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Determinants of Push Bicycle Usage: Revelations from an Exploratory Survey on Users of the Cycle Lane from Kospalena Bridge to Piliyandala, Sri Lanka

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Abstract

Rapid urbanization and population growth have made non-motorized transportation (NMT) such as cycling, walking, and other human-powered means of travel a sustainable solution in reducing urban congestion and environmental impact. This study investigates the factors that influence the utilization of the bicycle lane from Kospalena Bridge to Piliyandala and examines the obstacles encountered by cyclists on this route. Primary data was collected from school students, professionals, and other commuters over 16 years of age, who traveled by bus or bicycle along this route on a weekday from 7.00 am to 5.00 pm. A total of 98 commuters were surveyed, comprising 36 cycle lane users and 62 bus users. The analysis employed chi-square tests and Kruskal-Wallis H tests using SPSS software. The findings show that financial savings are the most significant factors motivating the use of bicycle lane, followed closely by saving time. Health benefits were also an important motivator, but ranked slightly lower. Environmental factors, such as rainfall and temperature, are recognized but considered less influential than personal benefits. Social status and gender are seen as the least important factors, with gender having minimal impact on the decision to use cycle lane. The results suggest that personal and financial motivations are the dominant factors driving bicycle lane usage, while social and environmental considerations hold comparatively less importance in participants' views. The main challenges faced by the bicycle users are inadequate infrastructure (61%), safety issues (22%), and obstructions from pedestrians and street vendors (17%). Based on these findings, it is recommended that priority be given to the development of proper infrastructure, such as dedicated cycle lanes and parking facilities. It is also advisable to enhance the existing safety measures with increased awareness and protection for cyclists and pedestrians.

Keywords: Non-motorized Transportation, Cycle Lane, Infrastructure Development, Sustainable Transport, Urban Mobility

1. Introduction

Rapid urbanization and population growth on a global scale have had a significant impact on transport systems, leading to increased traffic congestion, environmental pollution, and a decline in the quality of life. Non-

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motorized transportation (NMT), which includes walking and cycling, has emerged as a sustainable alternative to motorized transport, offering numerous benefits such as reduced traffic congestion, improved land use, and environmental relief. (Rietveld, 2001).

Non-motorized transportation is defined as traveling from one place to another using human power, without using engines or motors (Safiz et al, 2021). Non-motorized transportation, also known as active transport, is the mode of transport that is driven by human energy instead of fossil fuels and other forms of energy (Indian Ministry of Housing and Urban Affairs, 2021).

Globally, non-motorized transport can be identified as a dominant means of people-oriented transport in both developed and developing countries. Globally, there has been rapid growth in the urban population, increasing from 30% in 1930 to 54% by 2014 and expected to grow to 66% by 2050 (United Nations, 2014). This rapid urbanization and population growth are creating a greater demand for motorized transport. As a result, the number of cars worldwide is expected to increase by 2.2 to 2.26 times between 2014 and 2050. This increased motorization in urban areas leads to increased air emissions and a significant reduction in traffic speed, thereby increasing time spent on travel and overall fuel consumption, which has negative social, economic, and environmental impacts. In particular, many developed countries have gravitated towards the concept of non-motorized transportation to improve air quality, reduce global warming, and improve people's overall welfare (Zafiz et al, 2021).

Non-motorized transportation may be influenced by several factors, such as the built environment, the geographical nature, weather conditions, social and economic conditions, etc. (Safiz et al, 2021). For example, people may be encouraged to choose the modes of walking or cycling instead of motorized transport if proper provisions are made for artistically and skillfully planned cycle lanes, pedestrian lanes, and safe crossings. On the other hand, ill-conceived infrastructure may easily discourage individuals from adopting NMT, which would lead them to rely increasingly on motor vehicles, thereby aggravating traffic congestion and the release of environmental toxins (Mansoor et al., 2022).

Socioeconomic factors have been found to play a key role when adopting modes of NMT. In developing countries such as Sri Lanka, a substantial portion of the population experiences low-income status, where affordable modes of transport play a significant role in their expenditure concerns. NMT undoubtedly proposes a more economical substitute to motor-powered transportation, thereby presenting itself as a more feasible alternative to low-income households. In addition, individuals who adopt NMT will enjoy a

number of health benefits, such as enhanced physical and mental fitness and a reduction in the risk of chronic illness. This will inevitably be a factor that motivates individuals to adopt these modes of transportation (Safiz et al., 2021).

Conversely, adverse weather conditions, such as increased temperatures and rainfall, may also impact the utilization of NMT. Areas that experience severe weather conditions, like higher temperature rates or torrential rainfalls, may show a significant reduction in walking or cycling. (Safiz et al., 2021). Hence, in order to enact NMT initiatives effectively and sustainably, it is pivotal for these factors to be thoroughly considered in the processes of their arrangement and implementation.

