, and often times violence erupts. Education and participation seem to be solutions, but the process can be time consuming and costly. This study therefore set out to explore how communities around five existing WtE power plants in Thailand perceived government policy, their community's participation, and the creation of shared value by the local WtE facilities.

2. Literature review

2.1. Government policy (GP)

The People's Republic of China (PRC) in February 2005 made one of largest state-sponsored commitments toward renewable energy when leaders adopted the Renewable Energy Law which encompassed directives for the management of solid waste. By 2013, the PRC was operating 166 WtE plants, converting over 30 percent of the nation's MSW (municipal *solid waste*) to energy (Cheng, 2017).

Under Thailand 4.0 (Jones & Pimdee, 2017), 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. Specifics of this are outlined in the Thai government's 2015 power development plan (PDP 2015), which indicated that fossil fuels are not only economically and ecologically unsustainable, they also expose the Kingdom to the unpredictability of global commodity markets (Pornavalai, 2017). As a component of PDP 2015, the Thai government also released the Alternative Energy Development Plan 2015 (AEDP), which prioritized power generation from waste, biomass, and biogas. The goals established for this alternative energy plan were 7,279 MW in 2014, which would climb to 19,635 MW in 2036 (Pornavalai, 2017).

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 (Bernstein, 2004). Research from Nigeria supports this, as it was stated that the establishment of a WtE facility was overwhelming viewed as a benefit to the community (92.8 percent), when compared to the existing habits of burning waste in open landfills. The study also indicated that community acceptability is additionally conditional on community education, advocacy, and social marketing (Hammed, Sridhar, Olaseha, Ana, & Oloruntoba, 2012).

In the United Kingdom (UK), Pidgeon, Demski, Butler, Parkhill, & Spence (2014) 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. However, although resource intensive, national-level deliberation is possible, and can produce useful insights both for participants and for science policy.

Park (2015) 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 if the government intervenes in a pre-existing market. Yi & Feiock (2014) added to the discussion and indicated that renewable energy development in the US is influenced by regulatory institutions and the party affiliations of the governor and legislators.

MacArthur (2015) 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 government policy (GP), the following three items were therefore placed into the research framework. These included policy formulation (PF), policy implementation (PI), and troubleshooting (TR). From this, the following three hypotheses were developed:

H1: Government Policy (GP) has a direct positive influence on Waste Management Power Plants (WMPP).

H2: Government Policy (GP) has a direct positive influence on Community Participation (CP).

H3: Government Policy (GP) has a direct positive impact on Creating Shared Value (CSV).

2.2. Community participation (CP)

Thailand's Department of Alternative Energy Development and Efficiency (2017) has suggested methods to promote WtE production. Suggestions included government run community campaigns to promote community participation and waste sorting activities. They also suggested that better knowledge sharing with municipals, communities, and the general public was necessary. Also, students needed to be better educated in understanding how waste management helps the environment and increases energy savings. This is consistent with research from Sadeghi et al. (2014) 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. They also needed to involve the communities in the initial planning process (Mukisa, 2009).

From the above theories and scholars' concepts of Community Participation (CP), the following four items were therefore placed into the research framework, which included information (IN), listening (LI), community participation (CP), and community empowerment (CE). From this, the following hypothesis was developed:

H4: Community Participation (GP) has a direct positive influence on Creating Shared Value (CSV).

2.3. Waste management power plant (WMPP)

The United States Environmental Protection Agency [USEPA] (2017) has suggested that energy recovery from the combustion of municipal solid waste is a key part of non-hazardous waste management. Further preferred methods include source reduction and reuse, recycling/composting, energy recovery, and treatment and disposal. The European Commission (2017) modified this model somewhat and discussed the use of prevention, re-use preparation, recycling, other recovery methods, and disposal. WtE facilities can also generate a renewable energy source while reducing carbon emissions by offsetting the need for energy from fossil sources. It also has the potential to reduce methane generation from landfills (Pornavalai, 2017; Pyper, 2011).

According to the European Commission [EC] (2017), efficient WtE processes include co-incineration in combustion plants, co-incineration in cement and lime production, waste incineration in dedicated facilities, and finally, 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). Results from these EC efforts have been notable, as waste incineration in the EU-27 has grown steadily since 1995. In 2015, municipal waste incineration had increased to 64 million tons, which represented a rise from 67 kg per capita in 1995, to 127 kg per capita in 2015 (Eurostat, 2017).

