

Article



Household Waste Sorting Participation in Developing Countries—A Meta-Analysis

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Received: 10 December 2019; Accepted: 23 March 2020; Published: 24 March 2020



Abstract: Given the increasing efforts at improving waste management in developing countries, this study aimed to analyze factors that influence participation in household waste sorting. It thereby is the first review that extends the published literature on this topic. A meta-analysis was conducted that analyzed twelve influencing factors. A moderate correlation was found for the most strongly influential factors—attitude, moral norm, subjective norm and perceived behavior control—which indicates that people's perception of waste sorting is most influencing in prompting participation in household waste sorting in developing countries. The results of this meta-analysis indicate that knowledge, situational factors, such as physical conditions, and governmental incentives can influence participation in household waste sorting in developing countries but the relationship between those factors and other factors with high correlations should be studied further. Notably, socio-demographic factors have the weakest influence on the participation in waste sorting in developing countries despite a large body of research on such factors. It can be constructive to take the relationship across the identified factors and the participation in waste sorting into consideration when aiming to implement measures to increase the participation in waste management schemes through waste sorting. The outcome of this study may contribute to recommendations and policy suggestions regarding the promotion of sustainable waste management through household waste sorting in developing countries.

Keywords: waste sorting; participation; recycling behavior; developing countries; source separation; waste management

1. Introduction

Global economic development has accelerated in recent decades and is expected to grow starkly in the future [1]. Simultaneously, the world population is growing and is expected to exceed 8 billion by 2024 and up to 11.2 billion by 2100 [2]. Hand in hand with these developments goes an incredible increase in the generation of municipal solid waste (MSW) [3]. Currently, the global MSW generation is 2.01 billion tons annually, which is predicted to increase by 70% to 3.4 billion tons by 2050 unless action is taken [4].

Internationally recognized classifications for the development of a sovereign state include Gross National Income [5], as well as Human Development Index, Gross Domestic Product, political stability, industrialization and freedom [6]. Countries can thus also be classified as threshold, low income, lower-middle income, upper-middle income or high income countries depending on the Gross National Income [7]. In the context of this meta-analysis, an article was considered to be on a developing country when the country the study took place in had a Human Development Index of less than 0.8 [6] in the United Nations Human Development Report [8] and a Gross Domestic Product that ranged from less than USD 4000 to at least USD 25,000 [9,10] at the time when the study was published.

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Furthermore, countries were considered to be "developing" concerning waste infrastructure provision when, per Kaza et al. [4], one or more of the following aspects were true: more than 62% of the waste was unaccounted for, more than 42% was openly dumped, more than 34% was send to landfills or when there was no data available.

Waste management infrastructures and service provision vary significantly across the countries that are developing by this classification. As an example, the infrastructure coverage may not be consistent. Parts of China, Malaysia and South Africa have established comprehensive and constructive coverage of waste services in some places and cities, while other parts of these countries are not covered and have poor or no waste services at all. In developing countries with high population densities, managing and treating the accumulating amount of waste has become challenging given undeveloped urban waste management systems, lack of relevant technologies or limited available resources for waste management [11–15]. In some countries, insufficient waste management severely impacts both human health and well-being, as well as urban development [16]. For example, uncontrolled burning of waste is the largest source of dioxins, which are among the most toxic chemicals known to threaten human life [17]. Landfilling, in which untreated waste is piled up to heaps or dug into the ground, is still the most common method of MSW disposal worldwide [18]. Landfills, however, are a major source of soil and groundwater contamination and transmittable diseases [16,19]. Many developing countries mainly rely on landfills in managing their waste [4]. MSW is typically landfilled near urban areas, which causes cities to become surrounded by waste gradually. Despite some efforts aimed at improving the status quo of waste management throughout developing countries [20,21], landfills are particularly concerning given the health and environmental impact affiliated with them. Moreover, the ever-increasing volume of waste to be managed in the future is additionally concerning, especially since landfills are already overwhelmed at present [4].

Efficient waste management systems are thus needed in order to improve the current situation and protect human health and the environment, especially so given that many materials in household waste can be recycled, which contributes to the conservation of energy and resources. Waste management systems are often set up in a way in which the goal is to landfill as little as possible and recycle, reduce and reuse as many resources as possible [22]. In order to achieve this, waste management systems need to encourage the public's participation because people can make a direct impact by making waste sorting part of their everyday routines [23].

The participation in waste sorting is also referred to as "source separation", which describes the action of sorting waste into its different fractions which can take place in many contexts, such as at factories or industries. The focus of this meta-analysis, however, is on waste sorting within the context of households and by people who form society. In developing countries, the participation in waste sorting can take place as part of recycling schemes that may be provided by the municipality, the private sector or nongovernmental organizations. The way in which waste management infrastructures are set up can have a significant influence on the level of participation in them [22]. In countries that are in the focus of this study, sorted waste may be picked up at the house or householders may be asked to bring their waste to recycling stations or collection points. However, the participation in waste sorting can also take shape in the selling of materials for a livelihood, claiming deposits on recyclable materials such as glass, aluminum or plastic bottles or by using recyclables as a currency to pay for goods [24]. Financial benefits can motivate the participation in sorting by householders and informal collectors make in regards to enabling higher recycling rates in developing countries, which needs to be taken into account when waste management systems are to be reconstructed or adapted [24].

Waste sorting is a particularly valuable tool to improve waste management and focus has increasingly been directed at efforts to increase waste sorting participation in developing countries [25]. Because household waste sorting occurs at a person's home, it is linked to individual behavioral patterns. Factors that impact waste sorting participation are thus highly important when aiming to improve the efficiency of waste management by encouraging people to sort the waste in developing

countries without integrated waste management systems. Varying factors that impact household waste sorting have been in the focus of previous research across developing countries, but the specific factors those studies focused on and their findings vary. As an example, multiple studies found that there are differences in attitude towards waste sorting between younger and older generations [26–28] while others concluded that age does not impact participation in sorting [29]. Social surveys conducted in higher education institutes in developing countries found that sixty percent of surveyed students in Bolivia participate in waste sorting by sorting up to half of their household waste, even though recycling rates are generally low [30]. Whereas, roughly half of the students who participated in a survey in China claimed to sort their waste despite much higher participation rates among their parents (around one in three) [31].

Different research aims and designs may contribute to varying outcomes, but likewise, so can the researchers' different backgrounds direct the way studies on this subject are concluded. This study aims to meta-analyze the current state of the literature on factors influencing household waste sorting in developing countries. The results of this study can complement the determination of decision-makers and waste management providers that aim to improve waste management system schemes in developing countries. It can also determine which factors need to be investigated further in future research on people's participation in waste sorting in developing countries.

