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Improvement of Environmental, Social, and Cultural Attributes in the Slum Settlements on the Riverbanks of Yogyakarta City under the Sultan's Rule

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Abstract: A riverbank revitalization program is being carried out to overcome the problem of slum areas and restore the role of the river. Many local governments in Indonesia are working to revitalize riverbanks, with Yogyakarta being one of them. As a special region in Indonesia, the Yogyakarta government has implemented the *Mundur*, *Munggah*, *Madhep Kali* (M3K) program, under Government Regulation (PP) No. 38 of 2011, to manage the conservation, development, and control of the destructive power of river water. This study aimed to ascertain how changes to the riverbanks affect both people's quality of life and the river itself. The factors that influenced the changes in the environment, society, and culture of the community after the M3K program were also determined in this study. This study used a descriptive method with qualitative and quantitative data analyses. The statistical analysis method used was logistic regression. The findings obtained show that the M3K program has transformed people's mindsets and habits toward keeping the environment clean, particularly the river area. According to the findings of the logistic regression analysis, the variables that determine the changes in the social and cultural environment of the community affected by M3K are age, education, employment opportunities, and income.

Keywords: slums; urbanization; development; environmental; social change

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1. Introduction

Every year, the population growth in Indonesia significantly increases [1]. The high population density affects the growth and emergence of various problems, especially in urban areas. There is still a lack of community awareness about the hygiene of the residential settlements [2]. This results in the development of a slum environment that takes over all vacant spaces, including river banks. Similarly, Yogyakarta, which is known as a cultural hub, government center, tourism area, and student city, encounters the same issues [3]. According to BPS, the total population in Yogyakarta in 2023 will reach around 4,073,907 people [4]. Cities are typically formed and developed based on economic development, and they adhere to a pattern of cohesion and moderation [5]. As a result, many people wish to live in Yogyakarta because they believe the city has a lot of possibilities for them to earn a more significant income. In this case, those with lower incomes will tend to use all available resources to maintain their lives, such as the banks of the Yogyakarta River, resulting in the growth of slums [6].

A slum environment is a residential or urban area that does not have a primary livelihood activity, food, or housing for people to live in a safe and healthy environment [7]. Slum settlements are also determined by indicators such as population density, building planning, building construction, building ventilation, building density,

roads, drainage systems, toilets, frequency of waste disposal, method of waste disposal, and street lighting [8]. Slum regions are classified into four types, with slum areas near the river being one of them [9]. This identification is comparable to the increase in communal dwellings along riverbanks, which affects the urban landscape. Slums are also common on the outer edges of cities and along riverbanks [10]. Slum settlements are also inappropriate for habitation since they lack regular structures and have poor structures. This pattern frequently appears in places that are prohibited, such as riverbanks [11]. The development of slum areas can lead to several problems, such as land degradation, pollution, environmental health hazards, and erosion due to improper waste disposal [12]. This issue requires solutions, such as that carried out by the Governor of Yogyakarta by revitalizing, repairing, and restoring the river's essential function [3]. The presence of settlements along the riverbanks affects socioeconomic factors, including the availability of jobs for the local population. Environmental, social, and economic sustainability have always been the three pillars of urban growth that must be balanced. These factors must be taken into account when building housing because it has been recognized that regulations must be complied with ethically and sustainably while developing residential areas [13].

Slum areas are also sites where various cultures mix. Therefore, managing them requires stronger support to improve the welfare and independence of the community [12]. Given that the community is the main actor in program implementation, community involvement in the development process is crucial. Current research focuses on optimizing community participation in revitalization initiatives and their implementation in the establishment of an integrated development system [12,14,15]. Locals live on riverbanks due to the economic constraints that limit them from having a good living space [16]

The influence of the slum environment that occurs on the riverbank is very detrimental. The river has lost its function due to human activities and has become polluted. As a result, the Yogyakarta government launched the *Mundur, Munggah, Madhep* Kali (M3K) program in 2011. The arrangement of some buildings has changed in this program to make them taller and face the river instead of being too close to it, improving the aesthetics of the riverside areas while also maintaining the cleanliness of the river. M3K focuses on the design, planning, implementation, and post-implementation stages. In the Muja Muju region, this approach can be observed along the Winongo, Klitren, and Gajahwong rivers. This riverside area is a slum area that the Yogyakarta Sultanate has revitalized. Structure, culture, and social processes are three important development-related factors that must be used and maintained properly. These three factors are critical in ensuring that what is constructed meets the needs of the environment. It is expected that the community's involvement in initiating, planning, and monitoring the river revitalization process will raise their awareness of the importance of protecting and maintaining the place they are working on once the construction is complete. The transformation of the environmental area from its initial conditions to ideal conditions is undoubtedly what residents desire and a source of pride because they support and participate in community projects themselves [16].