From the above theories and scholars' concepts of waste management power plant (WMPP), the following four items were placed into the research framework. These included waste incinerator pollution control (WIPC), ash and dust handling (ADH), noise pollution control (NPC), and waste water quality (WWQ). From this, the following hypothesis was developed:

H5: Waste Management Power Plants (WMPP) have a direct positive impact on Creating Shared Value (CSV).

2.4. Creating shared value (CSV)

Wójcik (2016), suggested that CSV is a conceptual response to deficiencies in corporate social responsibility (CSR). Furthermore, it was stated that CSV proponents see business activity through the value creation in both economic and social dimensions. Porter & Kramer (2011) 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 three ways, which includes 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, and is one area where energy companies can add value to society.

In a report from the Singapore Environment Institute, components of CSV were discussed as the "5 Rs". These "Rs" included Refuse (avoid buying unnecessary waste), Return (return packaging materials to suppliers), Reduce (reduce waste at the source), Reuse (reuse everything that is possible), and Recycle (Reuse any remaining waste streams) (Kakegawa, n/d).

In Europe, recent regulations have been implemented in which the goal was to recover 60 percent of all packaging put on the market. As a result, the municipal waste generation landfilling rate in the EU-27 dropped from 63.8 percent in 1995 to 25.3 percent in 2015 (Eurostat, 2017).

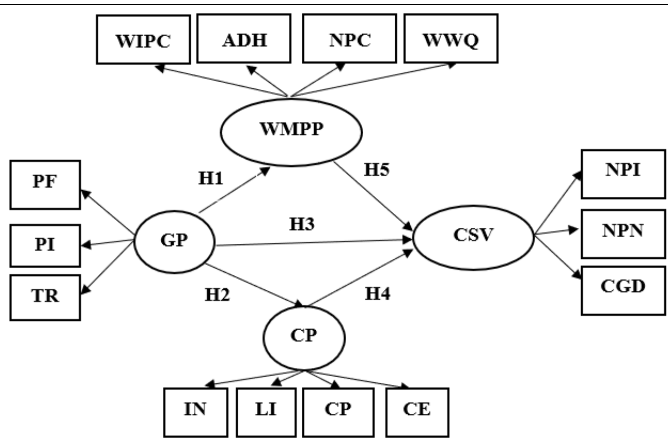
From the above theories and scholars' concepts of creating shared value (CSV), the following three items were placed into the research framework. These included new product invention (NPI), new production norms (NPN), and cooperative groups development (CGD).

2.5. Conceptualized model

Based on the above hypotheses and review of the literature, the researchers have developed Figure 1's conceptual framework which includes the causal relationships between government policy (GP), community participation (CP), waste management power plant (WMPP), and creating shared value (CSV).

Model development is shown in Figure 1.

FIGURE 1. CONCEPTUALIZED MODEL



Note. GP - Government Policy, CP - Community Participation, WMPP - Waste Management Power Plant, CSV - Creating Shared Value.

3. Methodology

3.1. Population and sample

The sample population or unit of analysis for this research included 361 questionnaires obtained from community residents by cluster sampling between November - December 2016. The survey was conducted in five communities surrounding 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).

TABLE 1. LATENT AND OBSERVED VARIABLES

LATENT VARIABLES	OBSERVED VARIABLES	THEORY AND REVIEW OF THE LITERATURE
Government Policy (GP)	Policy formulation (PF) Policy implementation (PI) Troubleshooting (TR)	Cheng, 2017; Hammed et al., 2012; Jones & Pimdee, 2017; MacArthur, 2015; Park, 2015; Pidgeon et al., 2014; Pornavalai, 2017; Standaert, 2017; Yi & Feiock, 2014.
Community Participation (CP)	Information (IN) Listening (LI) Community participation (CP) Community empowerment (CE)	Department of Alternative Energy Development and Efficiency, 2017; Mukisa, 2009; Sadeghi et al., 2014.
Waste Management Power Plant (WMPP)	Waste incinerator pollution control (WIPC) Ash and dust handling (ADH) Noise pollution control (NPC) Waste water quality (WWQ)	Clay, 2016; Department of Alternative Energy Development and Efficiency, 2017; European Commission, 2017; Eurostat, 2017; Geronimo, 2017' Pascual, 2017; Pornavalai, 2017; Pyper, 2011; Sadeghi et al., 2014; Safar et al., 2016; United States Environmental Protection Agency, 2017.
Creating Shared Value (CSV)	New product invention (NPI) New production norms (NPN) Cooperative groups development (CGD)	Eurostat, 2017; Kakegawa, n/d; Porter & Kramer, 2011; Wójcik, 2016; World Energy Outlook, 2016.

