



“Environmentally-Friendly Movement” as a Program to Support Sustainable Development Goals Using Text Mining Methods

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Abstract: Nowadays, environmental initiatives and campaign activities are promoted massively in Bandung City. These activities are part of the program to achieve sustainable development goals at the municipal level. Text mining methods from online news and media were conducted to understand the implication of the program to the pro-environmental behavior and consciousness of the Bandung City residents. A questionnaire survey to 340 residents of Bandung City was also distributed randomly to see the relationship between sociodemographic profiles (age and education level) and pro-environmental behavior of the respondents. Results showed that the Kang Pisman program became the highest environmentally friendly movement program promoted through mass media. This result also corresponds to the questionnaire survey in which people in Bandung City try to reduce their produced waste. Besides, education level is insignificant, and age becomes one-factor influencing environmental behavior. The interesting point is that the government should enhance organic waste management since many people are unwilling to process their organic waste. To promote, educate, and engage residents in pro-environmental behavior, stakeholders should conduct environmentally friendly movements, thus achieving local SDGs target.

Keywords: environmentally friendly movement, SDGs, sustainability, text mining

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INTRODUCTION

The conscious environmental community is a part of the sustainable development goals (SDGs) agenda (Janakiraman et al., 2021). Many countries are working hard to achieve this target as they have many environmental, social, and economic problems to be solved (Barua, 2020). The municipal government introduced environmental education through the campaign and social movement, non-government organizations (NGOs), and other stakeholders as tools for developing the conscious community (Kluttz & Walter, 2018). For instance, in Germany, there is a movement called *the Fridays For Future (FFF)* movement organized by young environmental activists who support climate protection worldwide. This movement successfully engaged the younger people in pro-environmental behavior among their members (Wallis & Loy, 2021). Another best practice of environmental movement, which was used to reduce the food waste from sources, was held in Canada and United States. *Love Food Hate Waste* and *Food: Too Good to Waste* are a 12-week food waste campaign that is popular to gain local people's awareness, knowledge, and motivation. This campaign was also equipped with gamification to engage the community to save their food, thus reducing their food waste (Soma et al., 2021). *Advanced Locality Management* is a Mumbai city program organized voluntarily by environmentally conscious citizens. This program organizes waste separation and collection at the household scale. This program is derived from *Swachh Bharat Mission* which the Indian government introduced to promote *Clean India*. The contribution of this program to behavior change and increasing community participation in waste management is significant (Mukherjee Basu & Punjabi, 2020). Therefore, those environmental education practices (through non-formal way) was proven to promote the SDGs target and agenda (Garcia et al., 2017).

As part of committed countries in the SDGs, Indonesia is also triggered to achieve sustainable communities in each city. Establishing a circular economy system becomes one of the prioritized urban development policies (Fatimah et al., 2020). This system is supported by law enforcement from municipal government and voluntary programs conducted by NGOs, the community, and other stakeholders (Lestari et al., 2015; Utari & Arifin, 2019). *Adipura* Program is an example of a well-known central government program

that rewards the city that can maintain its environmental performance (Dethier, 2022). To get the *Adipura* achievement, many cities in Indonesia promote local environmental movements and campaigns. However, as many programs face, sustaining the environmental programs is not as simple as planned (Lawrence et al., 2020). Many factors may influence the sustainability of environmental management programs, such as age, gender, social, economic, and education level, social influence, and incentives (Xu et al., 2018). Therefore, there is a gap in the published literature that can explain the success of environmental movements or campaigns to improve the environmental consciousness of the residents.

