The Malaysian Cycling-Friendly Neighbourhood: A Signal For The Enhancement Of The Convenience Infrastructure.

Mohd Zahid Mohd Salleh¹, Nurhayati Abdul Malek^{2*}, Noriah Othman³ and Sharifah Khalizah Syed Othman Thani⁴

¹Centre of Studies for Postgraduate Studies, Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA, 40450 Shah Alam, MALAYSIA

^{2,3,4}Centre of Studies for Landscape Architecture Faculty of Architecture, Planning & Surveying Universiti Teknologi MARA, Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, MALAYSIA

Abstract. In Malaysia, a carbon neutral country aspiration relatively by 2050 through sustainable approaches should have heeded further. The concept of Green Mobility in the residential neighbourhood is an essential mechanism towards improving the lifestyle and sustaining the environmental quality by providing the cycling-friendly environment. The study aims to identify the cycling-oriented design factors specifically on the cycling infrastructure in Malaysian Residential Neighbourhood through the relationship between the perceived physical environments and cycling participation. The content analysis through the review of the literature applies in this study. By modifying the Ecological approach in the Cycling-Friendly Neighbourhood enhancement for the cycling infrastructure in Malaysia, the awareness and experience of the people are required to evaluate. Henceforth, the relationship between perceived environment, cycling participation level and cycling-oriented design factor will take part later to validate the significant relationship for each construct through empirical study. The convenience infrastructure design factors have been highlighted in the study comprises four elements such as safety and security, accessibility and connectivity, attractiveness and aesthetic and convenience and comfort. Thus, it will give interest and facilitate the stakeholders in creating the cycling-friendly environment in the residential neighbourhood through supportive infrastructure for the communities.

1.0 Introduction

Carbon emission is a globally environmental disorder that is consistently alarming around the world. Consequently, Malaysia has targeted to reduce carbon emission approaching 2030 with a reduction of 45 per cent and relatively by 2050 Malaysia will be a carbon neutral country[1]. The issue is attributable to an urban mobility tendency among Malaysian that were remarkably dominated by motorised vehicular to mobile. Furthermore, the unheeded of walking and cycling in urban planning has commonly resulted due to the anxiety of car used as a necessity of modernity [2]-[3].

Moving forward, the concept of the Green Mobility is the essential mechanism towards improving the people lifestyle and sustaining the environmental quality which emphasises the movement of people to make it safe, enjoy and healthy likes cycling [4]. The potential intervention of cycling adoption such as promotional activities and improving infrastructure are significant findings from the previous study [5]. Formerly, the walkability and connectivity improvement are closely related in the study. However, the substance of people's awareness and experience towards cycling activity in relation with physical environment need to investigate further.

Therefore, this study aims to identify the cycling-oriented design factors for Malaysian Residential Neighbourhood by evaluating perceived physical environment and cycling participation level. There is very scarce literature that discussed the ridership level

that influences by physical environmental factors in the Malaysia context. Hence, this study will deliberate the potential of embracing cycling, where the rate of cycling is still initial stages due to lack of infrastructure [6]. However, the journey of this study will initiate from the views of cycling-friendly environment literally.

2.0 The Cycling-Friendly Environment

The cycling-friendly environment in residential neighbourhood area in Malaysia needs to investigate for the future betterment of living [7]. The convenience infrastructure, marketing programs, integrated planning of land use and the car used restrictions are the substance for promoting cycling adoption [8]-[9]. Besides, the policies entitlement, community design and supportive infrastructure are the significant components should be emphasised [10]. To shift the cycling activity viable mode of transportation in Malaysia, the current setting character, behavioural understanding and potential intervention will be discussed subsequently.

2.1 Purview of Malaysia Neighbourhood Environment in cycling adoption

The Green Township Policy Initiatives has been continually promoting environmental stewardship for green urbanisation by focusing on land used planning and green transport in Malaysia [11]. The concept of reducing, shift and improve are facilitated the sustainable environment approach which minimises travel, shift to

* Corresponding author: nurhayati8203@salam.uitm.edu.my

the environment-friendly mode and improve energy efficiency by mixed development approach [11]. It is gladly received by Malaysia Local Authorities that invest in education strategies, green city guideline and infrastructure to empower green transport initiatives. For example Majlis Bandaraya Shah Alam (MBSA) with implementing a new dedicated, 23.5km cycling track running out Shah Alam Centre by connecting the existing residential neighbourhoods [12].