The research method used a 59-item instrument to assess the four constructs in the CSV model. All questionnaire items used a 7-point Likert type agreement scale response format (Likert 1972). 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).

3.2. Reliability

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 1) Managing Director of Pracharat Samakkhi Petchaburi (Social Enterprise) Limited, 2) Dean of the Faculty of Engineering, Southeast Asian University, 3) Secretary-General, Association for the Prevention of Global Warming, 4) Director, Office of Natural Resources and Environment, Phitsanulok Province, and 5) the Senior Executive Vice President of SPCG Public Company Limited.

A trial assessment of 25 questionnaires was also conducted prior to the actual survey to determine questionnaire reliability and consistency. The reliability value was calculated by using Cronbach's α (Cronbach, 1990) to ensure internal consistency within the items. According to Best & Kahn (2006), when interpreting Cronbach's α, it ranges from 0 to 1 with a value of ≥ 0.70 reflecting good reliability. According to the pre-test, Cronbach's α averaged 0.836, indicating reasonable reliability (George & Mallery, 2010; Hair et al., 2016).

Furthermore, the survey questionnaire was divided into two parts (Appendix 1), 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, community participation (CP) with 16 items, waste management power plant (WMPP) with 12 items, and creating shared value (CSV) with 20 items.

TABLE 2. CREATING SHARED VALUE 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.

Scale measurement made use of a 7-point Likert type agreement scale (Likert, 1972), 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 (Table 2), the interpretation of these responses was calculated by using the following formula:

$$\text{Interval} = \frac{\text{the highrest score} - \text{the lowest score}}{\text{the number of interval}}$$

3.3. 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 Lisrel (linear structural relations) 9.10 for the collected data (Jöreskog, Olsson, & Fan, 2016). 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, and the 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 are 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 (Cronbach, 1990).

3.4. Qualitative data analysis

Sample size suggestion usually depends on the complexity of the specified model, but typically ranges from 5 to 20 questionnaires per observed variable. Also, according to the UCLA Statistical Consulting Group (2016), the overall sample size should exceed n = 200 cases. Therefore, from the above and other reviewed theory, a ratio of 20:1 was deemed to be reliable. Thus, the study's 361 individuals for 14 observed variables (14 x 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.

3.5. Confirmatory factor analysis (CFA)

To access the measurement models, a confirmatory factor analysis (CFA) was 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 (Fan et al., 2016). Wong (2013) also noted that for marketing research, a significance level of five percent, a statistical power of 80 percent, and R^2 values of at least 0.25 are considered normal. Also, Hooper, Coughlan, & Mullen (2008) 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. (2016), used higher criteria and suggested that the R^2 values should be greater than 0.25.

Standard modelling also accepts the proposed model if the p value is higher than 0.05, and if the x^2/df ratio is less than two (Byrne, Shavelson, & Muthén, 1989). This is consistent with Kline (1998) and Ullman (2001), which also indicated that the relative x^2 (chi-square) should be less than two. Additionally, another common SEM reporting goodness-of-fit statistic is the root mean square error of approximation (RMSEA) (Chen, Curran, Bollen, Kirby, & Paxton, 2008) and the discrepancy per degree of freedom (Hu & Bentler, 1999).

4. Results

4.1. Respondents' characteristics (n=361)

From the final sample of 361 individuals (Table 3), it was determined that 50.14 percent were male, and 49.86 percent were female. From the survey's results, the majority or 34.9 percent were between the ages of 31-40.