2. Methods

Given the aim of this study, a meta-analysis is the most appropriate method because a statistical analysis combines the results of multiple scientific studies [32]. By meta-analysis, the number of research samples can be expanded, the performance of statistical tests improved and the reliability of the resulting estimates increased. The results can thus be elaborated rather than narratively reviewed. Furthermore, by conducting a thorough meta-analysis of the factors that influence participation in household waste sorting in developing countries, quantitative conclusions can be drawn to evaluate each factor [32].

2.1. Selection of the Studies

The articles found were screened through the application of the following criteria:

- Publication date, topic and language: published between 1997 and 2018 and related to factors that influence the participation in waste sorting in developing countries. Articles in English were included
- Paper format: due to the aim of this meta-analysis, only peer-review publications that included data and results on factors that affect the participation in waste sorting in developing countries were included. Literature reviews and analytical reviews were not considered due to the lack of quantitative datasets required to fulfill the aim of this study. The data quality included means, standard deviations, t and F statistics tests, frequencies or counts, contingency table and Chi-square tests

The stages of the identification of relevant articles are presented in Figure 1.

In order to identify relevant literature, databases were searched using keywords, such as "household waste recycling behavior"; "municipal solid waste + factors"; "factors influencing waste management" and "household waste separation". Two thousand three hundred and twenty-six articles were so identified. Titles and abstracts were screened in order to ensure the first inclusion criterion was met. Two hundred and eighty-two articles met this requirement and were considered potentially relevant and imported to Endnote. Eighty-eight articles that were cited in potentially relevant articles were additionally considered. A total of 370 articles were analyzed for eligibility and whether they entailed the data (i.e., quantitative datasets, such as means, standard deviations, t and F statistical tests, frequencies or counts, contingency table and Chi-square tests) necessary for the meta-analysis. Thirty-nine articles fulfilled these criteria. Articles that reached the final selection were read in detail

and analyzed in their entirety so to ensure the accuracy and validity of the data and therefore suitability for the meta-analysis. No articles were dismissed during this stage, and 39 articles were included in the meta-analysis.



Figure 1. Literature selection process.

2.2. Data Analysis

The effect size is quantified as the correlation r, between the participation in household waste sorting in developing countries and the factors influencing it. Some of the effect sizes are directly quoted in the source articles, for example, where Pearson coefficients (ES_r) or Spearman coefficients are given. Some were calculated on the basis of the original data, such as contingency tables, t-test or F values using statistical calculation. The effect size of all included studies was then computed using the "Fisher Z" transformation [32]. In order to do this, the Comprehensive Meta-Analysis (CMA) 2.0 [33] was used to calculate the overall effect size (correlation r). The average effect size was calculated for each factor by considering the data found in each study to be statistically independent [33]. The degree of influence of correlation (r) was categorized as small (±0.1 to ±0.29), medium (±0.3 to ±0.49) or large (±0.5 to ±1.0) [34].

True variation was considered likely due to the effects of moderator variables, such as the year of publication and country in which the research was conducted. A random-effect model was therefore appropriate for this meta-analysis. It should, however, be noted that this is simply an assumption that required verification. To verify this assumption and to determine the heterogeneity of the studies, the Q test was performed. Using the Q test, the selected model was tested by advancing the hypothesis that all studies have the same true effect size (fixed-effect model). Q follows a central chi-square distribution with $d_f = k-1$, where k is the number of studies and d_f is the degrees of freedom. The *p*-value was obtained from Q in the chi-square distribution table. If the *p*-value is less than 0.05, a hypothesis should be rejected, and the random-effect model should be chosen [35]. The Q test showed that the random-effect model was appropriate for all factors in this study. Besides Q test, the I-square test was also conducted to test the homogeneity between studies. According to

Higgins, et al. [36], I-square scores higher than 25%, 50% and 75% correspond to low, medium and high heterogeneity, respectively.

Publication bias, which refers to positive results getting published more than negative ones, can be assessed using Rothstein's failsafe number, N_{fs} . When N_{fs} is smaller than 5N + 10 (N = number of studies which discussed this factor), the possible impact of publication bias should be recognized with caution [37]. This coefficient thus refers to the number of studies needed to reverse the conclusion when the summary effect size of the meta-analysis is statistically significant.

3. Results

Through the rigorous literature screening process, 39 studies that assessed factors that influence the participation in household waste sorting in developing countries were identified and included in this meta-analysis. These studies were published between 1997 and 2018 and were conducted in Bangladesh, Malaysia, Iran, Hong Kong, Taiwan, China, Mexico, South Africa, Ecuador, Nigeria, Guinea, Cuba, Vietnam, Ghana, Thailand, Ethiopia and the Philippines.

Except for one study, all included articles met the inclusion criteria at the time of publication and would still do so now. Only the study conducted in Hong Kong [38] met the inclusion criteria because of the HDI/GDI in the year of publication but has since emerged in that regard. Despite its progress regarding the Human Development Index and Gross National Product, 66% of Hong Kong's waste is still landfilled according to Kaza, et al. [4].

Each included study used self-reporting questionnaires to collect data. Thirty-three of the included studies were based on actual participation in household waste sorting [28,31,38–66] while six were based on intentions to participate in it [25,67–71]. All of the included studies were conducted in cities and based on households as samples except for five. Ghani, et al. [68] conducted a survey among the staff of a university campus. Ifegbesan [47] surveyed school students. Ramayah, et al. [58] and Zhang, et al. [31] conducted a survey on students at university campus. Lastly, Tatlonghari and Jamias [60] conducted their survey on households in a village. All but two studies were conducted in the context of long-term recycling programs. The studies by Hernandez, et al. [46] and Xiao, et al. [62] were conducted within the context of pilot recycling programs.

Each article was analyzed systematically in order to categorize the factors that impact participation in household waste sorting in developing countries. Detailed information on the authors, factors discussed, the statistical methodologies used, the countries the studies were conducted in and the sample size of the included articles are presented in Appendix A Table A1.

The three main variables identified are presented in Figure 2. These are (i) *governmental incentives and factors*; (ii) *psychological variables*, including perceived behavior control, perceived consequence, attitude, subjective norm and moral norm; and (iii) *situational variables*, including situational factors, knowledge and the socio-demographic factors, including age, gender, income and education.



Figure 2. Identified variables and factors that influence the participation in household waste sorting in developing countries.

The majority of included studies investigated a combination of at least two of these factors. Due to the diverse data collated, some factors had similar meanings but were named differently. On such occasions, these aspects were integrated using the meta-analysis approach employing umbrella terms. The aspects included are described below for each factor along with the respective results.