The Sri Lankan government has been able to identify the great potential of NMT for the people. It has therefore initiated many methods to encourage the adoption of NMT, including the construction of several bicycle lanes in main city streets. Notably, the government of Sri Lanka has embarked on promoting NMT through several measures, such as constructing bicycle pathways in cooperation with the initiative of the "World Bicycle for Working Day". These proposals are underway with the objective of streamlining traffic congestion, reducing environmental pollution, and creating a more sustainable urban environment. The bicycle pathway from the Kospalena Bridge to Piliyandala is one such proposal, which has been designed with the intention of encouraging individuals to take up cycling when engaging in their daily commutes.

The objective of this research is to identify the factors that influence the utilization of the bicycle lane from the Kospalena Bridge to Piliyandala and to determine the factors challenging the cyclists utilizing this lane. By identifying factors related to both motivation and challenges faced by cyclists, this research aims to provide valuable insights for developing countries when adopting NMT modes. This research is significant due to its potential contribution to urban planning policies, improvement of infrastructure related to cycling, and the promotion of sustainable transport solutions, which ultimately enhance mobility, environmental sustainability, and public health in Sri Lanka.

2. Literature Review

‘Sustainable Transportation’ is a concept both developed and developing countries alike have shown remarkable interest in, due to its promising capacity to deliver multiple benefits in relation to the environment, economy, and society. It is believed that non-motorized transport (NMT) systems of ‘walking’ and ‘cycling’ are the main components of any sustainable transport

system. Various studies conducted on the adoption of NMT underline a number of determining factors that have influenced people to utilize cycling infrastructure, such as bicycle paths. The following literature review investigates the determinants that affect people's willingness to adopt non-motorized transport modes, with a special focus on the bicycle lanes from Kospalena Bridge to Piliyandala in Sri Lanka.

Urban Infrastructure and Design

The key component that either encourages or deters the use of non-motorized transport systems is none other than urban infrastructure. It has been observed that the adoption of NMT is largely based on how well the built environment has been designed, incorporating bicycle paths and pedestrian lanes appropriately, and the quality of these facilities. According to Pucher et al. (2010), in most cities, potential cyclists are discouraged from adopting NMT modes due to the inadequacy of infrastructure and a lack of safety, as special lanes have not been dedicated for cycling. As Banister (2008) cites, the placement of proper infrastructure, such as properly maintained, systematic, and safe bicycle lanes, would inevitably boost the demand for cycling.

Safety and Security Concerns

'Safety' is one of the most crucial and decisive factor one would consider before adopting NMT modes. In areas of heightened traffic, the tendency for accidents and other safety concerns such as personal security, theft, and lack of proper lighting is also high, thereby discouraging persons from resorting to cycling or walking.

Research by Godefrooij et al. (2015) observed that the perception of safety, specifically how well protected the bicycle lanes are and the measures that had been taken to reduce traffic, had a direct impact on the cycling rates of the metropolitan areas.

Social and Cultural Factors

Another factor that may influence the adoption of non-motorized transportation is that of cultural norms and public opinions towards cycling. In most developing countries, 'cycling' is a common mode of transport for lower-income groups; hence, a sense of social stigma has been built around cycling, which can lead to dissuasion from it (Ahsan, 2012). In countries like Sri Lanka, car ownership has traditionally been more prevalent and preferred over cycling. Therefore, the initiation of a cycle lane may not be viewed in a favorable light, as commuters might associate it with inconvenience and social inferiority. On the other hand, with the increasing congestion in urban areas,

individuals may begin to view it differently, recognizing its practicality and sustainability (Gossling et al., 2016).

Environmental Awareness and Sustainability

Even on a global scale, one of the key driving forces behind the implementation of sustainable transport systems has typically been environmental consciousness. Research by Buehler and Pucher (2012) indicates that people who possess a higher sense of environmental awareness show a greater tendency to adopt modes of non-motorized transport. In relation to Sri Lanka, the daily increase in air pollution, traffic congestion, and climate change may induce a shift in attitudes, enabling the concept of NMT to gain more favorable acceptance.

Economic Factors

Another factor that plays a pivotal role in the adoption of cycling is the economic incentives or constraints specifically related to owning and maintaining a bicycle. For lower-income groups, the cost-effectiveness of owning a bicycle is much more favorable compared to motorized transport, making cycling a more viable option for them (Heinen et al., 2010).

Policy and Government Support

For the development and maintenance of non-motorized transportation, the proper channeling of governmental policies and investments in cycling-related infrastructure remains crucial. As declared by Pucher and Buehler (2017), countries with well-established and effective cycling systems usually show solid government backing through the offer of economic provisions such as bicycles, tax incentives, and implementing steps for the creation of cycling-friendly urban policies. However, in Sri Lanka, though there has been discussion on initiatives to improve public transport, the focus on developing infrastructure to encourage NMT, such as cycling, is unfortunately at its most primitive level.