TABLE 3. RESPONDENTS' CHARACTERISTICS (N=361)

RESPONDENTS CHARACTERISTICS	FREQUENCY	PERCENT
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

TABLE 3. RESPONDENTS' CHARACTERISTICS (N=361)

RESPONDENTS CHARACTERISTICS	FREQUENCY	PERCENT
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

4.2. Respondents' information

Table 4 shows that the factors that affect creating shared value (CSV), which includes waste management power plant (WMPP), community participation (CP), and government policy (GP). Interpreted results from the 7-point survey ranged from 4.71 - 4.83 (Best & Kahn, 2003; Likert, 1972).

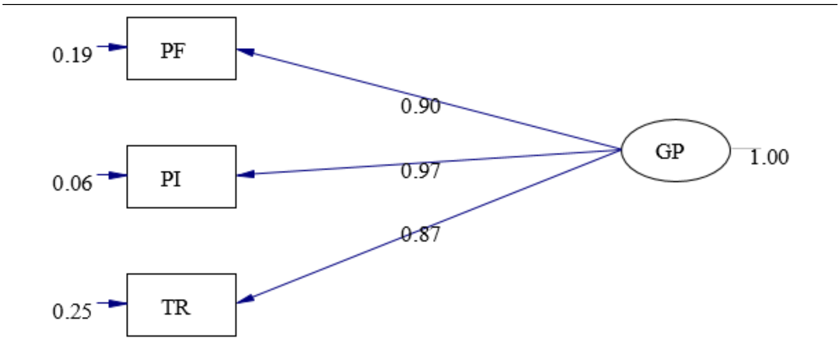
TABLE 4. MEAN AND STANDARD DEVIATION AND SURVEY INTERPRETATION

Latent Variables	$\bar{x}$	S.D.	Interpretation
CSV	4.79	1.26	I somewhat agree.
WMPP	4.73	1.22	I somewhat agree.
CP	4.71	1.32	I somewhat agree.
GP	4.83	1.35	I somewhat agree.

4.3. Confirmatory factor analysis (CFA) results

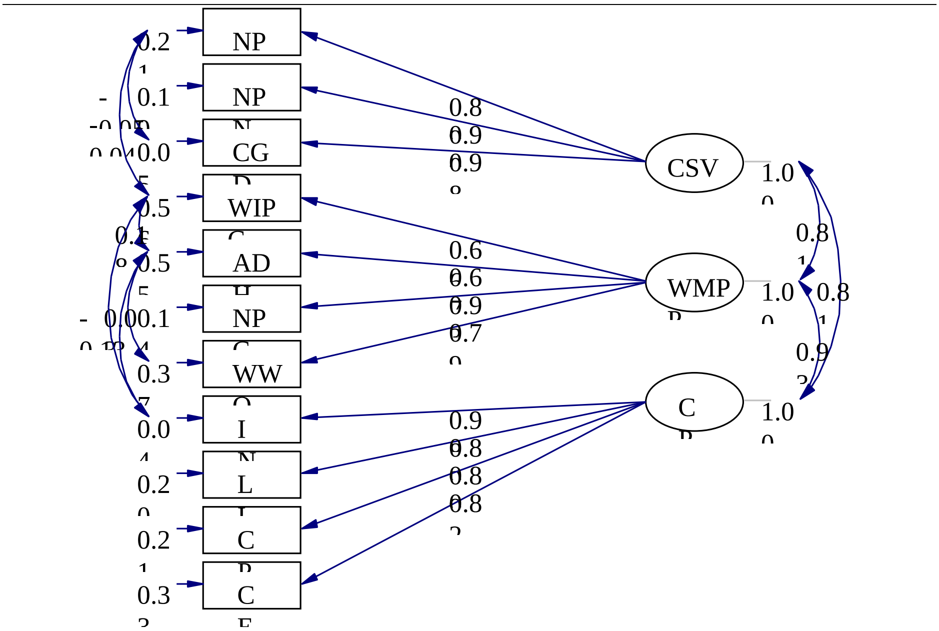
CFA analysis of the dependent and independent variables was built on the conceptual framework derived from the study of relevant documents and scholarly research (Figure 2 and Figure 3). By analyzing the confirmatory components with the LISREL 9.10 program, $\chi2$ was determined to not be statistically significant ($p> 0.05$), $\chi2/df$ was ≤ 2.00, RMSEA ≤ 0.05, and the standardized root mean square residual (SRMR) was ≤ 0.05. The goodness-of-fit statistic (GFI) was reported at 0.995, which shows good fit as it is higher than 0.90 (Hooper et al., 2008). The value for the adjusted goodness-of-fit index (AGFI) was 0.986, which also indicates a good-fitting model as its value is also greater than 0.90.