Table 1 presents the results of the meta-analysis for each factor, including the correlation (*r*), Q and I-square test and the number of studies that each factor discussed. The factors investigated and included in this meta-analysis as well as the effect-size and 95% CI (confidence interval) calculations are presented in Appendix B Figure A1.

Factor Analyzed	Alyzed Correlation r (95% CI)		I-Square (%)	Failsafe N	No. of Studies		
Governmental Incentives and Factors							
Governmental Incentives and Factors	0.26 [0.16, 0.36] **	255 **	96.1	935	11		
	Psyc	hological Va	riables				
Perceived Behavior Control	0.28 [0.22, 0.34] **	159 **	88.7	3734	19		
Perceived Consequence	0.25 [0.03, 0.44] *	89 **	95.5	169	5		
Attitude	0.39 [0.24, 0.52] **	1559 **	98.6	8367	23		
Subjective Norm	0.30 [0.22, 0.38] **	369 **	94.8	4364	19		
Moral Norm	0.35 [0.22, 0.46] **	171 **	95.3	1356	9		
Situational Variables							
Situational Factors	0.19 [0.10, 0.29] **	222 **	93.7	1213	15		
Knowledge	0.14 [-0.05, 0.32]	226 **	96.9	200	8		
Age	0.08 [0.02, 0.14] **	257 **	93.4	409	18		
Gender	0.11 [0.01, 0.21] *	247 **	95.1	249	13		
Education	0.09 [0.02, 0.15] **	209 **	93.8	839	14		
Income	0.02 [-0.07, 0.12]	325 **	96.0	16	14		

Table 1. Results of the analysis of the determined factors.

* p < 0.05, ** p < 0.01; For gender, the positive value (r) is interpreted as female are correlated to waste sorting.

The correlation (*r*) for governmental incentives and factors is 0.26. The correlations (*r*) for perceived behavior control and perceived consequence are 0.25 and 0.28 respectively. Moderate correlations were found for factors that are part of this variable: attitude (r = 0.39), moral norm (r = 0.35) and subjective norm (r = 0.30). The correlation (*r*) found for situational factors is 0.19 and for knowledge it is 0.14. Low correlations were found between the socio-demographic factors of age (r = 0.08), gender (r = 0.11), education (r = 0.09) and income (r = 0.02).

Consulting the chi-square table for the Q-values, I-square values were identified at approximately 90%. The result is in line with the conclusion of the Q test which found that all factors are highly heterogeneous. The result also confirmed the appropriateness of a random effect model for this meta-analysis. The failsafe numbers for all variables are higher than 5N + 10 except for the income variable (failsafe n = 16). Publication bias must thus be considered for the income variable making results on income potentially unreliable. Furthermore, the correlation (r) for knowledge (r = 0.14) and income (r = 0.02) were not statistically significant.

4. Discussion

The results for each variable and factor, as well as remarks, policy implications and limitations of this study will be discussed in the next section.

4.1. Governmental Incentives and Factors

Governmental incentives include financial rewards for people who participate in sorting or penalties when they fail to do so, as well as mandatory regulations and laws. Other aspects that were analyzed within the "governmental incentive" factor are aspects that the included studies focused on and which relate to incentives that governments can influence. These include *rewards*, *market incentives* [63], the *value of recyclable waste* [58], *awareness of the benefits* of household waste sorting, the *cost-value ratio* as well as *regulations*.

The correlation (*r*) for governmental incentives is 0.26, which indicates a moderate positive influence on household waste sorting participation. Monetary rewards or regulations offered by governments can encourage householders to sort in developing countries. Even though studies in developed countries have concluded that governmental incentives are a significant predictor of participation in waste sorting [72–75], how and if rewards or penalties increase the participation in sorting is not understood [76].

It is often municipalities who are responsible for the provision of efficient waste management [13], but the organizational, financial, complexity and multidimensionality related issues they face [77] often reach beyond the capacities of municipal authorities [78]. In response, private recycling companies were found in cities across developing countries. These private companies appreciate the value of recyclable materials but their business models also increased the participation in household waste sorting [13]. Government subsidies, promotions and investments in private microenterprises and waste management companies might hence promote higher participation rates in household waste sorting by making waste collection services more affordable [15].

Trust in governmental waste management systems, policies and programs can influence participation in household waste sorting in developing countries. As an example, when the government in Xiamen, China, requested every household to pay 60 RMB biannually towards the improvement of waste management, less than 25% paid the fees. Moreover, when 10–20 communities were chosen every year as waste recycling demonstration communities, the initiative was soon called off for lack of traction [62]. This is consistent with other findings that show that trust and satisfaction with the waste management system and laws introduced by the government have a significant effect on waste sorting participation [79]. Furthermore, increased participation rates can be achieved when people get the chance to take part in decision making regarding the waste management system in which they are supposed to participate [13].

Increased trust and satisfaction, through means such as transparency in the system and in the authorities that offer them may be the most important element to consider when aiming to increase the participation of households in waste sorting. It can be assumed that when trust and satisfaction are improved, the influence of incentives, knowledge-provision and other waste sorting related actions by the government will also be more impactful.

4.2. Psychological Variables

4.2.1. Perceived Behavior Control

Perceived behavior control refers to how individuals perceive their ability to participate in sorting [80,81]. Numerous studies found an influence of perceived behavior control on participation in sorting [56,58,64,67]. *Perceived difficulties* [25,58,67], *perceived lack of recycling facilities* [82] and *perceived behavior* control since they are obstacles to waste sorting and impact the participation in it.

The correlation (*r*) for perceived behavior control was found to be 0.28. Multiple studies found a high positive relationship between perceived behavior control and participation in waste sorting [56,67]. The result of the factor perceived behavior control of this study is in line with results that show that self-efficacy is influential in household waste sorting [43]. This indicates that the influence that self-efficacy has on the participation in waste sorting in developing countries can be enhanced through means such as supervision and motivation among communities. Because subjective norms among society impact peoples' perceived behavior control, the public should be provided with detailed information addressing not only the benefits of sorting but also the responsibility carried by every individual [64].

In summary, the results indicate a small to moderate positive relationship between perceived behavior control and participation in waste sorting. Given that perceived behavior control is influenced by the availability of waste facilities, the probability that people participate in waste sorting increases the stronger people perceive satisfaction with the availability, user-friendliness and accessibility of these facilities. This, however, indicates that governments and responsible institutions need to increase their efforts in supplying the population with targeted information about waste sorting in order to reverse the common perception that it is challenging to participate in waste management schemes [25,67].

4.2.2. Perceived Consequence

Perceived consequence refers to a person's perception of the outcome of participating in sorting. Several aspects were analyzed within the umbrella factor perceived consequences. Among these are the *perceived usefulness* of participating in waste sorting which refers to a person's perception of the usefulness of waste sorting as well as *consequences of waste sorting*. Moreover, parts of the perceived consequence factor are also the *relative social benefits* that refer to social benefits which can be gained through participation in waste sorting and *motives* which refer to a person's choice to participate in sorting and the consequences associated with that choice.