Based on previous research, the factors influencing slum settlements are geographic size, preparedness and foresight, and resources and financing [14]. Meanwhile, another study discussed the possibility of slum transformation into tourist destinations [15]. This approach improves the lives of the local people in the economic sector. Previous study findings have also indicated that the modification of the slum environment through social marketing interventions and place branding via social media has elicited favorable responses from the local community [15,17]. Thus, this study aimed to investigate the influence of the leadership of the Sultan of Yogyakarta on the environmental, social, and cultural transformation of riverside slum communities in Yogyakarta, to analyze the impact of giving formal authority to traditional leaders in overcoming environmental and social issues, and to conduct an economic valuation of riverside slum areas following the implementation of the *Mundur*, *Munggah*, *Madhep Kali* (M3K) program. However, the Sultanate of Yogyakarta must consider that this program will include educational aspects, as proper participation of the residents of these slums is required. Education is one factor that shapes

a society's perspectives. People with a high level of education will readily accept a new mindset to keep their residences clean, and they understand the concept of reciprocity in the environment. A high level of public education will also help people recognize that maintaining the perceived benefits is preferable to repeating an unpleasant experience due to the substantial settlement. Another study found that education greatly contributes to urbanization, skillfully trains people's way of thinking to develop continually, and enables socialization for people to become good and responsible citizens [3,14,18].

The changes that have occurred in the river's function must be maintained since they can boost numerous community aspects, such as income and community welfare. As is well known, the role of a better river benefits the larger community in both social and environmental aspects. The researchers observed and analyzed behavioral changes in people before and after the M3K program. This research also looked into the factors that influence environmental changes, society, and culture. According to the researcher's hypothesis, changes in the community's environmental, social, and cultural conditions must exist as a result of observed changes and differences. The community is expected to recognize the positive results of this development, such as cleanliness and comfort. On the other side, the community's behavior that remains unchanged may be due to disappointment over their dissatisfaction with the development that is being carried out.

2. Materials and Methods

This research took a qualitative approach, including ethnographic and quantitative studies. The mixed-method approach enables the researcher to investigate a research subject holistically. Qualitative data were collected using an ethnographic approach, including interviews and field observation using our research instruments (see Questionnaire Tables in Section 3.3). To collect the data, researchers observed the research field and distributed questionnaires to respondents. This research was conducted in settlements near the river in the Special Region of Yogyakarta. Total of 100 respondents were selected from the formula-calculated population. They came from three different locations in the Muja Muju region, including the Winongo, Klitren, and Gajahwong rivers. To improve the research outcomes by having more samples, the researchers advise future researchers to employ a large number of respondents.

SPSS software version 26 was used for the statistical calculations in this quantitative approach. The analysis used in this study included univariate analysis, which determined the quantities and percentages (age, gender, and length of stay in Yogyakarta), bivariate analysis, which examined the correlation between the dependent variable (the impact of the formal authority) and the independent variables (transformations in the socio-cultural environment and economic valuation), and factor analysis, which identified the most important factor related to the impact of the Yogyakarta Sultanate's formal authority. Additionally, this study looked at the economic valuation both before and after the M3K program.

The data collected were analyzed descriptively using logistic regression analysis. *Logistic regression analysis* is a method used to describe the role of the dependent variable, which is a dummy variable. The dummy variable is a variable that is used to assume a category with a significant outcome of one and a non-significant result of zero [14]. This analysis was conducted to analyze the relationship between the independent and dependent variables. Logistic regression works similarly to linear regression, but with a binomial response variable. Logistic regression models the probability of outcomes with variable characteristics. The model used was the logarithm of probability because the probability is a ratio of the following model [14].

$$\log \frac{\pi}{1-\pi} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$$

where

Y = variable of changes in a social environment and culture.