Individual Characteristics and Attitudes

Demographic factors, such as age, gender, income, and level of education, may also impact cycling behavior. A study by Oja et al. (2011) shows that youngsters, especially in the urbanized areas, tend to adopt modes like cycling as they demonstrate a particular willingness to explore different forms of transport.

Use of non-motorized transport modes in Sri Lanka

In Sri Lanka, non-motorized transport modes, particularly cycling, have historically been the most popular, especially in areas such as Jaffna, Trincomalee, and Ampara. Over time, with automobile usage increasing rapidly in urban areas, the practice of cycling has seen a significant decline, which has consequently led to an increase in congestion and environmental pollution (Dhahanayaka et al., 2018). Responding to these challenges, the government of Sri Lanka has recently taken steps to establish bicycle councils in cities, such as Piliyandala and Malabe, in line with the concept of "World Bicycle for Working Day" (Dhahanayaka et al., 2018). These proposals were initiated with the objective of streamlining urban traffic and promoting environmentally friendly transport options, marking a renewal of interest in modes of non-motorized transport.

Research by Arthi (2023) investigated the practice of non-motorized transport in Jaffna and underlined the alignment of NMT with sustainability goals. Non-motorized transport can be considered to be a safer, more economical, and environmentally friendlier approach, where minimal amounts of resources are utilized compared to motorized transportation. Arthi's study highlighted how important it was to integrate cycling and walking infrastructure into the existing road networks so as to increase accessibility and enhance the quality of life in urban areas. In Jaffna, the development of pedestrian and cycling infrastructure is considered vital for environmental sustainability and as a key measure to mitigate the adverse effects of urban congestion by reducing reliance on motorized transportation.

Research by Maduwanthi et al. (2016) investigated factors that influence the modes of transport in the urban area of Colombo. It focused on aspects such as gender, age, and level of education, which may impact an individual’s decision when using non-motorized transportation. The above research demonstrated that 21.6% of the trips made by individuals in the Western Province resorted to non-motorized transportation, which included walking and cycling. The study also discovered that a majority prefer public transport in Colombo, where most people resort to walking when accessing either the bus or train stations. This emphasizes how important it is to integrate NMT options into urban planning to enhance access to public transport and thereby reduce the dependence on motorized personal vehicles.

Although a significant number of research studies have been conducted on the benefits and the nature of non-motorized transport both globally and in Sri Lanka, a considerable gap can be seen in the research studies that particularly address the efficacy of cycling infrastructure, like the cycle lane that has been dedicated from the Kospalena Bridge to Piliyandala. Although

previous studies, such as those by Maduwanthi et al. (2016) and Arthi (2023), have explored the broader aspects of non-motorized transport (NMT) in Sri Lanka, there is a lack of research specifically examining the challenges and influencing factors related to the use of the dedicated bicycle path between Kospalena Bridge and Piliyandala. The objective of this study is to address this gap by ascertaining the determinants that influence the adoption of the cycle lane from Kospalena Bridge to Piliyandala and to identify the challenges encountered by its users. The researcher hopes to provide critical insights that may raise the attention of urban transport planning and policy in Sri Lanka towards this concept.

3. Materials and methods

3.1 Study area

The selected study area of this research is the bicycle lane from Kospalana Bridge to Piliyandala, as shown in Figure 1.1. The government of Sri Lanka built this cycle path under the concept of the "World Bicycle for Working Day" program, with financial aid from the Asian Development Bank.

The chosen bicycle path is 2.4km of length and falls under the jurisdiction of the Kesbewa Municipal Council. The route from Kospalaena to Piliyandala covers six Grama Niladhari Divisions, which are: Wewala East, Wewala West, Thumbovila West, Suwarapola East, Suwarapola West, and Kolamunna.