The correlation (r) of perceived consequence is 0.25 which indicates that participation in household waste sorting in developing countries is more likely when it is perceived to have positive consequences. Lacking awareness of the positive outcomes that can be achieved through waste sorting is a significant hindrance to participation in sorting [83]. Because one's attitude is affected by the perception of outcomes, people are more likely to have positive attitudes after realizing that waste sorting can have positive outcomes. Perceived consequence thus contributes to positive attitudes towards waste sorting [25,61].

4.2.3. Attitude

Attitude describes a person's favorable or unfavorable evaluation of participation in waste sorting. Attitude can be operationalized in two ways. One of which evaluates the results of waste sorting to determine attitudes [25]. The other more commonly used way evaluates attitudes by focusing on a person's assessment of whether the participation in waste sorting is favorable or unfavorable while dismissing the consequences of that personal assessment [52,61,64,68,70]. Moreover, attitudes towards the environment [25,49] were also analyzed within the umbrella factor "attitude".

Attitude is the most significant factor that influences household waste sorting participation in developing countries because positive attitudes towards or being in favor of waste sorting proposedly increase the likelihood of participation in sorting [25,43,49,56,67,69,71]. However, several studies found the contrary and concluded that attitude has no significant correlation with participation in waste sorting [59,64,68,84]. Rather, these studies suggest that participation in sorting tends to be low despite positive attitudes. One explanation for this could be that changing patterns and maintaining altered habits can be challenging when people are used to doing tasks in a certain way [85].

Household waste sorting participation may be low despite positive attitudes for a variety of other reasons, such as aspects like convenience, accessibility of facilities or knowledge. Most study participants in developing countries highlighted the lack of adequate facilities or efficient waste management systems. This unavailability likely discourages people from waste sorting despite positive attitudes. This would be congruent with research that found a lower correlation between actual behavior and attitude than between behavioral intention and attitude [38]. However, a negative correlation of factors with attitude would indicate that there can be participation in waste sorting despite negative attitudes towards it. For example, lower levels of education and income in developing countries can create an incentive to collect recyclable material for resale and financial gain rather than ideological commitments to the environmental benefits of effective waste management.

Environmental concern in this context refers to how much a person cares about the impact participation in waste sorting on the environment and is another aspect of attitude that can influence the participation in waste sorting in developing countries. Part of environmental concern is also environmental attitude, awareness of the consequences of inefficient waste management and environmental consideration.

In developing countries, people might remark that it is difficult to participate in waste sorting due to poor waste infrastructure even though they would like to do so given their environmental concern [49]. This is in line with some of the findings mentioned above and highlights the positive relation with attitudes. It is furthermore proposed that environmental concern influences the participation in waste sorting in developing countries both directly and indirectly [49].

Moreover, strengthening positive public attitudes or changing negative attitudes towards waste sorting without financial means is challenging for governments in developing countries [61]. Nongovernmental organizations and community-based organizations significantly contribute to waste management systems [86,87]. Such organizations can also contribute to strengthening positive public attitudes by involving people from the civil society in designing and implementing waste management systems [88]. Furthermore, nongovernmental and community-based organizations establish cooperation between informal waste collectors as well as private recycling companies with local authorities [86] which can also lead to an increase in positive attitude towards waste sorting among society.

In response to the difficulties governments face when attempting to change public attitudes without financial means, it was suggested that campaigns with constant succinct information can be used as a strategy to alter attitudes when these emphasize the importance of waste sorting [56,68]. However, campaigns are thought to be insufficient in changing attitudes towards waste sorting because they do not sufficiently raise awareness of the importance of waste sorting and do not provide enough knowledge on how to sort [64]. Ways to improve attitudes and participation in household waste sorting may, therefore, include providing knowledge about it and encouraging children early on to sort as part of educational curricula [20,21,28,47]. Furthermore, Ramayah, et al. [58] suggest that governments should encourage the private sector to increase the efficiency of green technologies by investing in them and publicizing such developments among society.

Given that attitude is the most substantial influencing factor in the participation in household waste sorting in developing countries (r = 0.39), participation in waste sorting is thus relatively likely when there are positive attitudes and external conditions facilitating sorting participation.

4.2.4. Subjective Norm

Subjective norm refers to the perception of expectations to participate in waste sorting [64,89]. Part of subjective norms are *social norm* [66,67,69–71], *social motivation* [25,44,45,48,68,84], *social pressure* [25,58,67,90] and *perceived reputation* [58,61], i.e., the way opinions of others, and the importance of those opinions, are perceived in terms of the standing in society.

Given that 19 out of 39 included articles mentioned subjective norm, this is one of the second most investigated factors that influence the participation in household waste sorting in developing countries. In this context, subjective norm refers to a person's perception of the role social pressure plays in whether or not one participates in waste sorting.

Subjective norms are part of the patterns which engage people to participate in waste sorting in the context of their daily life and the culture they find themselves in. The social pressure that people may perceive from the broader society influences moral norms regarding participation in waste sorting [64], given that people might look at the habits of the broader society before choosing to behave in specific ways [91]. However, subjective norms also center around how that engagement takes place while recognizing the role that culture may play in shaping the significance and expectation of the participation in sorting [23].

Multiple included studies found that subjective norms significantly positively influence participation in household waste sorting in developing countries [66,67,69–71]. On the other hand, some studies found that subjective norms less significantly influence the tendency to sort the waste in developing countries [25,44–46,68,84] because internally generated motivation is thought to be more likely to lead to participation in sorting than the influence of family, peers or others [68].

The results of this meta-analysis found a correlation (r) of 0.30 for subjective norm, which indicates that it is a moderately influencing factor in the participation of household waste sorting in developing countries. The result is in line with research that suggests that social influences are an influential part of the development of sustained participation in household waste sorting [31,92].

People are more likely to sort if they worry that they will be criticized for failing to do so by members of their family, community or colleagues. However, most of the data that contributed to these results originate from countries in the far East, such as China, Malaysia and Vietnam where cultural structures impact people's sensitivity to and consideration of how others judge them. In some collectivist countries, people might even consider the opinions of others more important than their own [58].

Nonetheless, there is a positive relationship between subjective norms and perceived difficulties, which indicates that people who face intense social pressure still tend to sort even if the conditions are inconvenient [67]. Subjective norms also affect waste sorting participation indirectly through perceived behavior control [64]. Future research would thus do well to consider the indirect influences of other variables.