With description:
Y = 1 (the occurrence of changes in social environment and culture);
Y = 0 (no change in social and cultural environment);
0 = constant;
β_1–β_6 = regression coefficient;
X_1 = age variable;
X_2 = education variable;
D_1 = job opportunities.
Information:
D_1 = 1 (increases job opportunities);
D_1 = 0 (does not increase job opportunities);
D_2 = Visitor capacity.
Information:
D_2 = 1 (increases visitor capacity);
D_2 = 0 (does not increase visitor capacity);
D_3 = Income.
Information:
D_3 = 1 (increase income);
D_3 = 0 (does not increase income).

The model can be declared correct if there is no significant difference between it and the observed value using the Chi-square approach. If the significance value surpasses 0.10, the model can be declared to fit the criterion. An overall fit test was carried out using the omnibus test of the model coefficient through the Chi-square test approach. It was found that the significance value was smaller than 0.10 and the independent variable influenced the dependent variable. The *t*-test, also known as the partial test, is a method for testing whether or not the effect of independent variables on the dependent variable is significant [15]. This technique was carried out by comparing the significance value of each variable with a level of 10%. The independent variable significantly affected the dependent variable if it had a significance value below 10%. Logistics regression is a statistical and data-processing approach that statisticians and researchers use to assess and classify binary and proportional response data sets [19]. A logistic regression model is a method that interprets the coefficients in the model through the odds ratio (trend value). The odds ratio, often known as the trend ratio, is a measurement used to quantify the percentage or level of the independent variable's tendency to the dependent variable. The odds ratio is denoted by B or Exp (B). The odds ratio is used to determine the probability trend of a variable.

3. Results

3.1. Mundur, Munggah, Madhep Kali (M3K) Program

Under Government Regulation (PP) No. 38 of 2011, which regulates the conservation, development, and control of the destructive power of river water, the local government, or the Sultanate, is currently trying to revitalize riverbanks in Yogyakarta City. The riverbank revitalization program in the Yogyakarta City area is carried out under the Governor of the Special Region of Yogyakarta [3–6]. This program is called M3K, or the *Mundur*, *Munggah*, *Madhep Kali* program. In this program, the riverbanks are revitalized by displacing a small part of the housing for road construction, green open space, and reducing the potential for flooding. The government has implemented the program to eradicate slum areas and restore the operation of river ecosystem services that have been degraded and impaired. These services include supply, regulatory, cultural, and other supporting services [16,18,20]. The findings imply that the formal programs led by the Sultanate have had a significant impact on both variables, i.e., socio-cultural transformation and economic valuation. The transformation of the socio-cultural environment in this study was assessed from the aspect of the cleanliness of the surrounding environment, how the M3K program has been implemented, and how the power of the Sultan of Yogyakarta has influenced it.

Based on Table 1, show that the formal authority continues to have an impact on slums' circumstances. The effects of unplanned development can cause several problems: increased flood risk, environmental pollution, uncontrolled community growth, and other waste problems [21]. The local people could tackle that pattern, especially those living in the slums, by increasing community resilience in the areas [20,22]. However, the government's initial move is still important in attracting people's contributions. As a result, the M3K program is also a tool for the community to put into action the community's objective of being free of slums and more environmentally friendly. The community also contributes to this development in the initial program in the field [23]. The river area will be cleared of residential buildings that serve as a terrace for residences as part of the M3K program. Applying the M3K concept results in building regularity, which allows for both wind and sunlight to enter the living space, resulting in a less humid environment that is more comfortable, healthy, and fresh. All of these changes improve the visual quality of the environment, providing a sense of relief in balancing the building heights and density [24].

Table 1. The implementation of M3K.