Nonetheless, the existence of cycling infrastructure in the residential neighbourhood should be considered and integrated with the neighbourhood environmental factors. It is because the built environment and cycling behaviour relationship have been documented with consistent positive significant [13]. The aspects that influence cycling behaviour in relation with neighbourhood environment can be measured by using a Neighbourhood Environment Walkability Scale (NEWS) as per Table 1 below.

Table 1. Neighbourhood Environment Walkability Scale (NEWS)

Factors	Authors/Years
LUMD	[14]
LUMA	[14], [15], [16], [17],[18]
SC	[19],[15],[20],[21],[16],[17]
CF	[19],[15],[20],[13],[14],[22]
AE	[15],[20],[13],[14],[22],[17],[18]
TS	[19],[15],[20],[21],[14],[22],[17],[18]
CS	[15],[16]

LUMD: Land Use Mix–Diversity; LUMA: Land Use Mix–Access; SC: Street Connectivity; CF: Cycling Facilities; AE: Aesthetics; TS: Traffic Safety; CS: Crime Safety; DD: Distance to Destination. Source: Author, 2018

2.2 Inadequacy of Convenience Infrastructure influences cycling behaviour in Malaysia

Although motorised vehicle dependent is robust for transportation purpose, currently cycling intention among Malaysian towards leisure and recreation is rising gradually and steadily [12]. The participation of cycling activity likes "*Hari Tanpa Kenderaan*" among Malaysian reveals the effort of behavioural alteration towards cycling adoption [23][24]. Nevertheless, it requires a substance to support and initiate the consciousness towards cycling in term good quality of infrastructure and vast promotion.

However, the cycling infrastructure quality provision in Malaysia are still unconvincing, unsecured environment, improper execution and shared with motorbikes [6]. Up till now, the accountability to evaluate of cycling infrastructure design was done by local Authority with difference standard guidelines. The paths design are incompletely durable as well as segregated and unconnected [25]. Moreover, the effective and comprehensive guidelines from the public entities need to be enhanced with appropriate knowledge

and expertise in the different field for bicycle infrastructure design.

2.3 Providing a Cycling-Friendly Environment with Frontier Technologies

Formerly, the identified neighbourhood environment factors and behavioural factors will be integrated with a new concept of Green Mobility Framework. It is the essence of future improvement towards cycling adoption in the residential neighbourhood in Malaysia. It is a part of The Global Mobility Report 2017 (GMR) to evaluate the performance of the transport sector and the capability of movement for goods and people. Four pillars have been underlined to meet the objectives, for instance, universal access, efficiency, safety and green [4]. Nevertheless, it faces a hinder against the Green Mobility growth specifically inadequate infrastructure issues [26]

Currently, the Fourth Industrial Revolution, IR 4.0 is confronting over the world with new technology and the bicycle innovation. However, the infrastructure and the pleasant environment of this mode is still infancy. For example, the bike-sharing technology to swap from car to bike is ineffective in Malaysia due to the cluttering of the bicycle on the vehicular road become an eyesore and the vandalism issues [27]. The issues are the infrastructure provision does not fulfil the generous concentration in the experience of the environment from the cyclist's specs [28] and also the potential cyclist. Therefore, the cycling-oriented urban design needs to be seen from different angles without compromising safety, convenience and complete network only.

2.4 An Ecological Approach in shifting cycling adoption in Malaysia

This study is derived from the Ecological Model for Physical Activity in creating an active living promotion to the community through physical activity. Five multilevel of influences such as intra-personal factor, perceived environment, behaviour, behaviour setting and policy has been underlined in the model [29]. The multilevel of influences initially from the demography characteristic (intra-personal factor) to see the correlation between demography profile and the behaviour. The perceived environment is the substantial contribution in the study to divert considerable interest in the experience and also the awareness of people to engage the cycling activity indirectly. The behaviour setting such as neighbourhood, recreational, school, workplace and other where the place of the action like cycling took placed [29]. The understanding of setting characteristics of cycling infrastructure is a vital interest to explore in the creation of Cycling-friendly Environment. However, the policy factor is varied in focus and include such things as programmatic adoption [30] while in this study try to focus cycling-oriented urban design factor specifically in convenience infrastructure primary.

3 Methodology

The journal published selection is around 2006 until 2018 to be addressed. Four main categories of journal publication are chosen for this study, for instance, Public Health, Transportation, Social Science and Environmental Research. The journal materials are searched using Science Direct, Google Scholar, Web of Science and PubMed. The journals have been collected to review based on the related keywords such as cycling, bicycle, residential neighbourhood, bikeway design, active travel, green mobility, physical activity and the built environment. Finally, the specific characteristics were determined in the review, for instance, the journals are written in English, research sample are focusing on adult, and elder in different contexts likes European and Asian, focusing on cycling activity and specifically on cycling infrastructure and design. Additionally, the policies, guidelines, reports and also newspapers are also incorporated to contribute for developing the path model of the study that suits to Malaysia context.