In sum, the subjective norm, directly and indirectly, impacts the participation in waste sorting in developing countries with a correlation (r) of 0.30, which is considerable. Targeting subjective norms through social pressure can thus be an effective way to encourage higher participation rates in a waste sorting system.

4.2.5. Moral Norm

Moral norm referred to the perception of the moral obligation to participate in waste sorting [93] and was mentioned in several included pieces of literature as an influential factor [56,61,64,67,70]. Three aspects that relate to the moral norms were analyzed within the umbrella factor "moral norm". These include *moral obligation* which refers to a person's perception of whether it is morally right or wrong to participate in waste sorting [94] as well as the *personal norm* which refers to a person's individual opinion of whether or not the participation in sorting is right [64]. Lastly, *responsibility* is an essential factor that should be considered when evaluating moral norm and it refers to a person's participation in waste sorting due to a sense of responsibility [58,64].

Nine studies concluded that moral norms profoundly influence waste sorting participation, and some concluded that moral norms are the most important influencing factor [56,64,67,70]. As mentioned earlier, many studies on household waste sorting in developing countries were conducted in the far East. In many eastern cultures, norms are perceived as more important than attitudes. In such cultures, aiming to establish a social-ethical climate through campaigns and education might be worthwhile when targeting waste sorting to become a moral norm [61]. Perceived consequences and responsibility are also key factors that influence moral norms [64], which indicates the need for future research to understand these relationships better. Learning from people who made sorting their waste an everyday routine can aid tailoring campaigns aimed at moral norms. It can do so by providing knowledge and raising awareness about how individual action can improve the environment and human well-being locally and globally [23].

The correlation (r) of moral norm regarding the participation in waste sorting is 0.35, making it the second most impactful factor and leading to the conclusion that targeting moral obligations may be a relevant way to encourage higher participation rates in household waste sorting in developing countries.

4.3. Situational Variables

4.3.1. Situational Factors

Situational factors are physical conditions that encourage or discourage participation in waste sorting. These include *convenience, time* available for waste sorting, having enough *space* for waste or even separate waste bins and the *cooperation* of other residents. Additional situational factors are the type of *residential area, distance to a recycling center or waste container* and the *condition of this waste facility*. Moreover, situational factors also include the *accessibility or availability of recycling infrastructure, containers* and *a collection point*.

With a correlation (r) of 0.19, situational factors are modestly influential factors that impact household waste sorting in developing countries. The result is in line with research that has shown that participation in waste sorting is more likely when factors such as time to sort, space to accommodate sorted waste and available waste infrastructure are satisfied [53,95,96]. The lack of waste service provision likely keeps people from sorting their waste because people do not know what they are meant to do with their sorted waste. This is why service provision is essential if a waste management system is to succeed.

The factor of space has commonly been discussed as an inconvenience for householders [97–100] given that separate bins for the different fractions of the waste may take up space in the household. The time it takes to sort the waste is commonly perceived as a factor that discourages participation in waste sorting [97,101]. The provision of easily accessible and nearby waste facilities significantly affects the participation in household waste sorting [102] as well as the number of fractions people tend to sort [13] in developing countries.

Situational factors not only have a direct influence on the participation in waste sorting but they also influence attitudes and perceived behavior control, thereby influencing waste sorting participation indirectly [45,52,58]. As mentioned earlier, regardless of principally positive attitudes to waste sorting, low participation rates can occur when people find it hard to adapt to waste sorting because it is not (yet) a habitual task of daily routines or a learned behavior [103].

Situational factors are likely more influential than the result of this meta-analysis indicates given that only the direct influence was analyzed. However, situational factors also indirectly influence participation in household waste sorting in developing countries. Low participation rates can occur when there are no waste facilities but also when there is no cooperation of others within the household and when the waste management system is inconvenient. That is because these aspects impact both people's attitudes and their perceived behavior control. Future research might be able to gain a lot of constructive knowledge from studying the indirect influence of situational factors on participation in household waste sorting in developing countries.

The results of this meta-analysis furthermore indicate that it is crucial to efforts at encouraging household participation in waste sorting to focus on the convenience of waste management systems since this strengthens the impact of situational factors on participation as well as the influence of attitudes and perceived behavior control.

4.3.2. Knowledge

Knowledge in this context refers to two critical aspects. One of which is *intrinsic knowledge*, i.e., pre-existing knowledge. The other aspect is extrinsic knowledge, which a person can gain from external sources, such as in school or university [28,31,47,50], pictures on trash bins and information campaigns [25,28,61,67]. In addition, *information* and *communication* were considered part of the factor of knowledge.

The correlation (r) for knowledge is 0.14. Knowledge thus has a positive influence on waste sorting participation. The more intrinsic or extrinsic knowledge a person has, the more probable is participation in waste sorting. Not knowing how to sort or where to bring sorted waste prevents participation in waste sorting [97,104,105]. Insufficient information provided to the public about what resource recovery

can do and the difference that waste sorting can make might be a reason for low participation, given that such knowledge may otherwise be an incentive to sort the waste [23]. Given that language can be a barrier, visual and nonverbal communication, such as symbols or color-coded systems, may help instruct how to sort the different fractions of the waste [106]. As an example, the use of stickers in Sweden helped decrease the amount of missorted waste by 70% [107].

4.3.3. Socio-Demographic Factors

Socio-demographic factors are the most commonly studied predictors of participation in waste sorting generally. However, 20 of the 39 included articles studied socio-demographic factors in developing countries making them the least most studied factors contributing to this meta-analysis. Data on income, gender, education and age were analyzed.

Income

The aspect of income is least frequently reported in studies on waste sorting participation in developing countries and is the weakest predictor among the factors considered given its correlation (r) of 0.02. This result is inconsistent with a body of research that indicates that high income and high education typically go hand-in-hand and thus enable environmental knowledge, which in turn increases the likelihood of participation in waste sorting [108–113]. However, the majority of these studies were conducted in EU member states rather than developing countries.

It is not uncommon in developing countries for people to participate in waste management by sorting recyclables for economic reasons or even a living [42,114–116]. However, low-income areas tend to have inadequate waste facilities and infrastructure, which also prohibits participation in waste sorting [53]. Whether or not people live in an affluent area can also be an important factor in enabling access to waste management services, given that the provision of such services can vary within different areas of a country or even within cities.

Given such conflicting results on the influence of income in the literature, it is perhaps not surprising that the overall result of this meta-analysis fails to identify a correlation between income and the participation in waste sorting.