Bandung city is the capital city of West Java Province which has many successful implemented environmental programs and has become one of the best practices of environmental management in Indonesia (Gunawan et al., 2017). Bandung City Government, NGOs, community-based organizations (CBOs), private sector, academicians, and other environmental management experts consistently educate the Bandung City community and residents to become an environmentally friendly society (Nugraha et al., 2019). Some green initiatives and campaign activities such as *greeneration* and *cleanaction* were previously introduced in Bandung City and became part of society (Ramadan et al., 2016). Therefore, some ongoing programs that are now promoted include *bank sampah* or waste bank initiatives, recycling movement, and environmentally friendly movement. The waste bank, also called a community-driven material recovery facility (CdMRF), is also considered a facility that provides a recycling system at the community level (Budihardjo et al., 2022). The establishment of the waste bank can provide a circular economy in the community. The details of waste bank management have been briefly introduced recently in the Environmental and Forestry Law number 14/2021 (PermenLH 14/2021, n.d.). Besides, municipal government also promote new environmentally friendly movement such as *Kang Pisman – Kurangi Pisahkan Manfaatkan* (reduce, separate, reuse), *Diet Kantong Plastik* (reduce plastic bags), and *Bandung Bijak Energi* (Bandung wisely energy use) to achieve Sustainable Development Goals (Rosalina et al., 2019). Even though many programs were conducted to develop the environmentally-conscious community in Bandung City, no published report evaluated those program success.

To establish an environmentally conscious community in Bandung City, this research evaluates some environmental campaign programs released by the government, non-government organizations (NGOs), and other waste management parties. The environmental campaign's data were derived from online news, relatively connected to the environmentally friendly movement program. This study employs text mining methodologies to analyze the online news reporting programs and multivariate regression models to analyze the influence of sociodemographic profiles (age and education profile) on environmental behavior. This research also wants to find the most effective and significant campaign that affects the Bandung society's environmental consciousness and behavior. This study is hoped to give clear perspectives about the future development of environmentally friendly movement programs, especially in Bandung City.

METHODS

Data Collection

In this study, a desk study and online-survey questionnaire were used to collect the data for analysis (Zaman, 2014). All environmentally friendly movements were described to get a broader view of the current movement that has been done in Bandung City. Mass media news, published from 2008 to 2020, were also extracted from the internet. It was found that 43 news proceeded to the next stage of analysis. The screening phase was carried out in several stages. First, the keywords such as *masyarakat ramah lingkungan kota bandung* (environmentally friendly community of Bandung city), *gerakan lingkungan kota Bandung* (Bandung City environmental movement), and *lingkungan dan pemerintah kota Bandung* (environment and Bandung city government) were used for the article screening. Second, the authors were read and screened all of the news collected by checking the relationship between content and research aim. Some considerations are based on the availability of content, including titles, facts, and the arguments presented. The collected data were converted into .txt files and standardized by removing unwanted terms, abbreviations, and prepositions.

A questionnaire survey was conducted to verify the findings from the desk review study. The online questionnaire was distributed randomly in October - December 2019 to Bandung citizens to see their environmental consciousness after receiving mass media environmental-friendly movement information. This questionnaire was used to obtain the respondent's age, gender, educational status, and pro-environmental behavior. There were 340 respondents that filled out the questionnaire survey. The questionnaire used a Likert scale (1-5) to obtain correlation and cluster analysis data. The questionnaire design is provided in Table 1.

Table 1. Questionnaire design

Variables	Questions	Question
General profile	Age	Classified as below 20, 21-30, 41-50. Above 50
	Education level	Elementary, junior, senior, undergraduate, graduate school
Pro-environmental behavior profile	I bring my shopping bag while shopping. I bring a refill bottle/tumbler. I sort organic waste (food scraps, vegetable scraps) and inorganic waste (plastic bottles, plastic, cardboard, books). I make compost from organic waste. Do you want to be a member/staff/volunteer of a waste bank? I reuse items that can still be used. I don't burn organic and inorganic waste. I try to reduce leftover food after eating. I consume enough water. I try to save energy usage (gas and electricity).	Likert scale (1-5)

