Visual Improvement of Slum Areas to Accelerate Universal Access to Domestic Wastewater Treatment (Case study of Yogyakarta, Semarang and Manado)

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Abstract. Lack of sanitation access is among characteristics of urban slums; therefore strategies to improve sanitation are needed. One possible strategy is to improve visual appearance of slum buildings by painting walls with colours. Other than improving community awareness to maintain cleanliness, this approach can provide economic benefit for the residents, as it creates tourism activities. This paper observes visual improvement of slum areas; besides ability to accelerate access to domestic wastewater treatment is compared. This study observe domestic wastewater treatment facilities after visual improvement carried out in three different slum locations in Indonesia. They are Kampung Code in Yogyakarta, Kampung Wono Sari in Semarang and Kampung Sindulang in Manado. Initiation of coloring project of the three urban area is different. Community and private sector initiated Kampung Code painting project, while the local government initiated similar project of Kampung Wono Sari and Kampung Sindulang. Observation was performed by distributing questionnaires to residents of the slum areas and path analysis executed afterward. A sample size of 64, 270 and 102 were taken from Kampung Code, Kampung Wono Sari and Kampung Sindulang respectively, with 5% margin of error. Wastewater management behaviour was measured based on level of community intention to manage sanitation. Intention is derived from three different independent variables: attitude, subjective norms and perceived behaviour control. Significant effects of the colouring project to improve community awareness towards the importance of domestic wastewater treatment facilities was observed in all slums.

Keywords: coloring project, domestic wastewater treatment, slum area, visual improvement

1. Introduction
In 2017, there were 7.6 million slum houses in Indonesia, most of which are on riverbanks. Generally, slums have very poor sanitation. Indonesian government set a target of 100% universal access to sanitation in 2019, however only less than 2% of national and regional budget is factually allocated.
towards sanitation. Limited budget encourages community to develop projects targeting sanitation problem; a common alternative is to improve awareness towards the importance of sanitation.

There are several ways to raise public awareness of wastewater management, one of which is to improve visual area by mural and wall coloring. Beautification of slums is not a new. Cities around the world have implemented it in various ways result in varying degree of successes. For examples Prometrópole in Recife [1] and Rocinha in Rio de Janeiro, Brazil [2], Ganesh Nagar D in Mumbai, India [3], and in Egypt [4]. In Indonesia, slums of Jodipan and Ksatrian, Malang, were painted in rainbow colours to improve its appearance and make it look more attractive. This project also resulted in tourist destination besides to have significant improvement of waste management awareness, although it does not significantly affect wastewater management. This is due to low level of public awareness regarding importance of domestic wastewater management. In a study conducted by Zakiyya et.al [5] at the aforementioned colour village in Malang, it was found that wastewater awareness (dependent variable) cannot strongly predicted from the awareness of waste management (independent variable). However, the project brings significant improvement.

According to Sarli et.al.[6], coloring project in Malang slums is success due to: 1) initial strategic impacts since the location attracts public’s attention, 2) media ignites tourist hype, 3) direct economic impact due to tourism and attention of government officials to allocate budgets for sanitation purposes. Similar successful slum upgrade project is in Durban, South Africa. The success was driven by continuation of consolidated stakeholder and influence of local committee to strive for upgrade [7]. A research in Egypt showed that funds and government will are crucial for a successful upgrading project, while participatory methodology should always be adopted together with local government and active society organisations [4].

Separate studies on three different community developments projects in Yogyakarta [8], Semarang [9], and Manado [10] have also been conducted. All three locations have experienced visual improvements through large-scale wall colouring schemes, although the initiator of the projects might differ. In Yogyakarta, the initiator of visual improvement project was private sector. Meanwhile, visual improvement project in Semarang and Manado was initiated by the government. Colouring project is an effort to improve visual appearance of slums, which is expected to have an impact on sanitation behaviour of local community. This study explores whether visual improvement of slums can truly accelerate universal access to domestic wastewater treatment by comparing coloring results of all three-development projects.