Variable	Impact of Formal Authority	
	95%CI	*p*-Value
Transformation of socio-cultural environment	0.220–0.597	0.000
Economic valuation	0.083–0.396	0.022

3.2. General Condition of the Research Site

This study was carried out on three riverbank areas where slum settlements are located in the hopes that these settlements will improve with the implementation of the M3K program. These areas are the Winongo, Klitren, and Gajahwong Rivers, which are located in the Muja Muju and Mrican areas. These areas are the homes of people that live on the Sultan ground area, which is land owned by the Sultan of Yogyakarta. Before the M3K program, this river area was a slum area. This slum neighborhood arose as a result of the inability of the people who lived on the riverbanks to maintain sanitation. The M3K program's development in this area has resulted in considerable changes for the community One of the changes is that the riverbank area now looks cleaner and more beautiful. Following the implementation of the M3K program, this riverbank area has developed high tourism potential. These changes are shown in the growth of areas that employ certain themes. One of these developing places is the Mrican area, which is located near the Gajahwong River. This riverbank has developed into a popular tourist destination. The availability of this tourist destination boosts the economy of the neighboring town by allowing locals to open shops. However, our findings regarding the residents' income did not yield statistically significant results.

According to Table 2 below, 63% of the respondents were men, and the average respondent had an age of 46 (SD $\pm$ 14.9). Up to 51% of the respondents had spent more than 50 years in Yogyakarta, and 54% of the respondents said they strongly support the continuation of the Sultanate program. Within the Sultanate program, the Yogyakarta government implemented the M3K program. Before the M3K program was held, the respondents' incomes (36%) were greater than IDR 1,000,000, while the respondents' incomes (35%) ranged from IDR 450,000 to IDR 1,000,000 after the M3K program.

Table 2. Demographics of respondents' characteristics.

Variable	f	%
Age (46.4 ± 14.9)	-	-
Gender		
Female	37	37
Male	63	63
Duration of Living in Yogyakarta		
Under 30 years	46	46
About 30 years	3	3
More than 30 years	51	51
Perception of Sultanate Program		
Supportive Enough	6	6
Supportive	40	40
Very supportive	54	54
Income Before M3K Program		
No income	31	31
Between IDR 450,000 and IDR 1,000,000.	23	23
More than IDR 1,000,000.	36	36
Missing System	10	10
Income After M3K Program		
No income	17	17
Between IDR 450,000 and IDR 1,000,000.	35	35
More than IDR 1,000,000.	32	32
Missing System	16	16

3.3. Changes in the Riverbanks' Function

Our findings in Table 3 show that the slum transformation impact value is high. However, this considers that the formal authority, also known as the Sultanate, will utilize its power to implement such a program, such as M3K. The function of the rivers in the Yogyakarta area has primarily become slum settlements that use open ground on the riverbanks. Slums are commonly associated with non-permanent roofs, poor sanitation, a lack of private facilities, and the habit of tossing waste into rivers [25]. This pattern leads to the formation of many slum areas as a result of their incapacity to maintain environmental cleanliness. The situation has caused issues with the river's ecosystem, which has deteriorated as a result of domestic garbage and the advent of various disasters, such as floods and landslides [26]. Furthermore, without proper sanitation, it will pose a threat to the community in the form of diseases, such as diarrhea, typhoid, and pneumonia [17].

Table 3. Slum transformation impact value.

Variable	B	95%CI	*p*-Value
Transformation of socio-cultural environment	0.250	0.127–0.373	0.000

Dependent variable: Impact of formal authority:

$$R2 = 0.172 \times 110\% = 18.92\%$$

Rivers provide enormous potential and benefits for humanity and the environment, such as water supply, electricity generation, transportation, and recreation. However, the riverbanks are now densely populated with settlements, resulting in slum areas. As a result, it is critical to restore the river's proper role [27]. The M3K program has been

carried out as a solution to this issue. This development can change the condition of the community's settlements to be cleaner and more comfortable. Through the implementation of this program, the community has become more aware of how to keep their environment clean by managing their waste and developing their mindset to keep the environment clean. This river area is precious for the surrounding community and can be a model for developing other riverbank areas. Based on the Table 4, The *Mundur*, *Munggah*, *Madep Kali* (M3K) program was initiated by the sultan of Yogyakarta and aims to clean up, preserve, and enhance the slum neighborhoods along the riverbanks while preserving the river's functionality. This program prevents people from tossing trash into the river and creates beautiful landscaping for the buildings. This initiative has had a tremendous impact on people's habits for keeping the river clean from waste.

Table 4. Questionnaire on slum transformation impact value.