FIGURE 2. CFA OF LATENT VARIABLE GOVERNMENT POLICY (GP)



Note: Chi-Square (χ2) = 0.00, df = 0, p value = 1.000, RMSEA = 0.000.

FIGURE 3. CFA OF INTERNAL LATENT VARIABLES CSV, WMPP, AND CP



Note: Chi-Square (χ2) =9.92, df=23, p value=0.99175, RMSEA=0.000, SRMR=009, GFI=0.995, AGFI=0.986.

4.4. Convergent model analysis

From the LISREL 9.10 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 data. Also, to assess the validity of a test, convergent validity and discriminant validity were used. In SEM, CFA is usually used to access construct validity (Jöreskog et al., 2016). Hair et al. (2016) and Byrne et al. (1989) 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 χ^2 value was 34.04, which had 44 degrees of freedom (df). Therefore, the ratio between $\chi 2$ and the df was equal to 0.774 when tested, which showed statistical significance as it was ≥ 0.05. This also confirmed the model's hypotheses were not different from the empirical data. Further confirmation was established as the results of the GFI equaled 0.987, and the AGFI equaled 0.969 (Kenny, 2015). 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 (Hu & Bentler, 1999).

TABLE 5. CRITERIA AND THEORY OF THE VALUES OF GOODNESS-OF-FIT APPRAISAL

CRITERIA INDEX	CRITERIA	VALUES	RESULTS	SUPPORTING THEORY
Chi-square: $\chi 2$	$p \geq 0.05$	34.04	passed	Rasch, 1980
Relative Chi-square: $\chi 2$/df	≤ 2.00	0.774	passed	Byrne et al.,1989
GFI	≥ 0.90	0.987	passed	Hair et al., 2016; Jöreskog et al., 2016.
AGFI	≥ 0.90	0.969	passed	Kenny, 2015
SRMR	≤ 0.05	0.009	passed	Hu & Bentler, 1999
RMSEA	≤ 0.05	0.000	passed	Hu & Bentler, 1999.
Cronbach's Alpha	≥ 0.70	0.836	passed	Cronbach, 1990; George & Mallery, 2010; Hair et al., 2016; Tavakol & Dennick, 2011.

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

TABLE 6. THE CORRELATION COEFFICIENT, RELIABILITY, AND AVE OF LATENT VARIABLES

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

Note: *Sig. ≤ 0.01, The correlation coefficient between latent variables (below the diagonal in **bold**), reliability of latent variables (ρ_C) and the average variance extracted (AVE).

TABLE 7. HYPOTHESES TESTING RESULTS

HYPOTHESES	COEF.	T-VALUE	RESULTS
H1: Government Policy (GP) has a direct positive impact on Waste Management Power Plants (WMPP).	0.02	0.22	Rejected
H2: Government Policy (GP)has a direct positive impact on Community Participation (CP).	0.92	20.59**	Supported
H3: Government Policy (GP) has a direct positive impact on Creating Shared Value (CSV)	0.49	4.47*	Supported
H4: Community Participation (CP) has a direct positive impact on Waste Management Power Plant (WMPP).	0.90	7.65**	Supported
H5: MWPP has a direct positive impact on Creating Shared Value (CSV)	0.37	3.25**	Supported

Note. *Sig. < 0.05, **Sig. < 0.01 Critical ratios (t-values) more than 1.96 are significant at the 0.05 level. S.E. = standard error, CR = critical ratio (t-value).

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 GP the greatest, due to the value of 0.83.