2. Methodology
Three slum areas are visually improved through massive colouring project, i.e. Kampung Code, Yogyakarta; Kampung Wonosari, Semarang and Kampung Sindulang, Manado. These areas were chosen because they experience rapid change through external intervention, although the external force differs in each case. This study examined sanitation behaviour, namely management of domestic wastewater of people in the area as result of visual improvement. It also evaluated system, facilities, and infrastructure for domestic wastewater management before and after changes.

2.1 General Description of Study Area

2.1.1 Kampung Code, Yogyakarta.
Kampung Code is located in Gondokusuman, Yogyakarta. Kampung Code has 64 households and public facilities such as mosque, public toilets, public bathrooms, as well as maternal and child health center. In January 2017, PT. Sampoerna .Tbk recolored Kampong Code’s houses walls and roofs. Since then, many government officials, university students, and tourists are attracted to the area. As a result, the government gave more attention to fulfill basic infrastructure needs such as public toilet and solid waste collecting system in Kampung Code.
Before 2017, Kampung Code residents defecate directly into Kalicode River due to insufficient toilets and public bathrooms. However since 2017, all Kampung Code residents take bath, wash, and defecate either in private or in public bathrooms and toilets. In 2018, seven public toilets still used by the residents. These public toilets are generally made of bricks, while the water resources vary from springs, wells, drilling wells or pipelines. Individual and communal septic tanks are constructed generally of concrete materials and partly of brick pairs. About 49% of households have a private septic tank, while the rest use communal septic tank. Figure 1 shows Kampung Code, Yogyakarta.

2.1.2 Kampung Wonosari, Semarang. Kampung Wonosari is located at Randusari, Semarang, Central Java. It is strategic, as it locates within city centre and close to several tourist destinations. The visual improvement program initiated by the government in 2017. Coloring was carried out in two areas; RW 03 and RW 04 of Kampung Wonosari. The program is fully supported by mayor of Semarang and stakeholders, i.e. government, private sector and community during program planning, implementation and development.

Until November 2018, several simultaneous activities were carried out, including environmental improvement of the area, village walls colouring, branding and advertising as a tourist village “Kampung Pelangi”. Community empowerment activities are also carried out, besides construction of tourist facilities, land and property acquisition of the people and sanitation infrastructure in form of private septic tanks and communal septic tanks through subsidies. Figure 2 shows visual improvement in Kampung Wonosari before and after the program.

2.1.3 Kampung Sindulang, Manado. Kampung Sindulang is located at Tuminting, Manado. Before wall painting, this area was seedy. Due to its location right on the hill, the slum area was clearly
visible upon entering Manado airport. In 2016, Manado carried out massive tourism promotion, and local government decided to recolor the visible slum area in order to be more representative. The idea of painting was inspired by Jodipan Malang colour village that managed to transform the slum into tourist destination (see [5,6]). The local community painted the village with materials provided by the government. Visual changes before and after the program can be seen in Figure 3.

![Figure 3. Kampung Sindulang, Manado (a) before coloring and (b) after becoming a colourful village](image)

### 2.2 Data Collection
Primary data is obtained directly from the field through observations and questionnaires. Yamane method, \( n = \frac{n_1}{1 + N \cdot e^2} \) was used to determine sample size, where \( n \) is sample size, \( N \) is population size and \( e \) is margin of error. Table 1 shows number of samples, population size and margin of error from different locations as case observed in this paper.

| Description       | Location of Study                  |
|-------------------|------------------------------------|
| Number of Population | Kampung Code, Yogyakarta          |
| Respondents       | Kampung WonoSari, Semarang        |
| Margin error      | Kampung Sindulang, Manado         |
|                   | 64                                 |
|                   | 830                                |
|                   | 142                                |
|                   | 64                                 |
|                   | 270                                |
|                   | 102                                |
|                   | 5 %                                |
|                   | 5 %                                |
|                   | 5 %                                |

A questionnaire based on Theory of Planned Behaviour was used with Likert scale. Three independent variables were used to measure level of community intention to manage sanitation; they are attitude, subjective norms and perceived behaviour control [11].