Gender

Gender is a more frequently studied aspect of waste sorting participation in developing countries. The correlation (r) for gender is 0.11 in which case -1 indicates men and +1 indicate women. Women are thus more likely to participate in waste sorting than men, which is consistent with Zhang, et al. [31] who found that female students in China are more likely to participate in sorting than males [31]. More than half of the literature on household participation in waste sorting in developing countries included in this meta-analysis is based on studies conducted in the East. In many eastern cultures, women are often perceived to be responsible for domestic household work whereas men are perceived as being responsible for work outside of it [117]. When this is the case, women spend more of their time and energy on household work. People who are more involved in running a household are also more likely to acquire knowledge on waste management [50], which may impact their motivation to sort. Given that societies develop towards gender equality, and increasingly, both men and women find employment in developing countries [117], many women might find less time for household chores [118,119]. As part of such developments, preconceptions about who is responsible for the household may shift, and both genders may engage more equally in waste sorting.

Education

The correlation (r) for education is 0.09, which indicates a minor positive influence of the level of education on the participation in waste sorting in developing countries.

Empirical research concluded that education influences waste sorting participation positively because higher education enables better access to environmental knowledge [31,41,47,51,55,56,60,65]. However, other studies found that particularly in developing countries, education does not significantly influence the participation of householders in waste sorting [31] because among the well-educated greater focus is laid on money and status than waste sorting [38,50,54,57,68,120]. Waste sorting is also associated with dirty and unhygienic labor [69] that is predominantly pursued by the poor [121].

Age

Age is the most studied socio-demographic variable studied in developing countries and the correlation (*r*) for age is 0.08 in which -1 indicates young people and +1 older people. The result indicates that older people are more likely to participate in sorting. Various studies found that all ages are relevant in terms of participation in waste sorting. The younger generation is likely to sort waste due to the attention paid to environmental knowledge provided in schools [42,47]. However, people between the age of 25 and 35 years of age were found to be more likely to sort than their younger peers [28]. However, the older generation is most willing to sort [28,39,41,50,54,56,59].

One explanation for this could be that older people who are about to retire or already are retired have more time which can be used towards waste sorting than people of working age with families have. Another aspect that influences the results on age is likely lack of education due to which younger people in developing countries may be less inclined to sort the waste. However, given the current efforts in educating school children in developing countries about effective waste sorting and the difference it can make, the raised awareness may lead to increased participation of that generation in sorting [28,50].

4.4. Remarks

The results of this meta-analysis show that government incentives and factors that relate to a person's perception of waste sorting, such as attitude, moral norm, subjective norm, perceived behavior control and perceived consequence are most influential on the participation in waste sorting in developing countries. Whereas situational factors and knowledge are the second most influencing factors and socio-demographic factors are the least influential factors.

The results of the meta-analysis also indicate that people's perception of waste sorting is the most important factor in developing countries that prompts participation in it. This could, however, be due to the poor conditions that waste management systems often have in developing countries. People who participated in studies in places where the waste management system is dysfunctional may not consider situational factors or knowledge relevant to their participation in waste sorting when they are resentful towards governmental incentives.

Government incentives were found to be influential which indicates that trust and satisfaction with the waste management system and laws introduced by the government have a significant effect on waste sorting participation. Despite having a lesser correlation than other factors, the results of this meta-analysis indicate knowledge and situational factors can nonetheless influence participation in sorting in developing countries. More so, these factors can influence factors that relate to consequences, norms, attitudes and perceptions and thereby prompt participation in waste sorting [28,45,52,58]. However, this indirect influence could not be analyzed in this meta-analysis due to an insufficient amount of quantitative data on it. The socio-demographical factors showed a very small correlation to participation in waste sorting, despite being the most studied factors included in this meta-analysis, which leads to doubts around the constructiveness of increased research efforts on them.

4.5. Policy Implications

In developing countries, it can be constructive to take the relationship across the identified factors and the participation in waste sorting into consideration when aiming to implement measures to increase participation in recycling schemes through waste sorting. Given that behavioral aspects are

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crucial in prompting participation in waste sorting [122–125], factors that prevent or discourage people from sorting should be addressed. The results of this meta-analysis showed that these factors that relate to behavior could be psychological, which included attitudes, perceived consequences, motivation and both subjective and moral norms. As such, strategies to increase participation in household waste sorting in developing countries could include knowledge provision as part of educational curricula. Teaching young generations about the importance and benefits of waste sorting can address attitudes and shift behavioral norms among the young society and the next generations to come.

However, it is also important to reach all of society with information, campaigns and strategic efforts that aim to increase participation in household waste sorting in developing countries. More so, user-adapted waste systems make participation in waste sorting likely. They can be achieved by engaging people in both designing waste management and involving them in decision-making processes. Because nongovernmental and community-based organizations already often do this, there should be cooperation among such organizations and local authorities or other waste service providers. Campaigns and practical strategies, such as transparency, employed by governments may strengthen credibility, trust and satisfaction of citizens making it more likely that people will act according to established regulations.

In order to resonate with factors such as attitude, moral norms and perceived consequences, emphasis should be laid on strategically communicating the undesirable ecological and human health-related consequences of mismanaged waste as well as the degradation of natural resources due to nonrecycling in developing countries. Moreover, the important work of informal collectors should be addressed, given the significant contribution they make to waste collection in developing countries. People should be informed that the work of informal collectors and their participation in waste sorting can make a direct difference not only to better living standards for themselves but also for people in their society as well as across the globe. This is because people's participation in waste sorting aids the correct management of waste, which, in turn, can avoid health issues resulting from uncontrolled dumping [19]. People should also have access to information that highlights that waste sorting enables sustainable waste management which avoids landfills and thereby helps minimize breeding grounds for communicable diseases that can flourish in landfills, improves air pollution and soil quality and avoids the depletion of resources which lowers the impact that the production of new materials has on the climate.

Targeted efforts at increasing the participation in household waste sorting in developing countries should also consider the results of this study in terms of situational variables. In order to address perceived behavior control, information provision on why and how to sort waste may encourage people to trust that they have the ability to participate in waste sorting and sound waste management. Lastly, in order to enhance the convenience of participating in waste management through sorting, the waste management infrastructure should be adapted to the needs of the people that engage in it.

4.6. Limitations

While meta-analyses are a constructive method in concluding multiple studies, sources of uncertainty exist which could direct future research. The homogeneity test verified that a random effect model was most appropriate in this study. However, this can mean that moderator variables could have impacted the final result to some extent through variables such as the year of publication or the country in which a study was conducted. These moderator variables and their impact on the accuracy of the results should be considered in future research. In addition, there is no unified standard questionnaire design regarding each of the factors analyzed in this meta-analysis. Responses thus may have different implications depending on the designs of the questionnaires across the included studies. In addition, the complexities of the waste systems across countries presents an additional challenge in interpreting the findings of this meta-analysis. Furthermore, there is no unified classification of the analyzed factors. Both of these moderator variables may have contributed to inaccuracies in the results.