No.	Variable	Yes (%)	No (%)
1	Is the land that you are using now hereditary land?	69	31
2	Are you a native of a riverside settlement in Yogyakarta?	63	37
3	Do you know that your residence is on the Sultan's Ground?	86	14
4	Does the Sultan's policy regarding structuring slum areas by the river have a positive impact?	97	3
5	Are there any binding regulations for Sultan Ground users in riverside slums in Yogyakarta?	54	46
6	Is your place of residence affected by the M3K program?	74	25
7	Have there been any changes around you in terms of environmental, social, or cultural aspects after the M3K program?	93	6
8	Have you ever thrown garbage on the banks of the river where you live?	58	42
9	Are there local leaders or community leaders who are influential in the riverside community where you live?	90	10
10	Is there socialization in the arrangement of riverbank areas in the area where you live?	91	9
11	Do local leaders or community leaders in your area take part in the outreach?	94	6
12	Is there good cooperation between the government, local leaders or community leaders, and local residents in carrying out programs for structuring slum areas on riverbanks in overcoming environmental and social problems?	100	-
13	Does the M3K program open up job opportunities for the local community in your environment?	86	14
14	Are riverside areas crowded with visitors after the M3K program?	81	19

3.4. Changes in People's Mindsets

Change is a social behavior, namely a change in form, nature, appearance, or conditions caused by various factors. In this case, the factors that influence changes in the rules of the values in society are all new things deliberately included in an environment, such as the mindset of the community [28]. Our findings show that the M3K Program has successfully influenced the locals' way of living. The mindset is the basis of how humans carry out activities. A mindset will produce a specific impact after it is implemented. In the past, slum communities only understood a "limited" mindset since they had an urgency to survive daily. Hence, a sustainable approach will not occur naturally without the Sultanate's interference. This result is also consistent with a prior study that found that those with low levels of wealth tended to settle illegally on land, such as along riverbanks [29–31]. These environmental, social, and cultural changes are manifested in improving the standard of the environment, which generally favors river cleanliness, good conditions of facilities and infrastructure, and a social culture that upholds environmental cleanliness. These changes are programs carried out in the M3K program.

This pattern causes overcrowded settlements with uneven and uninhabitable building quality. More attention must be paid to slum dwellers' lack of public awareness of their surroundings, which frequently leads to other problems [32]. The M3K initiative has been successful in influencing people's attitudes toward environmental preservation. The public statements shown in Table 5 demonstrate this finding.

Table 5. Questionnaire on changes in people's mindsets.

	Variable	SD	D	N	A	SA
1	In my opinion, I support the Sultan of Yogyakarta's program to change riverside slums to be clean and orderly.	-	-	6	40	54
2	How often did you throw garbage in the river where you lived before the M3K program?	52	16	14	12	6
4	In my opinion, having the M3K program makes my place cleaner and more comfortable.	-	2	2	43	53
5	In my opinion, the existence of the M3K program has made me and my neighbors more diligent in keeping the riverside areas clean.	-	2	8	47	43
6	The existence of the M3K program makes the community consistent in carrying out community service programs.	-	9	17	44	30
7	After the riverside slum area was organized, people became reluctant to throw garbage in the river.	-	5	21	43	31
8	How influential are the views/opinions of local leaders or community leaders in the area where you live?	1	5	24	54	15
9	In my opinion, local leaders or community leaders in the area where I live also support the existence of a government program in structuring riverside slum areas.	1	1	14	62	22
10	I support the existence of a government program in structuring riverside slum areas because local leaders or community leaders in the area where I live support the program.	-	1	10	50	39
11	The people in the area where I live support the government's program in structuring riverside slum areas because local leaders or community leaders support the program.	-	2	15	59	24
12	The people in the area where I live play a role in maintaining the cleanliness of the riverside area due to calls from local leaders or community leaders.	-	1	23	51	25
13	The existence of the M3K program has made the riverside area an attraction for local people/other areas to visit.	-	5	19	38	38

SD: strongly disagree; D: disagree; N: Neutral; A: Agree; SA: strongly agree.