### 2.3 Data analysis
Collected data was analysed using SPSS v.24 Program. There were two stages of data analysis. First, reliability and validity tests were conducted to design the questionnaire and second, path analysis was conducted to find relationship between variables. Reliability of the questionnaire was investigated by using DeVellis reliability criteria [12]. While correlation criteria by Dancey & Reidy [13] was used for Validity test.

Purpose of path analysis was to explain direct and indirect effects of independent variables/causes on a set of variables. In this study, relationship between visual improvement and behaviour of urban communities in sanitation management was investigated. Different variables considered for each study area can be seen in Table 2.
Table 2. Variables used for Path Analysis in different case study

| Variables                        | Indicators                                                                 |
|----------------------------------|-----------------------------------------------------------------------------|
|                                  | Kampung Code, Yogya | Kampung Wonasori, Semarang | Kampung Sindulang, Manado |
| Attitude towards behaviour       | - Affordability of Retribution Cost                                     | - Environmental Health    | - Tourism Attraction          |
|                                  | - Public Knowledge related to Domestic Wastewater                           | - Public Health           | - Environmental Aesthetic    |
| Subjective Norm                  | - Government                                                          | - Government              | - Regional Regulations Number 9 of 2016 |
|                                  | - Social Rules                                                        | - Structural society      | - Social Norms               |
|                                  | - Romo Mangun Values                                                  | - Neighbour               | - Social Media               |
|                                  | - Health Education                                                    | - Risk of Harm Caused     | - Availability of            |
|                                  | - Risk of Harm Caused                                                 | - Sanitation Facilities   | Sanitation facilities        |
| Perceived behaviour control      | - Availability of Sanitation Facilities                                 | - Tourist Village         | - Visual Improvement         |
|                                  | - Visual Improvement of Kampung Village                                | - Home Ownership          | - Behavior Knowledge         |

Table 2 shows that although variables taken into consideration are the same, indicators within each variables are different. The difference was because coloring process was different even when colouring project performed to the three slums.

3. Results and Discussion

Collected data review has resulted in a path coefficient; the higher path coefficient is the more efficient it can influence intention of domestic wastewater management. To calculate path coefficient, it is necessary to calculate correlation coefficient that shows existence of correlation between domestic wastewater management behavior and influencing factors. Then, further investigation into the effect of visual improvement as a perceived behavioral control can also be obtained. Path coefficient can only be calculated if there is a significant correlation between domestic wastewater management behavior and influencing factors. Summaries of results for all three case study are given, and then compared on why these differences occur.

3.1 Kampung Code, Yogyakarta

Figure 4 shows path analysis model of domestic wastewater management behaviour in Kampung Code, Yogyakarta. The p-value is 0.000, lower than standard of 0.001, which means that there is a significant relationship between people’s behaviour in managing domestic wastewater with attitude, subjective norm, and perceived behavioural control. Path coefficient value on attitude is 0.412, subjective norm path coefficient value is 0.261 and path coefficient value in perceived behavioural control is 0.256. Attitude variables are measured through two indicators, i.e. willingness of the community to pay retribution (path coefficient value = 0.442) and level of community knowledge related to domestic wastewater management (0.843). Subjective norm variables are measured through four indicators, namely government rules (0.323), social rules (0.677), Romo Mangun Values (0.299), and extension (0.312). Perceived behavioural control was measured through three categories, namely community knowledge related to the risk of hazards (0.224), availability of sanitation facilities (0.251), and visual improvement (0.791).