Data Analysis

Mass media analysis

Text data that has been collected from online mass media were transferred to a text format file (.txt). Text mapping analysis began with creating a map based on term co-occurrence using VOSViewer software®. The text format file was then submitted as VOSviewer corpus and scores file. Then, the full counting method was chosen for counting the text corpus because it can provide a more expansive data capture than the binary method, representing only one term for each news. It is critical to know a word that is mostly used with "environmentally friendly." The minimum number of term category occurrences was set to 4 and expanded the range of terms to 121 items or equivalent to 60% of the overall relevant word. Then, some extracted words were verified and removed some irrelevant words such as "tons," "light," "change," and many more. The fractionalization method was used as the normalization method because this method can describe link strength based on the relationship between the presence of items in the literature that intersect, not by summation like the association method. To get a clear and diffuse VOSviewer schematic view, we use the attraction input "2" with repulsion "-3". Then for clustering, it is set with a minimum cluster size of 8 items with the option to merge in a small cluster. The visualization scale is set to the "weight: occurrence" option, so items that look bigger are items that have more "occurrence."

Online questionnaire

The questionnaire survey was used to check the correlation between the news derived from online searching and the pro-environmental behavior of Bandung City residents after receiving the environmental campaign from the government and another stakeholder. Some sociodemographic profiles such as age and education level were analyzed using descriptive analysis. Therefore, the pro-environmental behavior profile was analyzed using analysis of variance (ANOVA) concerning the demographic profiles (age and education level). The younger the residents, the higher environmental behavior should be, and the higher the education level of the resident, the higher the environmental behavior profiles. This hypothesis will be used as the basis of the analysis of the pro-environmental behavior of Bandung City residents. After understanding the environmental behavior and its relationship with the sociodemographic profile, the environmentally friendly movement was evaluated descriptively to produce appropriate policy for creating sustainable societies in Bandung City.

RESULT AND DISCUSSION

Current Environmentally Friendly Movement in Bandung City

Kang Pisman (<https://www.kangpisman.com/>) is a program endorsed by Bandung Municipal Government to reduce, reuse, and recycle household waste from its source. This program aims to change the behavior and lifestyle of Bandung citizens, which are still poorly managing their waste. *Kang* means to reduce,

Pis means segregate, and *Man* means taking advantage of waste. This program received Milan Pact Award 2020 since this program has created 143 zero-waste (self-claimed) regions in the Bandung City communities (Pratama, 2021). This program includes some activities such as workshops on organic and inorganic waste management and treatment, training on recycling waste, training on the establishment of the waste bank, and workshop on urban farming methods (Sekarningrum et al., 2020).

Gerakan Indonesia Diet Kantong Plastik (<https://dietkantongplastik.info/>) is a non-profit organization (NPO) program that has been promoting the reduction of citizens' plastic use (mainly plastic bags) for daily life since 2013. This movement has been widely applied in many cities in Indonesia and aims to change the community perception and behavior to use reusable bags. This program has many activities such as socialization of reducing the use of plastic bags, exchanging the plastic bags with reusable bags, and campaign of waste reduction from sources (Setiawan & Fithrah, 2019). This social movement can attract public attention to reduce shopping bags through various attractive and exciting messages on social media. The program also inspired many industries and companies to realize the negative impact of plastic bags (Adestika, 2021).

Bandung Bijak Energi (<https://twitter.com/ehbdg>) is a movement initiated by CBOs, Government, NPOs, and companies in Bandung City (in 2011) to respond to *the Earth Hour* movement, which was initiated globally in 2007. Twitter is the most commonly used social media by the municipal Government of Bandung City, which is also followed by this program. These movements are used to reduce light pollution and electricity consumption during a range of time. It was found that *the Earth Hour* movement can reduce more than 4% of electricity consumption globally during the event (Jechow, 2019). The *Earth Hour* movement is conducted voluntarily, so *Bandung Bijak Energi* does. This movement used creative and attractive communication strategies to promote and protect the earth from climate change. This situation is also the reason behind the massive followers of those two movements during the event (Chan et al., 2020). All programs mentioned are still being held up to now. In Covid-19, those programs were still being held with some following restrictions.