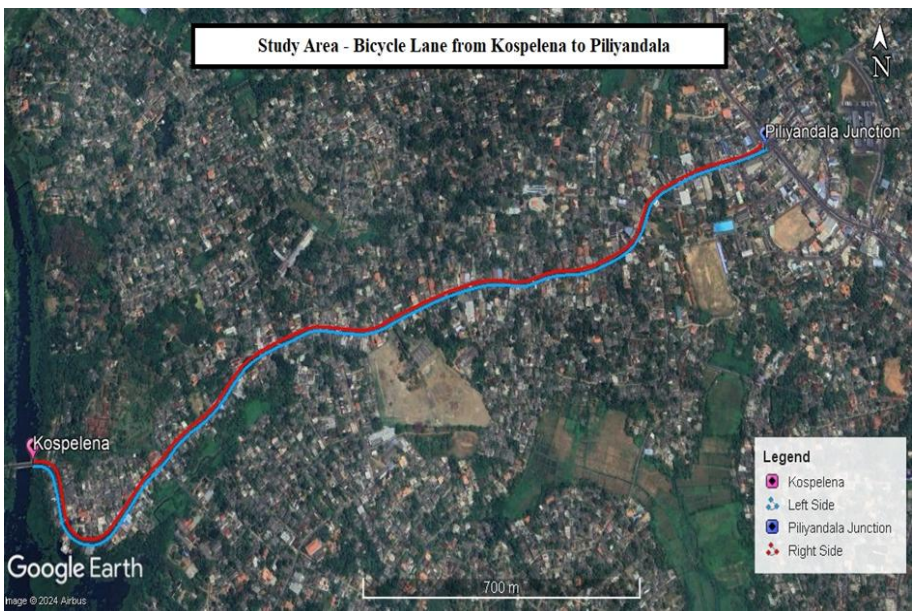

Figure 1: Location of the study area

3.2 Data Collection Methods

Primary data for this research were gathered by administering a structured questionnaire and a total of 98 commuters were surveyed, comprising 36 cycle lane users and 62 bus users. The questionnaire was intended to collect data on the respondents' socioeconomic background, travel behavior, and perceptions of non-motorized transport. It consisted of questions related to the factors that may influence the adoption of the cycle lane, such as economic, social, health, and environmental factors.

3.3 Sampling Techniques:

Purposive and convenience sampling methods were used for data collection. Purposive sampling was applied to ensure that the sample included respondents relevant to the study such as school students, employees, and other commuters aged 16 and older who traveled along the route either by bus on the main road or by bicycle on the adjacent cycle lane. Convenience sampling was used to select respondents who were available and willing to participate in the survey during the specified time frame.

The questionnaire was distributed among a sample of 98 respondents, which comprised 36 individuals who used the cycle lane and 62 individuals who traveled by bus along Route No. 255, which operates through the study area. The survey was conducted between 7:00 am and 5:00 pm to ascertain the traveling behavior of commuters during both peak and off-peak hours.

3.4 Analytical Methods:

The data gathered from the questionnaire were analyzed through quantitative methods. The quantitative analysis used statistical techniques to investigate the relationship between the factors impacting the usage of the bicycle lane and the respondents' travel behavior. The quantitative analysis comprised the use of chi-square tests and Kruskal-Wallis H tests. The chi-square test was applied to establish the connections between the categorical variables, such as gender, ethnicity, social status, and the use of the cycle lane. The Kruskal-Wallis H test was used to compare the mean ranks of influencing factors across different respondent groups namely, by gender, age, employment status, and primary mode of transport.

4. Results

The demographic profile of the respondents in this research presents a profound insight into the commuters who use the cycle lane from Kospalena Bridge to Piliyandala. The sample comprised 66 males (67.3%) and 32 females (32.7%). The major portion of the respondents were Sinhalese by ethnicity (85.7%), while the portions also comprised Tamils (8.2%) as well as Muslims (6.1%). This demographic composition demonstrates the wide range of population distribution in this area, thereby ensuring that the findings of this research reflect the local context.

4.1. Identifying the factors influencing the use of bicycle lane

- ***Ethnicity***

As shown in Table 1, the results of the Chi-Square tests indicate no significant relationship between use of bicycle lane and ethnicity. The Pearson Chi-Square test yielded a p-value of 0.236, the Likelihood Ratio test produced a p-value of 0.147, and the Fisher's Exact Test showed a p-value of 0.284, all of which are greater than the common significance level of 0.05, leading to the conclusion that there is no statistically significant association between the two variables. Additionally, a notable concern was that 66.7% of the cells had expected counts less than 5, which violates the assumptions of the Chi-Square test and could affect the reliability of the results. But Fisher's Exact Test produced a p-value of 0.284. Monte Carlo simulation yields a result greater than 0.05. This indicates that there is no statistically significant association between ethnicity and the use of bicycle lane.

Table 1: Chi-Square Test in ethnicity

Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)		
				Significance	95% Confidence Interval	
					Lower Bound	Upper Bound
Pearson Chi-Square	2.884[a]	2	.236	.284[b]	.275	.293
Likelihood Ratio	3.835	2	.147	.284[b]	.275	.293
Fisher's Exact Test	2.386			.284[b]	.275	.293
N of Valid Cases	98					
a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .37.						
b. Based on 10000 sampled tables with starting seed 2000000.						