The results show that all three variables, namely attitude, subjective norm, and perceived behavioural control have significantly relate to behaviour of wastewater management. However, attitude has the highest path coefficient value of 0.412, with indicator having the highest path...
coefficient value of being public knowledge related to domestic wastewater management. It means that behaviour of domestic wastewater management is mostly influenced by attitude that can arise when people understand importance of managing domestic wastewater. In other words, the higher level of community knowledge related to domestic wastewater management is, the better management of domestic wastewater will be [9]. Indicator with the highest value in subjective norm category is social rules. This means, closeness between neighbours greatly influences willingness of people to manage wastewater they produce. Indicator with the highest value from perceived behavioural control variable is visual improvement, which means that wall and roof colouring is able to increase awareness and willingness of the community to manage domestic wastewater. Based on these results it can be concluded that for Kampung Code, the most influential variable is attitude rather than perceived behavioral control. However, among factors that influence perceived behavioral control, visual improvement is still most dominant.

Figure 4. Path analysis model for domestic wastewater management behaviour in Code, Yogyakarta

3.2 Kampung Wonosari, Semarang

Figure 5 shows path analysis model of domestic wastewater management behaviour in Kampung Wonosari, Semarang. The p-value is 0.000, lower than standard value of 0.001, which means that there is a significant relationship between people behaviour in managing domestic wastewater with attitude, subjective norm, and perceived behavioural control. Path coefficient value towards intention on attitude is 0.270, subjective norm path coefficient value is 0.153 and path coefficient value in perceived behavioural control is 0.298. Meanwhile, path coefficient of intention and perceived behavioural control towards behaviour is 0.631 and 0.127 respectively. Perceived behavioural control
has both direct and indirect effect on behaviour, therefore if all three variables are taken into consideration, the path coefficient for attitude, subjective norm and perceived behavioural control towards behaviour are, 0.171, 0.097, and 0.316, respectively. It makes perceived behavioural control dominant variable affecting behaviour.

In this study case, attitude variables are measured through two indicators, namely environmental health (path coefficient value = 0.218) and public health (0.683). Subjective norm variable is measured with three indicators, i.e. government (0.272), community structure (0.362) and neighbours (0.386). Perceived behavioural control was measured through three categories, namely sanitation facilities (0.327), tourist village program (0.442) and home ownership program (0.381).

![Figure 5. Path diagram of domestic wastewater management in Wonosari, Semarang](image)

The results show that all three variables, namely attitude, subjective norm, and perceived behavioural control have significant relation with behaviour of wastewater management. However, perceived behavioural control has the highest path coefficient value of 0.316 towards behaviour, with indicator having the highest path coefficient value of being the tourist village program. It means that behaviour of domestic wastewater management is mostly influenced by tourist village program. Indicator with the highest value in attitude category is public health knowledge. Indicator with the highest value from social norm category is neighbours. Based on these results it can be concluded that for Kampung Wonosari, the most influential variable is perceived behavioral control. Moreover, among factors that influence perceived behavioral control, tourist village program that includes village coloring is the most influential.

### 3.3 Kampung Sindulang, Manado

Figure 6 shows path analysis model of domestic wastewater management behaviour in Kampung Sindulang, Manado. The p-value is 0.000, lower than standard value of 0.001, which means that there is significant relation between people behaviour in managing domestic wastewater with attitude, subjective norm, and perceived behavioural control. Path coefficient value towards intention on attitude is 0.340, while subjective norm value is 0.277 and perceived behavioural control value is 0.396. Meanwhile path coefficient of intention towards behaviour is 0.882. However, path coefficient from perceived behavioural control towards behaviour was not measured, although it exists. For the purpose of this paper, the number will simply be taken as x. Perceived behavioural control has both direct and indirect effect on behaviour. Therefore if all three variables are taken into consideration,
path coefficient for attitude, subjective norm and perceived behavioural control towards behaviour are, 0.300, 0.244 and 0.349+ \(x\), respectively. It makes perceived behavioural control dominant variable affecting behaviour.