The establishment of unified standards for factors influencing the participation in waste sorting would enhance the assessment of their meaning as well as their comparability in future research.

5. Conclusions

This was the first time that a meta-analysis was conducted with the aim to provide a quantitative assessment of the current state of the literature on factors that influence participation in household waste sorting in developing countries. The results indicate that:

- Meta-analysis as a method is effective in concluding factors that influence the participation in waste sorting from multiple studies. However, categorizing these factors and their relations to the participation in sorting is both constructive and challenging.
- The most strongly influencing factors are attitude, perceived behavior control and moral norms, which indicates that people's perception of waste sorting is most influencing in prompting participation in household waste sorting in developing countries.
- The results of this meta-analysis indicate that knowledge, situational factors and government incentives can influence participation in household sorting in developing countries but the relationship between those factors and attitude, perceived behavior control and moral and subjective norms should be studied further.
- Among the most notable results is that even though socio-demographic factors were the most studied factors that contributed to this meta-analysis, they have the weakest influence on participation in waste sorting in developing countries.

The results of this meta-analysis may contribute to recommendations and policy suggestions regarding the promotion of effective waste management aided by household waste sorting in developing countries. Further research can complement such effort further by focusing not merely on either factor that relates to attitudes and perception or on situational factors, knowledge and government incentives but rather the complexity, which is how the relationship among such factors prompts the participation in household waste sorting.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "conceptualization, L.Z. and K.R.; methodology, L.Z. and K.R.; software, L.Z.; validation, L.Z. and K.R.; formal analysis, L.Z., C.H. and K.R.; investigation, L.Z. and K.R.; resources, L.Z. and K.R.; data curation, L.Z. and K.R.; writing—original draft preparation, L.Z. and C.H.; writing—review and editing, C.H. and K.R.; visualization, C.H., L.Z. and K.R.; supervision, K.R. All authors have read and agreed to the published version of the manuscript

Funding: The authors are grateful for the financial support from Sparbankstiftelsen Sjuhärd.

Conflicts of Interest: The authors declare no conflict of interest

Appendix A

Table A1. Authors: influencing factors on household waste sorting, statistical analysis and sample sizes and countries studied *.

Author	Factors Investigated in Meta-Analysis	Statistical Analysis	Sample Size	Country
Afroz, et al. [28]	Situational factor (space for storage at home, distance to collection point), age, gender, income	Mean value, <i>t</i> -value	456	Bangladesh
Akil and Ho [39]	Age	Mean value, frequency and contingency table	670	Malaysia
Akil, Foziah and Ho [40]	Age	Mean value, frequency and contingency table	600	Malaysia

Author	Factors Investigated in Meta-Analysis	Statistical Analysis	Sample Size	Country
Babaei, et al. [41]	Age, education, gender	Mean value, frequency and contingency table	2400	Iran
Chan [38]	Attitude, perceived behavior control, subjective norm, age, education, gender Attitude, perceived behavior	Mean value, frequency and contingency table	167/173	Hong Kong
Chen and Tung [67]	control (perceived difficulty for lack of recycling facilities), subjective norm, moral norm, perceived consequences	Correlation <i>r</i> , t-value	541	Taiwan
Chu and Chiu [25]	Attitude, perceived behavior control, subjective norm, moral norm (ethical and moral aspects in engaging in recycling), perceived consequences (protecting natural resources and reducing societal cost as a consequence for recycling), situational factor (space for storage at home and convenience of recycling facilities), governmental incentives (rewards)	Mean vale, correlation <i>r</i>	386	Taiwan
Chung and Poon [42]	Age, education, gender, income	Mean value, Z-value	370/738	China
Corral-Verdugo [43]	control, perceived benavior control, perceived consequences	Mean value, correlation r	100	Mexico
Du Toit, et al. [44]	Attitude, perceived behavior control, subjective norm Attitude, perceived behavior	Correlation <i>r</i> , t-value	298	South Africa
Du Toit, et al. [45]	control, subjective norm, situational factor (space for storage at home and convenience of curbside and collection point schemes)	t-value, frequency and contingency table, correlation <i>r</i>	290	South Africa
Ghani, et al. [68]	Attitude, perceived behavior control, subjective norm, situational factor, age, education, gender	Frequency table, correlation r	204	Malaysia
Hernandez, et al. [46]	Attitude, subjective norm, knowledge	Mean value, correlation <i>r</i> , t-value	410	Ecuador
Ifegbesan [47]	Knowledge, age, gender	Mean value, frequency and	650	Nigeria
Janmaimool [48]	Subjective norm, moral norm	Mean value, correlation r	193	Mexico
Jekria and Daud [49]	Attitude	Correlation <i>r</i> , t-value	143	Malaysia
Li [50]	income	contingency table, odds ratio	391	China
Mamady [51]	Situational factor (access to recycling schemes in residential area and distance to the collection point, age, education, gender, income	Mean value, frequency and contingency table, odds ratio	1093	Guinea
Mosler, et al. [69]	Attitude, perceived behavior control, subjective norm, governmental incentives (trust to the government and local authorities)	Correlation <i>r,</i> t-value	299	Cuba

Table A1. Cont.

Author	Factors Investigated in Meta-Analysis	Statistical Analysis	Sample Size	Country	
Nguyen, et al. [70]	Attitude, perceived behavior control, subjective norm, moral norm, perceived consequences as waste problem threat health, governmental incentives (rewards and benefit from recycling and trust to local authorities)	Frequency and contingency table, correlation r	180	Vietnam	
Nomura, et al. [52]	Attitude, moral norm, situational factor, governmental incentives	Frequency and contingency table, correlation r	357	Vietnam	
Omran, et al. [53]	Age, education, gender, income	Mean value, frequency and contingency table	389	Malaysia	
Owusu, et al. [54]	Age, education, gender	Mean value, t-value, frequency and contingency table	384	Ghana	
Oyekale [55]	Governmental incentives (regulation for recycling), age, education, income	Mean value, frequency and contingency table	23518	South Africa	
Pakpour, et al. [56]	Attitude, perceived behavior control, subjective norm, moral norm, age, education	Mean value, frequency and contingency table, correlation <i>r</i>	1676	Iran	
Ying [57]	Perceived behavior control (perceived difficulty for recycling), subjective norm, education	Mean value, frequency and contingency table, correlation <i>r</i>	618	China	
Ramayah, et al. [58]	Attitude, perceived behavior control (cost for recycling), subjective norm, situational factor (availability of recycling infrastructure)	Correlation <i>r</i> , t-value	200	Malaysia	
Singhirunnu-sorn, et al. [59]	Attitude, knowledge, age, income	Mean value, frequency and contingency table, correlation <i>r</i>	151	Thailand	
Strydom [84]	Attitude, behavior control, subjective norm Attitude, situational factor (access to container for	Mean value, frequency and contingency table, correlation <i>r</i>	2004	South Africa	
Tadesse [120]	recycling), governmental incentives (regulation for recycling), age, education,	Mean value, correlation r	400	Ethiopia	
Tatlonghari and Jamias [60]	gender, income Attitude, knowledge, education, income Attitude, perceived behavior	Mean value, F-value, correlation r	100	Philippines	
Tamas, et al. [71]	control, subjective norm Attitude, perceived behavior control, subjective norm, moral norm, perceived consequences, situational	Correlation <i>r</i> , t-value	765	Cuba	
Xiao, et al. [62]	factor, knowledge Subjective norm, knowledge, governmental incentives (rewards and regulation) Knowledge, governmental	Mean value, frequency table correlation r	712	China	
Xu, et al. [63]	incentives (rewards and regulation)	Mean value, Correlation r	631	China	
Yuan, et al. [64]	Attitude, perceived behavior control, subjective norm, moral norm	Mean value, frequency and contingency table, correlation <i>r</i>	362	China	
Zhang, et al. [65]	Attitude, perceived behavior control, subjective norm, moral norm, situational factor, knowledge, age, education, gender, income	Mean value, frequency and contingency table, correlation <i>r</i>	208	China	