Source: Created by the author, 2024

- ***Gender***

According to Table 2, all statistical tests (Pearson Chi-Square, Likelihood Ratio, Fisher's Exact Test, and Linear-by-Linear Association) show significant associations between gender and the use of bicycle lane, with p-values well below the 0.05 threshold. This suggests that gender has a notable impact on the adoption of, or preference for, bicycle lane considered in this study.

Table 2: Chi-Square Test in gender

Chi-Square Tests									
	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
				Significance	95% Confidence Interval		Significance	95% Confidence Interval	
					Lower Bound	Upper Bound		Lower Bound	Upper Bound
Pearson Chi-Square	14.489[a]	4	.006	.003[b]	.002	.004			
Likelihood Ratio	17.840	4	.001	.001[b]	.001	.002			
Fisher's Exact Test	13.955			.004[b]	.002	.005			
Linear-by-Linear Association	12.778[c]	1	.000	.000[b]	.000	.001	.000[b]	.000	.000
N of Valid Cases	98								
a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is .73.									
b. Based on 10000 sampled tables with starting seed 1314643744.									
c. The standardized statistic is -3.575.									

Source: Created by the author, 2024

- ***Social status***

As given in Table 3 below, the results of the Chi-Square tests indicate a statistically significant relationship between the use of bicycle lane and its' impact on their social status. The Pearson Chi-Square test produced a value of 19.537 with a p-value of 0.001; this suggests a significant association. Similarly, the Likelihood Ratio test showed a value of 21.177 with a p-value of 0.000, confirming the relationship. The Fisher's Exact Test also yielded a p-value of 0.000, further supporting the significance. The Linear-by-Linear Association test, with a p-value of 0.002 (both asymptotic and Monte Carlo), reveals a strong linear association between the two variables.

Table 3: Chi-Square Test in Social Status

Chi-Square Tests									
	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
				Significance	95% Confidence Interval		Significance	95% Confidence Interval	
					Lower Bound	Upper Bound		Lower Bound	Upper Bound
Pearson Chi-Square	19.537[a]	4	.001	.000[b]	.000	.001			
Likelihood Ratio	21.177	4	.000	.001[b]	.000	.001			
Fisher's Exact Test	18.964			.000[b]	.000	.001			
Linear-by-Linear Association	9.444[c]	1	.002	.002[b]	.001	.003	.001[b]	.000	.001
N of Valid Cases	98								
a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 1.47.									
b. Based on 10000 sampled tables with starting seed 743671174.									
c. The standardized statistic is -3.073.									

Source: Created by the author, 2024

- ***Impact on Personal Health***

The Chi-Square tests shown in Table 4 reveal a statistically significant relationship between the use of bicycle lane and respondents' self-reported perceptions of personal health. The survey included Likert-scale questions that asked respondents to assess whether using bicycle lane had positively influenced their physical well-being (e.g., increased physical activity, improved fitness, or reduced stress). The Pearson Chi-Square test yielded a value of 26.049 with a p-value of 0.000, indicating a strong association. Similarly, the Likelihood Ratio test yielded a value of 30.221 with a p-value of 0.000, confirming the significance. Fisher's Exact Test also showed a p-value of 0.000, reinforcing the findings. The Linear-by-Linear Association tests demonstrated a standardized statistic of 4.899 and p-values of 0.000 (both asymptotic and Monte Carlo), further indicating a significant linear relationship between use of bicycle lane and respondents' perceptions of personal health improvement.

Table 4: Chi-Square Test in Impact on Health

Chi-Square Tests									
	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
				Significance	95% Confidence Interval		Significance	95% Confidence Interval	
					Lower Bound	Upper Bound		Lower Bound	Upper Bound
Pearson Chi-Square	26.049[a]	3	.000	.000[b]	.000	.000			
Likelihood Ratio	30.221	3	.000	.000[b]	.000	.000			
Fisher's Exact Test	26.458			.000[b]	.000	.000			
Linear-by-Linear Association	24.002[c]	1	.000	.000[b]	.000	.000	.000[b]	.000	.000
N of Valid Cases	98								
a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.20.									
b. Based on 10000 sampled tables with starting seed 1535910591.									
c. The standardized statistic is 4.899.									

Source: Created by the author, 2024

- ***Being able to save money***

The Chi-Square tests presented in Table 5 indicate a statistically significant relationship between the use of bicycle lane and respondents' perceptions of being able to save money. The Pearson Chi-Square test yielded a value of 23.421 with a p-value of 0.000, indicating a strong association. Similarly, the Likelihood Ratio test yielded a value of 28.371 with a p-value of 0.000, further confirming the significance. Fisher's Exact Test also provided a p-value of 0.000, supporting the findings. The Linear-by-Linear Association tests produced a standardized statistic of 4.677 and p-values of 0.000 (both asymptotic and Monte Carlo), demonstrating a significant linear relationship between use of bicycle lane and the ability to save money.