![Figure 6. Path analysis model of domestic wastewater management variable in Kampung Sindulang, Manado](image)

In this case study, attitude variables are measured through four indicators, i.e. tourism attraction (path coefficient value = 0.366), environmental aesthetics (0.308), public health (0.318) and environmental pollution (0.244). Subjective norm variables are measured through three indicators, namely Regional Regulations Number 9 of 2016 (0.434), social norms (0.423) and social media (0.411). Perceived behavioural control was measured through three categories, namely availability of sanitation facilities (0.468), visual improvement (0.311) and knowledge related to management (0.454).

The results show that all three variables, namely attitude, subjective norm, and perceived behavioural control have significant relation with behaviour of wastewater management. However, perceived behavioural control has the highest path coefficient value of 0.349+ towards behaviour, with the indicator having the highest path coefficient value being the availability of sanitation facilities. Meanwhile, visual improvement is the least influential indicator among perceived behavioural control variable. Indicator with the highest value in attitude category is tourist attraction. Indicator with the highest value of social norm category is newly established regional regulation. Based on these results it can be concluded that for Kampung Sindulang, the most influential variable is perceived behavioral control. Moreover, decisive factor that influence perceived behavioral control is the availability of sanitation facilities.

### 3.4 Comparison between Visual Improvement Projects in Yogyakarta, Semarang and Manado

Summaries of path coefficients for all study cases are presented in Table 3. It is clear that the dominant variables for each case are different.
Table 3. Comparison of three colour villages in Yogyakarta, Semarang and Manado

| Location                      | Attitude | Subjective Norm | Perceived Behavioural Control |
|-------------------------------|----------|-----------------|------------------------------|
| Kampung Code, Yogyakarta      | 0.412    | 0.216           | 0.256                        |
| Kampung Wonosari, Semarang    | 0.171    | 0.097           | 0.316                        |
| Kampung Sindulang, Manado     | 0.300    | 0.244           | 0.349+                       |

In Kampung Code, the dominant variable is attitude, with public knowledge related to domestic wastewater management being the most influential among all indicators. While for both Kampung Wonosari, and Kampung Sindulang, the dominant variable is Perceived Behavioral Control. However, dominant indicators of the two is different. In Kampung Wonosari, the dominant indicator is tourist village program, while in Kampung Sindulang, it is availability of sanitation facilities.

The reason for these differences might be in process of projects themselves. Kampung Code Project coloring program was initiated by non-governmental organisations. Prior to the project, Romo Mangun had tightly lead community development project in the area. Therefore, attitude and knowledge of the residents might have been developed before, so that colouring project is not as dominant as acquired attitude through education on domestic wastewater management. The two other projects on the other hand, were government driven and therefore brought forward faster and larger infrastructural changes into the area. The difference in dominant indicator between Kampung Wonosari and Kampung Sindulang might be because of difference in initial sanitation facilities.

4. Conclusion

Colouring project is influential in altering residential behaviour towards domestic wastewater management systems. However it is not the most determining factor. For Kampung Code, Yogyakarta, the most influential factor is attitude, with public knowledge related to domestic wastewater management being the most important indicator. However, among all perceived behaviour control, visual improvement of Kampung Code is still the most dominant factor in changing behaviour towards domestic wastewater treatment management. For Kampung Wonosari, Semarang and Kampung Sindulang, Manado, perceived behavioural control is the most dominant. In Kampung Wonosari, tourist village project is dominant factor to change behaviour. However, in Kampung Sindulang Visual Improvement is the most influential indicators within perceived behavioural control variable.

Difference in influence among variables might be because variation in process and initiator of each project. Kampung Code Project was initiated by non-governmental organisations, and was done after established community development project. While the other two projects were initiated by the government. Kampung Wonosari and Kampung Sindulang were initially untouched areas prior to the infrastructural improvements.

However even visual improvement is not always influential, it is still impactful in all three projects. Colouring project in slums significantly improve community awareness towards the importance of domestic wastewater treatment facilities. Through these study cases it is concluded that visual improvement is a cost efficient strategy to improve slum sanitation, and can help accelerate universal access to domestic wastewater treatment.

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