As shown in Table 5, most people agree to keep the environment clean. Approximately 99% of people agreed that after participating in the M3K program, they became more conscientious about maintaining cleanliness. People are averse to losing the benefits they have experienced, which has led to this new pattern. A total of 95% of the respondents said they are reluctant to throw trash in rivers and want to prevent garbage buildup and pollution and maintain the river's health, smell, and beauty. They also agree that community service projects to clean up the area should be carried out more frequently. The community is happy because the risk of flooding has decreased as a result of the construction carried out. As can we see in Table 6, with the M3K program, as much as 41% agreed, and 27% strongly agreed this program could improve health quality. Thus, they constantly maintain the river's cleanliness. This community attitude is in line with the statement by Febriani et al., which states that changes in people's attitudes are due to their experienced conditions that are easily influenced by perceived environmental stimuli [33]. This perception exists because the community is pleased with the M3K program.

Based on the community statements in Table 6, the M3K program has succeeded in transforming the role of rivers and riverbanks and their functions. This change is in line with another study that stated that redesign due to urbanization affects the socioeconomic and sociocultural replacement of local communities [34]. Transformations here include changes usually occurring in society, such as changes in habits, norms, customs, and even family relationships in rural and urban areas. Community settlements have become cleaner, as have the rivers. The community is also aware of the ownership of their territory, so positive development will continue. The community is also experiencing improved health. This circumstance exists because the garbage in the river was not only killing river animals but also impacting humans by the emergence of many diseases that polluted the surrounding groundwater [18,30].

Table 6. Multi-dimension assessment of M3K implementation.

Environmental Service Function		Scale (%)				
Biodiversity		**1**	**2**	**3**	**4**	**5**
Ecological Aspects						
a.	Pests and diseases control	3	8	10	46	33
b.	Seed dispersal by various animals in open environments	20	20	22	22	9
c.	Organic fertilization through feces	28	17	18	14	12
d.	Land restoration	8	4	14	34	39
e.	Increased health quality	6	8	18	41	27
f.	Freshwater fish cultivation	32	10	6	15	27
g.	Vegetation and urban farming	5	10	21	38	25
Economic Aspects						
a.	Trading place with MSME	4	8	15	31	42
b.	Fish trade	27	14	18	18	13
Socio-Cultural Aspects						
a.	Increased community creativity and entertainment	13	6	17	34	29
b.	More awareness about science and culture	14	13	17	31	23
Carbon Stocks and Oxygen Production						
Ecological Aspects						
a.	Optimized humidity	4	8	12	42	34
b.	Maintained temperature stability	6	10	13	37	34
c.	Increased air quality	4	11	11	31	43
Economic Aspects						
a.	Compensation for planting vegetation	18	17	11	18	20
Socio-Cultural Aspects						
a.	Increased fresh air for physical activities and coziness	1	8	13	51	27
b.	Optimized fresh air for cultural activities	9	8	17	45	19
c.	Utilization of growing vegetation culture	6	21	11	42	19

3.5. Logistic Regression Analysis Results

We utilized a few additional analyses and found some findings in this study. The Hosmer Lemeshow test analysis produced a Chi-square value of 8.578 with a significance value of 0.379, greater than 0.10. Therefore, there are similarities between the logistic regression model estimation data and the observation data. This alignment also shows that the model fit the data. Then, the omnibus tests of the model coefficients revealed the analysis results, producing a chi-square value of 10.707. The results of the significance analysis yielded a significance of 0.058 < 0.10. This means that the variable model used fit the overall data. In other words, the model with five variables included is valid. The results of the logistic regression analysis that was carried out show that the coefficient of the age variable (X1) was 0.036, with a significant value of 0.333, which indicates 0.333 > 0.10. It can be interpreted that the age variable has significantly affected the environmental, social, and cultural changes in society in the context of the M3K program. The odds ratio value

was 4.839, which means that the higher the age of the community, the more significant the environmental, social, and cultural changes, by 4.839 times.

The age of the community is an influential factor in environmental, social, and cultural changes. People who are older on average have experienced a variety of things, both good and bad. Older people have experienced the detrimental effects of living in slum areas. The assumption is that the community wants to avoid feeling the destructive impact they felt before and maintain the benefits they experience from the M3K program. The results of the logistic regression analysis that was carried out show the results of the variable education coefficient (X2) of −2.272, with a significant value of 0.334, which indicates 0.103 > 0.10. This means that the education variable has had a significant effect on the environmental, social, and cultural changes in Indonesia. M3K has affected communities. The odds ratio result was 0.103, which indicates that the environmental, social, and cultural changes increased by 0.103 times with the community's average age.