Table 5: Chi-Square Test in Being able to save money

Chi-Square Tests									
	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
				Significance	95% Confidence Interval		Significance	95% Confidence Interval	
					Lower Bound	Upper Bound		Lower Bound	Upper Bound
Pearson Chi-Square	23.421[a]	3	.000	.000[b]	.000	.000			
Likelihood Ratio	28.371	3	.000	.000[b]	.000	.000			
Fisher's Exact Test	24.557			.000[b]	.000	.000			

Linear-by-Linear Association	21.876[c]		.000	.000[b]	.000	.000	.000[b]	.000	.000
N of Valid Cases	98								
a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.57.									
b. Based on 10000 sampled tables with starting seed 1556559737.									
c. The standardized statistic is 4.677.									

Source: Created by the author, 2024

- ***Being able to save time***

The Chi-Square tests presented in Table 6 indicate a statistically significant relationship between the use of bicycle lane and respondents' perceptions of being able to save time particularly in comparison to travel by public bus services, which are often subject to delays due to traffic congestion. The Pearson Chi-Square test produced a value of 34.533 with a p-value of 0.000, indicating a strong association. Similarly, the Likelihood Ratio test yielded a value of 38.583 with a p-value of 0.000, further confirming the significance. Fisher's Exact Test also showed a p-value of 0.000, supporting the findings. The Linear-by-Linear Association tests produced a standardized statistic of 5.682 and p-values of 0.000 (both asymptotic and Monte Carlo), demonstrating a significant linear relationship between use of bicycle lane and the ability to save time.

Table 6: Chi-Square Test in Being able to save time

Chi-Square Tests									
				Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
					95% Confidence Interval			95% Confidence Interval	
	Value	df	Asymptotic Significance (2-sided)	Significance	Lower Bound	Upper Bound	Significance	Lower Bound	Upper Bound
Pearson Chi-Square	34.533[a]	4	.000	.000[b]	.000	.000			
Likelihood Ratio	38.583	4	.000	.000[b]	.000	.000			
Fisher's Exact Test	34.472			.000[b]	.000	.000			
Linear-by-Linear Association	32.290[c]	1	.000	.000[b]	.000	.000	.000[b]	.000	.000
N of Valid Cases	98								
a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 1.84.									
b. Based on 10000 sampled tables with starting seed 484067124.									
c. The standardized statistic is 5.682.									

Source: Created by the author, 2024

- ***Influence of environmental factors such as rainfall and temperature on bicycle usage***

The Chi-Square tests indicate a statistically significant relationship between the influence of environmental factors such as temperature and rainfall on bicycle usage. Table 7 shows that the Pearson Chi-Square test produced a value of 15.681 with a p-value of 0.001, suggesting a significant association. Similarly, the Likelihood Ratio test yielded a value of 17.790 with a p-value of 0.000, further confirming the significance. Fisher's Exact Test also produced a p-value of 0.001, supporting the findings. The Linear-by-Linear Association tests showed a standardized statistic of -3.883, with both asymptotic and Monte Carlo p-values of 0.000, indicating a strong linear relationship between bicycle lane usage and environmental factors.

Table 7: Chi-Square Test to determine how environmental factors, such as rainfall and temperature, affect the use of NMT

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
				Significance	95% Confidence Interval		Significance	95% Confidence Interval	
					Lower Bound	Upper Bound		Lower Bound	Upper Bound
Pearson Chi-Square	15.681[a]	3	.001	.001[b]	.000	.001			
Likelihood Ratio	17.790	3	.000	.001[b]	.000	.001			
Fisher's Exact Test	15.187			.001[b]	.000	.002			
Linear-by-Linear Association	15.081[c]	1	.000	.000[b]	.000	.000	.000[b]	.000	.000
N of Valid Cases	98								

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 2.57.

b. Based on 10000 sampled tables with starting seed 508741944.

c. The standardized statistic is -3.883.

Source: Created by the author, 2024

4.2. Examining the most important factors that affect the use of bicycle lane in the Piliyandala area

The Kruskal-Wallis H test given in Table 8 was used to further analyze the most significant factors affecting the use of NMT initiatives.

Table 8: Kruskal-Wallis H test to examine the most important factors that affect the use of NMT

Test Statistics[a,b]	
	Statistic
Kruskal-Wallis H	141.975
df	7
Asymp. Sig.	.000
a. Kruskal-Wallis Test	
b. Grouping Variable: Factor	

Source: Created by the author, 2024

As indicated in Table 8, the Kruskal-Wallis H test yielded a statistically significant result ($H = 141.975$, $df = 7$, $p < 0.001$), indicating that, at the 95% confidence level, there are significant differences among the factors in terms of their impact on the use of bicycle lane in the Piliyandala area.