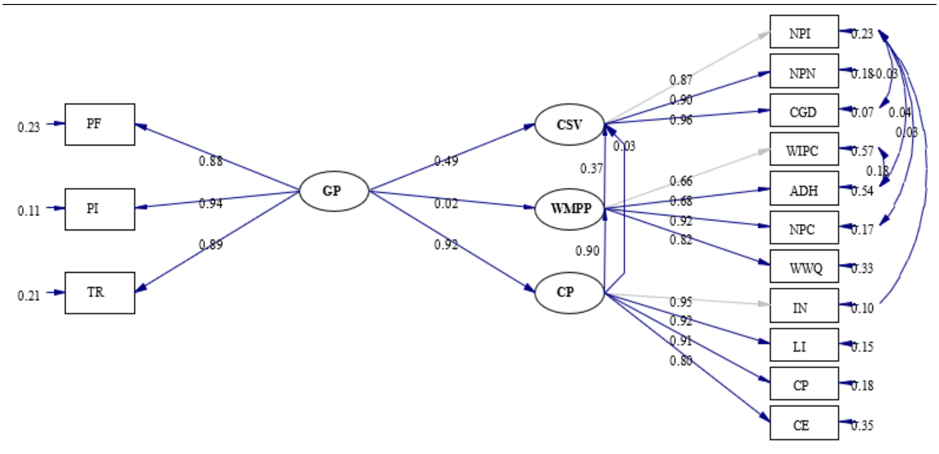
TABLE 8. STANDARD COEFFICIENTS OF INFLUENCE ON CAUSAL MODELING OF CREATING SHARED VALUE (CSV) BY COMMUNITY WASTE MANAGEMENT POWER PLANTS (WMPP) IN THAILAND

DEPENDENT VARIABLES		INDEPENDENT VARIABLES			
		R^2	GP	WMPP	CP
CSV	DE	0.68	0.49**	0.37**	0.03
	IE		0.34**	-	0.33**
	TE		0.83**	0.37**	0.36**
WMPP	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**	-	

4.5. SEM results

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 government policy (GP), waste management power plant (WMPP), and community participation (CP), with a total score of 0.83, 0.37 and 0.36, respectively.

FIGURE 4. SEM FINAL MODEL WITH VALUES FROM ESTIMATES (N=361)



Note: Chi-Square = 34.04, df = 44, p value = 0.860, RMSEA = 0.000, SRMR = 0.013, GFI = 0.987, AGFI = 0.969.

5. Discussion

Results from the study showed that hypothesis H1 was not supported, as government policy (GP) in Thailand had an overall negative impact on waste management power plants (WMPP). Contributing to this rejection was the questionnaire scores in which the items concerning policy formulation (PF), policy implementation (PI), and troubleshooting (TR), were calculated at 4.79, 4.82, and 4.90, respectively (Appendix 1). 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 (2017), it 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. H2 showed that government policy (GP) has a direct positive impact on community participation (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 WtE 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 (Geronimo, 2017; Standaert, 2017).

Results from the study also supported hypothesis H3 and showed that government policy (GP) was determined to have had a direct (0.83) and positive affect ($p \leq 0.01$) on creating shared value (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 (Kakegawa, n/d). Also, Cheng and Hu (2010) 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.

Community participation (CP) also had a direct and positive influence on the *waste* management power plant (WMPP) (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 (Bernstein, 2004).

Additional hypotheses support comes from the City of Amsterdam which in 1992 created Afval Energie Bedrijf (AEB), a WtE enterprise owed 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 (McCarthy, 2004). 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.

Concerning the waste management power plant (WMPP), and its effect on creating shared value, 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 (Chrusciak, 2016). It is also stated to be a $29 billion business.

Kramer & Pfitzer (2016) also suggested that *creating shared value* 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] (2016) 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.

6. Conclusion

Research from Sivakumar & Sugirtharan (2012) has suggested that in India, an increase in income by Rs. 1000 results in an increase of solid waste generation by one kilogram per month. The global waste from cities alone is already enough to fill a line of trash trucks 5,000 kilometers long every day (The World Bank, 2013) with global waste having risen from 30 million tons in 1980, to 200 million tons today, with most of it winding up in ill-tended landfills around major cities. Those landfills are at or near capacity, spawning illegal waste dumping and burning. The World Bank also estimates that by 2025, China's solid waste generation will double to more than 500 million tons annually (Standaert, 2017).

There is no doubt there are significant issues when communities are faced with the disposal of solid waste, and by extension, the conversion of this waste to energy. Thus far, the most significant legislative initiatives have been introduced in Europe, and combined with declining landfill capacity, WtE growth continues. Also, as economic and social factors shift the availability of essential resources, WtE will eventually become the most economically viable option for MSW disposal (Cheng, 2017). However, the majority of the plants established in the WtE markets of Europe, Japan, and North America are in need of modernization, and upgrade to improve overall plant efficiency.