Results of Text Mining Analysis

It has obtained 5 data clusters with 65 items, as detailed in Table 2. In general, the total number of links is 299, with a total link strength of 978. A cluster is a grouping of items based on the attachment between items from the entire processed news. In translating cluster connectivity, it is necessary to collaborate with values and illustrations from VOSviewer software. For example, cluster 1 with the word campaign is associated with the environmental campaign. Likewise with cluster 2, for example, Kaia – product – straw – friendly product – youth. If analyzed comparatively in one of the news stories entitled "Reduce Plastic Waste, These Are Environmentally Friendly Packaging Glasses from Kaia", it will be found that "Kaia" is an environmentally friendly product in the form of straw, which is traded in cafes and restaurants where the younger generation initiates it. Item and cluster analysis needs to be balanced with the bibliometric illustration reasoning below. In simple visualization, based on the definition of the fractionalize method, closely spaced items show a more substantial relevance power than items far away. For example, a campaign item in cluster 1 with a shopping item will be stronger than a "campaign" item with a "building" item. Cluster coloring also helps visualize grouping, and for example, a purple "food" item will cluster differently from a yellow "recycle" item.

Table 2. Top 5-word lists for each cluster

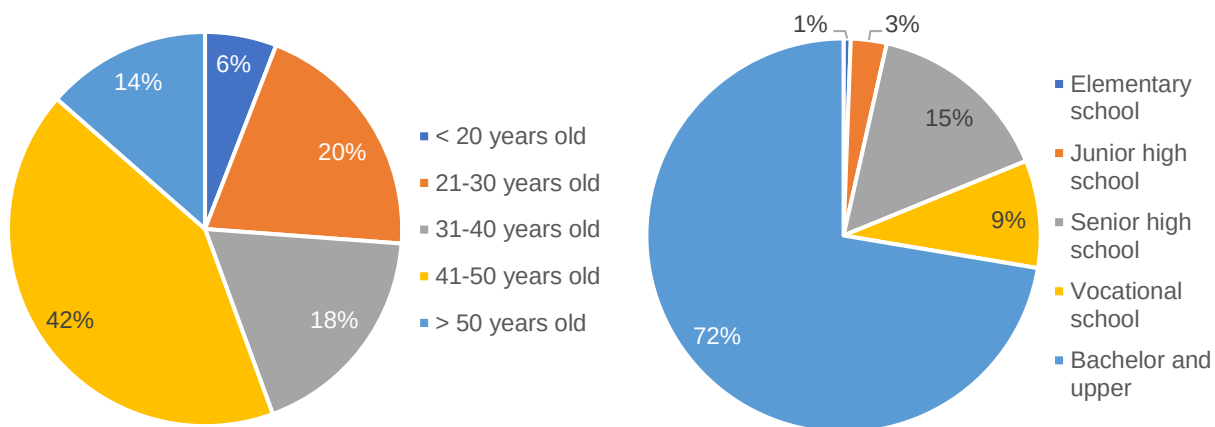
Cluster	Words	Weight			Cluster Score
		Link	Total Link Strength	Occurrence	
1	campaign	27	139	45	557
	event	20	82	20	
	own bag	7	62	7	
	plastic	25	53	23	
	shopping	13	40	7	
2	kaia	16	88	25	437
	product	18	62	35	
	straw	12	45	12	
	restaurant	10	39	8	
	café	8	34	9	
3	consumer	21	86	30	405
	own shopping bag	12	61	16	
	plastic bags	16	45	9	
	home	11	43	13	
	cardboard	7	32	7	

Table 3. Results of item details analysis for each cluster

Cluster	Cluster Name	Text Mining Results
1	Environmental campaign	campaign, event, own bag, plastic, shopping, innovation, balitbang pupr, itb, road, healthy environment, household waste, asphalt mixture, school, earth hour, building
2	Environmentally friendly product	kaia, product, straw, restaurant, café, cup, youth, training, plastic straw, cooperation, pla, friendly product, paper, dispora, knowledge
3	Plastic bag reduction	consumer, own shopping bag, plastic bags, home, cardboard, reusable bag, sabilulungan movement, modern market, reduction, sustainability, traditional market, entrepreneur, understanding
4	Waste reduction and recycling campaign	kangpisman, composter, reduce, culture, separate, recycle, economic value, garbage bank, waste bank, environmental campaign, organic waste, environmental activist
5	Online shopping and plastic waste potential	food, delivery bag, driver, ministry, gojek, policy, disposable cutlery, klhk, initiative, single-use plastic

Results of Statistical Analysis of Environmental Consciousness

From the questionnaire survey, it is found that most respondents that were filling out the questionnaire were coming from the middle age (42%) and followed by 21-30 years old (y.o.) about 20%, 41-50 y.o. for about 18%, and others. Most respondents also have a higher education level (at least bachelor's degree level), accounting for 72% of the total respondents. The distribution of the respondents can be seen in Figure 2.