The results of the logistic regression analysis that was carried out show that the employment opportunity variable coefficient (D1) was 0.558, with a significant value of 0.683, which indicates 0.683 > 0.10. It can be interpreted that the employment opportunity variable has significantly affected the environmental, social, and cultural changes in communities affected by M3K. Additionally, the odds ratio value was 1.747, which means that the number of environmental, social, and cultural changes increased by 1.747 times with employment opportunities. Riverbank revitalization has made the river area attractive and comfortable. This will entice tourists to pass through this location to experience its beauty and comfort, which has the potential to produce job opportunities. This is owing to the large number of tourists from different locations visiting the city.

In the results of the logistic regression analysis that was carried out, the coefficient of the visitor capacity variable (D2) was 2.388, with a significant value of 0.039, which indicates 0.039 < 0.10. It can be interpreted that the visitor capacity variable has had no significant effect on environmental, social, or cultural changes. The capacity of visitors after the revitalization has increased significantly. The area has become crowded, with people passing by to see the area. People want to enjoy the city planning that the government has created. This has not significantly affected the environmental, social, or cultural changes because migrants do not participate in community empowerment or have a sense of ownership of the area. However, the capacity of these visitors will significantly affect the economic aspects of the community.

The results of the logistic regression analysis that was carried out show that the income variable coefficient (D3) was 1.188, with a significant value of 0.219, which indicates 0.219 > 0.10. It can be interpreted that the income variable has significantly affected the environmental, social, and cultural changes in society. In other words, the M3K program impacts these aspects. Furthermore, the odd ratio value was 0.259, indicating that the older the community, the greater the increase in the environmental, social, and cultural changes by 0.259 times. The increasing quality of buildings that are beautiful and comfortable makes this area have great tourism potential. This potential, if properly utilized, will improve the community's welfare to the point where the community will be very conscious of maintaining the cleanliness of the riverbank area. This may also be demonstrated in the Gajahwong River area, which has succeeded in transforming its environment into a community educational tourism destination [35]. The income of the neighboring community will rise as a result.

4. Discussion

According to the results, the respondents' average age was 46.4 years, and 63% of them were men. There was a difference between the average income before and after the implementation of the M3K program. Our study also corroborates prior research, which found that 50.2% of people living in slums earn less than USD 1.9 per day, whereas, previously, it was more than USD 2.24 [35,36]. This pattern indicates that people living in slum areas usually have low incomes. In addition, the transformation of the socio-

cultural environment has a value of SD = 4.57, with a min-max value of 10–38. According to the research conducted by Boateng and Adams [18], for the built environment, the coefficients for all item pairs are 0.42 < Hij < 0.76 (p < 0.0001), with a total scalability coefficient for all item pairs at HS = 0.52 (p < 0.001) [18]. Hence, environments that are given special attention will positively impact environmental transformation. This study also found that the transformation of the sociocultural environment is also significantly related to the impact of the formal authority, with a p-value of 0.000. In the socio-cultural context, the Sultanate does not fully encourage the emergence of urbanization but rather encourages sustainable environmental development. This development aims to promote holistic human development, health, and education [31,37]. In line with other studies, it is stated that geographic size (B = 0.395; p-value = 0.000 < 0.01), readiness, and foresight (B = 0.144; p-value = 0.019 < 0.05) are related to urban resilience.

According to this study, 38% of the respondents said that the locations for growing vegetation and urban farming were properly implemented after executing the M3K program in the context of the ecological component of the environmental service function. In line with other studies, this greening activity should be carried out evenly in all areas with slum settlements. The goal is to create mobilization justice regarding sustainable environmental development [18,38,39]. As a result, an appropriate environmental transformation will be achieved, and slum settlement conditions will gradually improve. It was also found that the implementation of the M3K program has positively impacted the people of Yogyakarta, according to 42% of the respondents. They argued that with so many places used for economic activities, such as trade, slum areas have the potential to become tourist destinations. This finding is in line with the findings of previous research, which stated that the transformation of slum environments, if good program interventions are carried out, will produce positive changes [36,39]. In line with the research described in our Results section, as many as 41% of the respondents stated that the preservation of the beauty of the landscape ecosystem was very good, and 46% responded positively that making it a tourist destination would open up new job opportunities for the people of Yogyakarta. The table shows that through the M3K program, 37% of the respondents stated that a stable ambient temperature was good, and 34% said it was very good. This result is in line with previous research explaining that the locations of residences affect urban development, with a p-value of 0.001 [40]. As a result, as many as 41% (Table 5) of the respondents said that the M3K program enhanced their health and quality of life.