The findings presented in Table 9 reveal that financial savings is perceived as the most significant factor influencing the use of bicycle lane, with participants assigning the highest rank to that. Time saving follows closely as another key motivator. Perceived health benefits, such as improved physical fitness and overall well-being, also play an important role in encouraging the use of bicycle lane, although they are ranked slightly lower than time saving. Environmental factors, including rainfall and temperature, are acknowledged but considered less influential compared to personal and financial motivations. Social status and gender are viewed as the least impactful, with gender in particular having minimal perceived influence on the decision to adopt bicycle usage. Overall, the results reflect participants' opinions, indicating that personal and financial considerations are the primary drivers for using bicycle lane, while social and environmental factors are seen as less significant.

Table 9: Ranks Table of Most Important Factors Affecting the Use of NMT

Ranks			
	Factor	N	Mean rank
Statistic	Being able to save money	36	216.21
	Being able to save time	36	186.25
	Cycling has an impact on health (perceived health benefits)	36	183.97
	Environmental factors such as rainfall and temperature affect bicycle use	36	122.22

	Cycling affects your social status (social perception concern/barrier)	36	111.78
	Cycling affects your gender (contextual determinant)	36	69.10
	Total	288	

Source: Created by the author, 2024

4.3 Identifying the Challenges in Implementing NMT Systems

Table 10 presents a frequency analysis that was executed in order to recognize the challenges encountered by the respondents. The analysis given in table 10 revealed that inadequate infrastructure was the most commonly encountered challenge; 61 respondents considered this to be a substantial factor. This is suggestive of the fact that one of the barriers to the adoption of the use of bicycle lies in the inadequacy of appropriate facilities, such as cycle lanes and parking. 'Safety issues' were cited as the next most challenging aspect, with 22 respondents declaring concern with relation to accidents, traffic, or inadequate protection measures when utilizing bicycle lanes. The least concern was directed at street vending and pedestrian obstructions, which were raised by 17 respondents. Though this has been cited as a concern, it is clear that it is not as predominant as the concerns related to issues of infrastructure and/or safety.

Table 10: Frequency Analysis of Challenges to Implementing NMT

Challenge	Frequency
Inadequate Infrastructure	61
Safety issues	22
Obstructions from pedestrians, street vendors	17

Source: Created by the author, 2024

This research also reveals that monetary saving, time saving, and benefits to health are the principal driving forces of individuals to adopt the use of bicycle lane in Piliyandala. It is also important to note that social status and gender have a lesser impact when deciding to resort to cycling. Moreover, it was identified that key impediments to the process of effectively implementing bicycle lane usage were related to inadequacies in infrastructure and safety concerns.

5. Discussion & Conclusion

The research findings reveal a number of major determining factors influencing the usage of bicycle path from Kospalena Bridge to Piliyandala in Sri Lanka. This research reveals that participants perceive monetary savings, time efficiency, and health benefits as the most influential factors shaping the use of the bicycle path in Piliyandala. These are not considered objectives in

themselves, but rather perceived benefits or motivators influencing user behavior. In contrast, factors such as gender and social status are understood as contextual or social influences, with relatively less perceived impact on the decision to use the bicycle path. Additionally, the study identifies key implementation challenges, particularly inadequate infrastructure and safety concerns, which hinder wider adoption. These findings suggest that authorities should prioritize addressing structural barriers and reinforcing the perceived benefits to effectively promote bicycle path usage in the area.

These findings corroborate with similar research, which also identified 'cycling' to have more preference owing to its affordability and positive impact on personal well-being (Heinen et al., 2010). The study also found a significant relationship between gender and bicycle path utilization suggesting of the fact that the male population was more likely to utilize the bicycle path; this is indicative of cultural and social norms associated with cycling, as it is viewed as a more male-dominated activity. This revelation also connects with previous research studies, which have also identified gender disparities when adopting cycling, where men in general were found to have higher cycling rates (Gössling et al., 2016).

The role of social status in impacting the adoption of bicycle path also requires particular focus. The study found that social status is one of the key drivers influencing bicycle lane usage. This is suggestive of the fact that persons who bear a higher social rank may have a lower tendency to resort to cycling as a mode of transport, owing to possible perceptions of cycling being an activity associated with the less affluent. With rising rates of car ownership in Sri Lanka, the bicycle path initiative runs the risk of facing cultural resistance if commuters perceive cycling to be an activity of inconvenience and/or one that is socially inferior. This echoes the findings of Ahsan (2012), who also observed such cultural aspects significantly influencing the perceptions towards the use of bicycle path, particularly in areas where motor vehicle ownership bears strong affinities to social status.