**Figure 2.** Distribution of respondents by age (left) and education level (right)

An interesting result is coming from the pro-environmental behavior profile of Bandung City residents. As shown in Figure 3, the respondents have good environmental behavior and consciousness since they strongly agree to activities such as saving energy usage, responsible water consumption, waste reduction, reuse, and recycling. However, many respondents are not willing to be staff members or volunteers of a waste bank. The residents also doubt processing their organic waste due to limitations such as odor problems, bigger space, and complicated maintenance. Therefore, bringing a refill bottle and their shopping bag while shopping is also a more significant challenge that the local government must face.

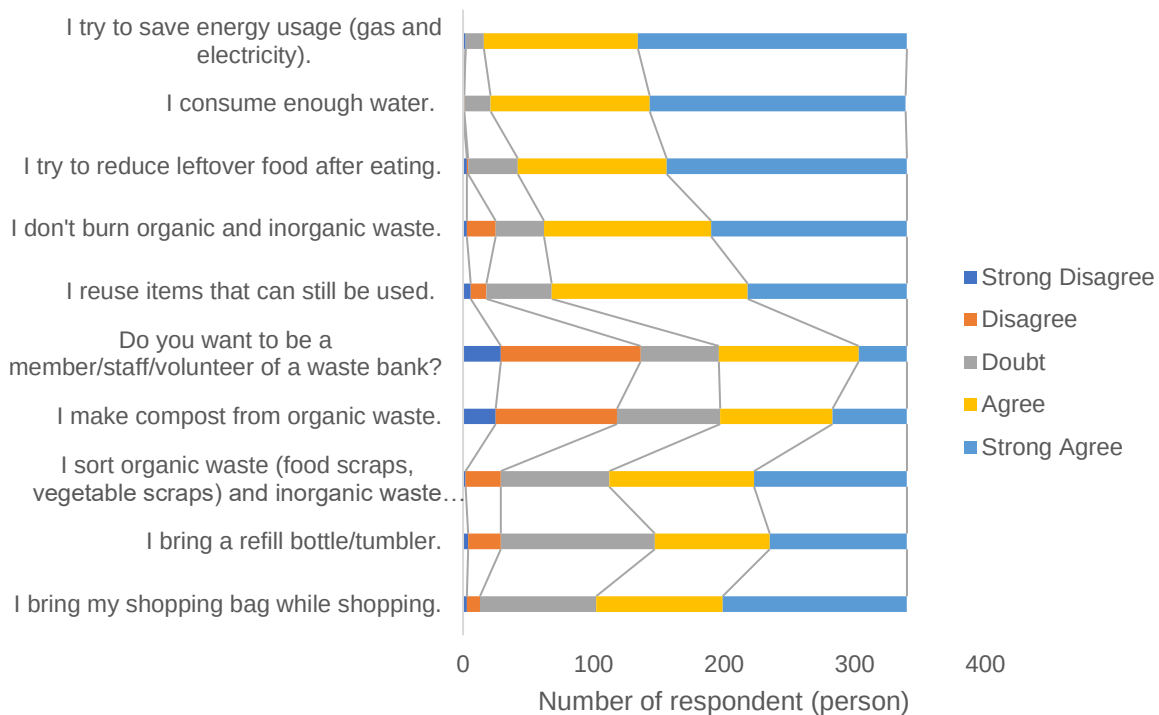


Figure 3. Pro-environmental behavior characteristic of Bandung City residents

Based on statistical analysis, all the questionnaire results have 0.821 Cronbach Alpha values which are defined as reliable. The Pearson correlation is also significant at the 0.01 level (2-tailed) for all questionnaire results, further processing for multivariate regression analysis. The regression analysis showed that the education level is not statistically significant for determining the behavior and only explains 7.1% of the model formed. In contrast, the age of the respondents can describe the model better (about 30.3%) of the behavior than the education level. The model's R square (R^2) is only 10.9%, which means that age can only significantly influence the behavior level of 10.9%. In other words, many factors may influence the success of pro-environmental behavior change in Bandung City. At this point, some environmentally friendly movement such as *kang pisman* (*kurangi, pisahkan, manfaatkan*), *diet kantong plastik*, *Bandung bijak energi*, and *Bandung pisahkan sampah* may be effectively implemented to change the behavior of Bandung City residents.

According to the text mining analysis, *Kang Pisman* program is the most frequently discussed program in the online news compared to other environmentally friendly movements/programs. As previously described, the international forum recognized the Kang Pisman since it can provide many zero-waste communities in Bandung City (Pratama, 2021). Some activities of *Diet Kantong Plastik* are already included in the *Kang Pisman* program, so it is not necessary to change the behavior of Bandung City citizens. Therefore, since the *Earth Hour* program is only held once a year, the changing behavior is not significant. However, a piece of exciting information is documented in Figure 3. People are already conscious of the consequences of electricity usage. The higher electricity usage will make them spend more money (direct usage) than waste management itself (Linderhof et al., 2019). The higher the waste generated is not proportional to the higher cost they should spend to the government or third parties. Therefore, higher efforts also were detected in the recycling practices with no incentives (Knickmeyer, 2020). In this case, the campaign of water and energy usage reduction is not the prioritization.