The natural river systems are increasingly burdened by agriculture and the urbanization of riparian zones, which often leads to structural measures, such as bank stabilization or flood protection [37,38,41]. Communities whose houses are on riverbanks will face the threat of catastrophic flooding [42,43]. However, as shown in Table 4, as many as 43% of the respondents stated that through the M3K program, flood protection in the Yogyakarta area is extremely good. If we reflect on another study, climate change threatens our ability to manage forest ecosystems sustainably [44]. Hence, people within the area of the M3K program agree with the results of the research in Table 4. The positive impact of the M3K program reflects that 28% of the sources of drinking water for various flora and fauna are good, and 28% of the respondents stated that their concern for flora and fauna and natural phenomena is high. The multivariate analysis of the factor that influences the impact of the formal authority the most is the transformation of the socio-cultural environment, with a p-value of 0.000. In addition, the analysis results show that the environmental transformation variable has contributed 17.2% to the impact of the formal authority, with a value of 95% CI 0.127–0.373. This indicates that the socio-cultural environment transformation variable is the most dominant in influencing the impact of the Yogyakarta Sultanate's formal authority.

Based on the results of the interviews with residents, the existence of the M3K program has resulted in a positive impact on the surrounding environment. Additionally, their home is now a popular tourist destination because it appeals to some visitors. Since the M3K program has been implemented by the local government, the neighborhood has tended

to maintain cleanliness more consistently. This is demonstrated by the research findings in Table 5, which show that 53% of the respondents strongly agreed that they would take better care of the environment after the M3K program was implemented, and the findings in Table 4, which show that 81% of the respondents agreed that, with the M3K program, the attractiveness of the city of Yogyakarta would increase [13].

5. Conclusions

Based on the findings of the analysis of various research data, the M3K program has the potential to transform the mindset and habits of the community to maintain environmental cleanliness, particularly in river areas. The results of the logistic regression analysis suggest that the variables that influence changes in the social and cultural environment of the M3K-affected community include age, education, employment opportunities, and income. These environmental, social, and cultural changes manifest as improvements in environmental quality, communities that work together to keep rivers clean, keeping existing facilities and infrastructure in good repair, and a culture within the community that values environmental cleanliness. These improvements will have a positive impact on the function of riverbanks and slum settlements in river areas in the future. The logistic regression model that has been compiled is expected to assist the Yogyakarta Sultanate in eliminating slums and building a better urban landscape. The findings of this study can provide beneficial additional information for researchers who want to undertake research in similar fields to broaden their analytical toolset.

Based on the research results above, the environmental transformation will have significant impacts if the human resources in the Yogyakarta area are of good quality. In addition, the transformation of the socio-cultural environment is also significantly related to the Sultanate of Yogyakarta. Slum-dwellers have evolved into a slum socio-cultural environment, and any development that disrupts that environment can negatively impact their well-being. Community empowerment, combined with renewable energy usage and strengthening community institutions' capacity to increase commercial business productivity, positively contributes to the sustainability of slum settlements and improves the environmental quality.

Overall, the M3K program in Yogyakarta has positively impacted the slum environment around the riverbanks. The M3K program can also improve the ecosystem of living things. It can preserve customs and socio-culture passed down as Javanese cultural heritage from generation to generation in the Yogyakarta Sultanate area. The Sultanate wants to maintain the mystical beliefs of the Javanese people. The protection of river cleanliness needs to be improved and maintained in the long term so that local people can enjoy a healthy environment. Clean rivers and reduced slums in Yogyakarta will provide opportunities for new jobs and make the area a tourist destination because if the community improves, it will have a positive impact on the environment.

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