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 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 and its regulatory and government officials.

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Appendix

QUESTIONNAIRE "THAI WASTE MANAGEMENT POWER PLANTS CREATING SHARED VALUE"

Creating Shared Value (CSV)	**(20 items = 4.79)**
New product invention NPI)	(7 items = **4.85)**
New production norms (NPN)	(7 items = **4.80)**
Cooperative groups development (CGD)	(6 items = **4.74)**
Government Policy (GP)	**(11 items = 4.83)**
Policy formulation (PF)	(3 items = 4.79)
Policy implementation (PI)	(4 items = 4.82)
Troubleshooting (TR)	(4 items = 4.90)
Community Participation (CP)	**(16 items = 4.71)**
Information (IN)	(5 items = 4.76)
Listening (LI)	(4 items = 4.73)
Community participation (CP)	(3 items = 4.77)
Community empowerment (CE)	(4 items = 4.55)
Waste Management Power Plant (WMPP)	**(12 items = 4.73)**
Waste incinerator pollution control (WIPC)	(3 items = 4.64)
Ash and dust handling (ADH)	(3 items = 4.79)
Noise pollution control (NPC)	(3 items = 4.76)
Waste water quality (WWQ)	(3 items = 4.79)
Total	**59 items**

59 ITEMS 4.45-5.03 (LOW TO HIGH)	MEAN	SD	SKEWNESS	KURTOSIS
CREATING SHARED VALUE (CSV)				
NEW PRODUCT INVENTION (NPI) 4.85				
1. Waste management power plants benefit the community and people.	4.51	1.55	-.53	-.14
2. I think waste management power plants should have health improvement programs for people in the community.	4.80	1.53	-.73	.08
3. I think waste management power plants should have projects to develop energy saving equipment for the community.	4.80	1.52	-.56	-.06
4. I think waste management power plants should have a project to help develop learning resources and education for people in the community.	4.88	1.48	-.71	.26
5. I think waste management power plants should provide scholarship support to students in the community.	4.94	1.49	-.68	.18
6. I think waste management power plants should provide educational support to schools in the community.	4.96	1.48	-.66	.11

59 Items 4.45-5.03 (low to high)	Mean	SD	Skewness	Kurtosis
7. I think waste power plants provide cheap electricity to the community.	5.03	1.52	-.74	.27
New production norms (NPN) 4.80				
8. I think waste management power plants should help utilize local resources efficiently.	4.69	1.55	-.46	-.29
9. I think waste management power plants should reduce household energy consumption.	4.73	1.48	-.53	-.21
10. I think waste power plants should contribute to community agricultural development.	4.85	1.55	-.48	-.36
11. I think waste management power plants should reduce greenhouse gas emissions.	4.69	1.59	-.58	-.20
12. I think waste management power plants should limit and control the amount of toxic gas emissions.	4.78	1.64	-.53	-.44
13. I think waste management power plants take care of the health and safety of their employees according to the standards of the Department of Labor.	4.85	1.52	-.62	-.03
14. I think my local waste management power plant finds local resources and raw materials.	4.98	1.54	-.61	-.01
Cooperative groups development (CGD) 4.735				
15. I think my local waste management power plant has helped develop and upgrade the quality of my community.	4.64	1.48	-.46	-.14
16. I think my local waste management power plants has improved the workmanship of the community.	4.81	1.53	-.56	-.12
17. My local waste management power plant promotes the skills and education of the community.	4.84	1.52	-.59	.06
18. My local waste management power plant empowers supervisors and local administrations.	4.85	1.55	-.57	-.20
19. My local waste management power plant promotes behavioral change in the community.	4.57	1.61	-.36	-.49
20. My local waste management power plant promotes and supports the strengthening of human rights.	4.70	1.58	-.47	-.35
Waste management power plant (WMPP)				
Waste incinerator pollution control (WIPC), 4.64				
21. My local waste management power plant emits odors from the waste it processes.	4.56	1.62	-.44	-.29
22. My local waste management power plant emits odors from the burning of electrical waste.	4.55	1.65	-.58	-.28
23. My local waste management power plant regularly monitors air quality.	4.81	1.56	-.56	-.17
Ash and dust handling (ADH) 4.78				
24. My local waste management power plant organizes waste collection time, to reduce noise in the community and to suit the lifestyle of the community.	4.77	1.44	-.50	-.11
25. My local waste management power plant emits noises when it burns waste.	4.66	1.56	-.48	-.24
26. My local waste management power plant has a sound protection system by use of planting trees around the waste incinerator.	4.93	1.50	-.59	.03
Noise pollution control (NPC) 4.76				
27. My local waste management power plant produces a pile of heavy ash and light ash.	4.70	1.56	-.41	-.33
28. My local waste management power plant has the technology to prevent acid rainfall from leaking into the community.	4.80	1.49	-.63	.07
29. I think my local waste management power plant has the technology to limit dust.	4.85	1.56	-.46	-.38
Waste water quality (WWQ) 4.79				
30. In my community, there is no problem with waste water.	4.66	1.64	-.42	-.50