4 Discussion

In adopting cycling activity in Malaysia, the current setting character, behavioural understanding and potential intervention have been discussed above. The Ecological Model has been adopted and modified with using four multilevel determinants in enhancing the Malaysia Cycling-friendly environment as shown in Figure 1. It shows that the cycling participation level will be influenced by the perceived residential neighbourhood environment.

Fig. 1. A Conceptual Framework of the Malaysian Cycling-Friendly Neighbourhood Enhancement

4.1 The perceived physical environment and cycling participation relationship

From the above Figure 1, three stages of perceived environment will be analysed. Firstly, the environmental perception is an awareness of the surrounding environment that hinder or motivate people to execute the cycling. The relationship between environmental perception associated with cycling participation can be measured by the attributes such as personal safety, crime, traffic, infrastructure availability, network system,

public facilities, park and open spaces, climate and natural features [6],[15],[13], [16], [18], [21], [31].

Secondly, the environmental preference is essential to investigate the tendency of people to consider the cycling activity desirable or not doing that activity. It is also related to the attitude of people. The cyclist preferred to do cycling is based on their high preferences about the overall environment that suit their specification needed. To measure the environmental preferences is categorised into four attributes, for instance, speed, space, security and distance that influence the cycling participation [32], [33]–[35].

Lastly, the environmental satisfaction is to measure the enjoyment of people to do cycling as a habit with the physical environment provided. The cycling participation will be high if the surrounding support elements are wisely offered need to investigate further. The previous study has been acknowledged that significant towards cycling activity such as maintenance, environment, network, design and personal satisfaction [36] that can be incorporated in this study.

4.2 Cycling-Friendly Neighbourhood Factor for the Convenience Cycling Infrastructure

The convivial cycling infrastructure design has been contributed in successful of the cycling adoption in European countries due to high level of cycling ridership. Besides, coherence, directness, attractiveness, traffic safety, comfort, and spatial integration are the proper design for cycle-network [37]. Repercussions, four aspects of bikeway design factors will be measured in the study such as safety/security (SSF) [33], [38]–[40], accessibility/connectivity (ACF) [38], [41], [42], attractiveness/aesthetic (AAF) [43]–[45] and convenience/comfort (CCF) [6], [31], [37] that have been identified in creating Cycling-Friendly Neighbourhood as shown in Table 2. All the attributes are aligned with the Green Mobility Framework's pillars as a contribution in Malaysia context that will be investigated further in the empirical study.

Table 2. The Cycling-Friendly Environment Factor complement with Green Mobility Pillars.

Main Findings		Green Mobility Pillars
SSF	Personal safety	Safety
	Separation of cycle path	
	Traffic density, a speed limit	
	Crime	
ACF	Ease to move	Efficiency
	Well connected	
	Proximity	
	Travel distance	
AAF	Natural elements	Green
	Landscape elements	
	Architectural detail	
CCF	Infrastructure availability	Inclusive
	Surrounding condition	
	Infrastructure quality	

SSF = Safety & Security Factor, AAF = Aesthetic & Attractive Factor, ACF = Accessibility & Connectivity, CCF = Convenience & Comfort Factor

5 Conclusion

The study has identified the cycling-oriented design factors of cycling infrastructure enhancement in Malaysia Cycling-Friendly Neighbourhood. Preliminary, the conceptual framework mentioned that the awareness and experience such as perceived physical environmental factors (Perception, Preference and Satisfaction) of people would contribute significant findings from resident's spec towards cycling-oriented design. In line with the infancy cycling infrastructure issues that have been underlined before, the infrastructure design intervention through the innovation with IR 4.0 has to be advanced concerns. The convenience infrastructure design factors have been highlighted in the study comprises four factors such as safety/security, accessibility/connectivity, attractiveness/aesthetic and convenience/comfort that aligned with four pillars of Green Mobility. Thus, it will give interest and facilitate the stakeholders in creating the cycling-friendly environment in the residential neighbourhood through supportive infrastructure environment for the communities. Finally, the signal of enhancement is to flame up and let call to action for Green Mobility comprehensively in Malaysian Residential Neighbourhood to accomplish the aspiration.

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6 References

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