Table A1. Cont.

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Author	Factors Investigated in Meta-Analysis	Statistical Analysis	Sample Size	Country
Zhang, et al. [66]	Attitude, perceived behavior control, subjective norm	Mean value, F-value, correlation <i>r</i>	250	China
Zhang, et al. [31]	Gender	Mean value, frequency and contingency table	509	China

* The studies were conducted in cities with households as the source of the samples, except for the following studies: Ghani, et al. [68] conducted a survey among the staff of a university campus, Ifegbesan [47] surveyed school students, Ramayah, et al. [58] and Zhang, et al. [31] conducted a survey on students at university campus, and Tatlonghari and Jamias [60] conducted their survey on households in a village. All studies were conducted in the context of long-term recycling programs, except for two studies by Hernandez, et al. [46] and Xiao, et al. [62] which were within the context of pilot recycling programs.

Appendix B

Study							Correlation r (95 % CI)
Chu & Chiu (2003)							0.08 [-0.02, 0.18]
Nguyen et al. (2015)			_	1			0.60 [0.49, 0.68]**
Nguyen et al. (2015)			-				0.50 [0.38, 0.60]**
Nomura et al. (2017)		: :	-	1 1			0 18 [0 07 0 27]**
Mosler et al. (2008)			-	_	-		0.52 [0.43, 0.60]**
Ovekale (2015)							0.05 [0.04, 0.06]**
Tadesse (2009)			-				0.38 [0.29, 0.46]**
Xiao et al. (2017)			- -	1			0.16 [0.09, 0.23]**
Xiao et al. (2017)		: :	- <u>-</u>	1		1	0.12 [0.05, 0.19]**
Xu et al. (2017)			-				0.18 [0.11, 0.26]**
Xu et al. (2017)							0.05 [-0.03, 0.13]
Governmental Incentives				<u> </u>			0.26 [0.16, 0.36]**
Hernandez et al. (1999)		1 1		1	1		0.13 [0.03, 0.22]**
Ifegbesan (2010)			•	1			-0.07 [-0.14, 0.01]
Singhirunnusorn et al. (2012)	_						-0.23 [-0.37, -0.07]**
Talonghari & Jamias (2010)				-			0.21 [0.02, 0.39]*
Tang et al. (2011)			-				0.10 [0.03, 0.17]**
Xiao et al. (2017)			-	1			0.56 [0.51, 0.61]**
Xu et al. (2017)				+			0.28 [0.21, 0.35]**
Zhang et al. (2015)							0.06 [-0.08, 0.19]
Knowledge			●	-			0.14 [-0.05, 0.32]
Afroz et al. (2010)				1			0.05 [-0.05, 0.14]
Afroz et al. (2010)			-	-			0.21 [0.12, 0.29]**
Chu & Chiu (2003)							0.17 [0.07, 0.27]**
du Toit et al. (2017)							0.12 [0.01, 0.24]*
du Toit et al. (2017)				1			0.09 [-0.02, 0.21]
du Toit et al. (2017)							0.13[0.01, 0.24]*
du Toit et al. (2017)							0.10[-0.01, 0.21]
Ghani et al. (2013)							0.01 [-0.12, 0.15]
Nomura et al. (2017)				1			0.24 [0.14, 0.34]
Mamady (2016)		1			-		0.52 [0.48, 0.56]**
Wamady (2016)				_			0.39 [0.34, 0.44]**
Ramayan et al. (2012)							0.11 [-0.03, 0.24]
Tadesse (2009)				-			0.13 [0.05, 0.42]**
7bang et al. (2011)				1 1			0.12 [0.05, 0.19]**
Situational Eactor							0.19[0.00, 0.32]
Chen & Tung (2010)			-		-		0.56 [0.50, 0.62]**
Chu & Chiu (2003)			-	-			0.20 [0.10, 0.29]**
Corral-Verdugo (1997)		1					0.17 [-0.03, 0.35]
Nguyen et al. (2015)			_	1			0.10 [-0.05, 0.24]
Tang et al. (2011)							0.15 [0.08, 0.22]**
Perceived Consequence							0.25 [0.03, 0.44]*
Chen & Tung (2010)			-		-		0.45 [0.38, 0.51]**
Chu & Chiu (2003)							0.11 [0.01, 0.21]*
Janmaimool (2017)							0.39 [0.26, 0.50]**
Nguyen et al. (2015)			-	-	•		0.52 [0.40, 0.62]**
Nomura et al. (2017)			-	-			0.22 [0.12, 0.32]**
Pakpour et al. (2014)							0.54 [0.51, 0.57]**
Tang et al. (2011)			-				0.18 [0.11, 0.25]**
Yuan et al. (2016)				-	-		0.45 [0.37, 0.53]**
Zhang et al. (2015)		1					0.17 [0.03, 0.30]*
Moral Norm							0.35 [0.22, 0.46]**
Note. *P < 0.05, **P < 0.01	-0.4	-0.2	0.2	0.4	0.6	0.8	

Figure A1. Cont.



Note. *P< 0.05, **P < 0.01

0.2

0.4

0.6

0.8

-0.4

-0.2

Figure A1. Cont.



Figure A1. Factors investigated and included in this meta-analysis. The effect-size and 95% confidence interval (CI) was calculated for each study. The overall synthesized for each factor shows under a group of studies; it is highlighted and underlined.

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