The research also identified that environmental factors, such as temperature and rainfall, also have an impact on the use of bicycle path, though of lesser significance compared to that of finance, time, and health. However, this result contradicts the findings of Buehler and Pucher (2012), who declared that environmental consciousness and concerns about pollution have a significant impact when adopting bicycle usage. However, with relation to Sri Lanka, where weather conditions may restrict the preference for cycling, it is obvious that more significant personal and economic factors would surpass the environmental concerns. Environmental consciousness bears a relatively low impact, which may be indicative of the requirement to launch awareness

campaigns that highlight the environmental benefits of cycling, specifically in relation to the increasing issues of pollution and congestion in Sri Lanka's urbanized areas.

In relation to the challenges posed to affect the bicycle path usage, the research observed that the main impediments lay in the inadequacies in the infrastructure and concerns related to safety. These challenges mirror the results obtained by Pucher et al. (2010), who declared that it was vital to have well-maintained and safe cycling infrastructure in order to confirm the successful implementation of NMT. Improper dedication of bicycle paths, unsuitable road conditions, and safety concerns were often considered as deterring factors for prospective cyclists. This highlights the requirement for improvements in infrastructure, effective planning, and formulating policies prioritizing the safety and convenience of cycling commuters. The observations regarding interferences related to the presence of pedestrians and street vendors indicate the importance of efficient practices in urban planning aimed at addressing these factors to foster the smooth function of bicycle paths.

To ensure better implementation of cycle lane project in the Piliyandala region, it is vital for the challenges that were identified to undergo immediate focus that would motivate the adoption of the bicycle path from Kospalena Bridge to Piliyandala. The following recommendations were proposed.

Improved Infrastructure and Safety Measures: The main impediments that were cited for the adoption of cycle lane usage, as found by research, were inadequacies related to infrastructure. To resolve this issue, it is imperative that the government and local authorities focus on investing in the proper maintenance of the cycle lanes, which should also be clearly demarcated so as to distinguish them from motor vehicular traffic. Furthermore, developing road safety through traffic-calming measures, better signposting, and proper lighting improvements will inevitably make the cycle lanes more enticing to commuters, particularly in areas with higher volumes of congestion.

Public Awareness and Education Campaigns: To resolve the issues pertaining to the social stigma associated with cycling and to enhance acceptance, it is evident that the creation of public awareness campaigns is vital. It is imperative that these campaigns target both men and women, highlighting the financial, health, and environmental benefits associated with cycling. Public awareness programs will contribute to the alteration of underlying attitudes, promoting cycling as a practical and socially acceptable mode of transport. Since younger commuters are more open to alternative modes of transport, special attention should be paid to shape their perception of cycling. (Oja et al., 2011).

Integration of Cycling with Public Transport: One of the most effective ways of boosting the implementation of cycle lane project is to integrate the cycling infrastructure with the existing public transport network. It is suggested that the cycle lane be linked to the bus and train stations, which would then provide a smooth transition for commuters. Such integrations would inevitably assist in the reduction of the usage of private vehicles, thereby encouraging commuters to resort to cycling as a viable first- or last-mile solution.

Addressing Environmental Factors: Although environmental factors were not as significant as other determinants in this study, they still play an important role in promoting sustainability. Future, policies should aim to increase public awareness of the environmental benefits of cycling, especially in the context of urban congestion and air pollution. Government campaigns that emphasize the reduction of carbon emissions through NMT adoption could motivate more people to opt for cycling.

Targeting Social Status and Gender Disparities: As gender was identified as a significant factor influencing bicycle usage, it is crucial to implement gender-sensitive policies that promote cycling among both men and women. Encouraging women to use the cycle lane may require addressing safety concerns and cultural perceptions of cycling as a male-dominated activity. Furthermore, awareness programs aiming to alter the attitudes towards cycling among groups occupying higher social strata would inevitably assist in expanding the use of bicycle lane.

Ongoing Monitoring and Feedback: Establishing systems for smooth monitoring of usage and collecting feedback is vital to certify the continual success and development of NMT infrastructure. Conducting surveys and assessments regularly on the effectiveness of the cycle paths may enable the authorities to obtain important information to enhance the system, thereby achieving an overall improvement of the project. Furthermore, this will allow the authorities to identify new challenges and impediments that may arise, thus allowing them to intervene in a timely fashion.

In conclusion, it is evident that a multi-dimensional approach is needed to effectively encourage the use of bicycle paths in the Piliyandala area. It is imperative that this approach addresses the challenges related to infrastructure as well as the cultural factors that seem to determine the commuters' preferred mode of transport. Finally, it is apparent that the implementation of necessary improvements to the existing cycling infrastructure, the launch of well-coordinated awareness programs highlighting the advantages of cycling while directing additional focus on safety concerns, will propel Sri Lanka to devise

a more sustainable and effective transport system that enriches the lives of commuters while minimizing the toll of transport on the environment.

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