Meanwhile, the waste management problem is still becoming an interesting issue to be solved by the government and other stakeholders. Many people are concerned about organic waste treatment and management. Organic waste management is hard to do because it needs a larger space and is not practically successful in the field (Abdel-Shafy & Mansour, 2018). Many people feel doubt about managing their organic waste by themselves. Proper decentralized organic waste collection and treatment facility is needed to solve this problem. Since Bandung City has a highly dense population, the micro-waste treatment method should be applied (Thiriet et al., 2020). The other interesting information is that the people in Bandung City are not willing to participate voluntarily in the waste bank. This condition is because the people do not have enough time to do the recycling practices in the waste bank (Raharjo et al., 2017). Furthermore, low willingness to participate in recycling activity is also found in Bandung City. The positive value of age and education level indicates that the oldest person and the highest education level will positively impact the higher pro-environmental behavior level. Therefore, promoting recycling and environmental knowledge is essential to

building environmental consciousness community (Patel et al., 2017).

From the results, some recommendations can be taken to increase the pro-environmental behavior of Bandung City residents. First, the *Kang Pisman* program should be more endorsed to the neighborhood, so many people engage in recycling activities. Second, recent studies showed the triumphant story of organic waste treatment by using black soldier fly (BSF). This alternative can also be considered at the household level (as part of the waste bank) to get more incentives for the community (Mahmood et al., 2021). Third, *Diet Kantong Plastik* organizer, which is also in line with *Kang Pisman* initiator, should be collaborated and do more campaigns as there is still more doubt of the people to reduce plastic usage. They were not sure to bring their bottle/tumbler and shopping bag. Some creative and innovative solutions such as gamification during the campaign should be provided to boost the pro-environmental behavior between respondents (Lidia et al., 2018).

CONCLUSION

Environmental consciousness can be derived from the environmental movement that needs stakeholders' support. Bandung city government established some environmentally friendly movements endorsed by the community, NGOs, and private companies to enhance the environmental consciousness in the Bandung City residents. As found in this study, the environmental movement can impact environmental behavior. The age of the respondents is significantly impacting the behavior and consciousness. Therefore, the education level seems not to contribute significantly to this case. Other factors need to be explored to deepen understanding of the most significant factor that can significantly improve Bandung City residents' environmental behavior and consciousness. Pro-environmental behavior will accelerate the achievement of all SDGs targets, especially in Bandung City.

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