59 Items 4.45-5.03 (low to high)	Mean	SD	Skewness	Kurtosis
31. In my community, water is safe to use.	4.85	1.57	-.53	-.39
32. In my community, there is no conflict with the waste management power plant water quality.	4.85	1.57	-.40	-.48
Community Participation (CP)				
Information (IN) – 4.76				
33. My local waste management power plant has published printed documents and newsletters about the benefits of their operations.	4.72	1.49	-.49	-.12
34. My local waste management power plant has disseminated information through various media.	4.89	1.52	-.57	-.18
35. I think my local waste management power plant gives exhibitions to the local community.	4.61	1.55	-.45	-.30
36. My local waste management power plant has provided information about electrical waste on their website.	4.75	1.47	-.54	.01
37. My local waste management power plant posts current information to the community.	4.85	1.55	-.63	-.02
Listening (LI) 4.73				
38. My local waste management power plant managers listen to community comments.	4.69	1.56	-.49	-.17
39. My local waste management power plant managers surveyed opinions from my community.	4.79	1.48	-.63	-.05
40. My local waste management power plant managers have organized a public forum in my community.	4.66	1.55	-.53	-.18
41. The government has given me the opportunity to comment through the waste management power plant website regularly.	4.79	1.55	-.53	-.22
Community participation (CP) 4.77				
42. The government has conducted a workshop to consider public policy issues and the management of waste management power plants.	4.65	1.59	-.40	-.33
43. Local government officials have held a public hearing in my community.	4.82	1.52	-.57	-.07
44. The government has set up a working group to suggest a policy on waste management policies.	4.85	1.51	-.58	-.01
Community empowerment (CE) 4.55				
45. My community was given the opportunity to decide on the construction of a waste facility located in my community.	4.45	1.67	-.24	-.58
46. I have done activities with my local waste-management power plant.	4.54	1.61	-.51	-.29
47. I have participated as a local community board member.	4.50	1.65	-.50	-.35
48. Before setting up a waste management power plant in my community, I had the opportunity to vote.	4.70	1.73	-.47	-.51
Government Policy (GP)				
Policy formulation (PF) (4.79)				
49. The waste management power plant located in my community complies with the law.	4.72	1.55	-.43	-.14
50. My local waste management power plant was established under applicable regulations and laws.	4.75	1.50	-.61	.14
51. My local waste management power plant receives support from government agencies	4.91	1.57	-.49	-.17
Policy implementation (PI) (4.82)				
52. My community's waste management power plant has complied with the requirements of the state.	4.87	1.55	-.58	-.08
53. My community's waste management power plant has complied with the terms agreed with the community.	4.73	1.58	-.52	-.14
54. Local government agencies have strict control over my community's waste management power plant.	4.81	1.49	-.58	-.20

59 Items 4.45-5.03 (low to high)	Mean	SD	Skewness	Kurtosis
55. I have the freedom to make suggestions and comments about my local waste management power plant.	4.88	1.62	-.57	-.25
Troubleshooting (TR) (4.895)				
56. I think local waste management power plants can help solve the problem of overflow.	4.96	1.53	-.49	-.27
57. If there is a disagreement between my community's waste management power plant and the community, government agencies will help fix it.	4.89	1.60	-.68	-.21
58. Government agencies have the knowledge to answer any questions I have concerning my community's waste management power plant.	4.81	1.56	-.54	-.18
59. I think government agencies can solve urgent problems with waste management power plants.	4.92	1.63	-.62	-.11