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## PERCEPTION TO CLIMATE CHANGE AND INDIGENOUS TRANSPORT IN DEVELOPING ASIA: A TRANSPORT USERS' PERSPECTIVES

IDERLINA MATEO-BABIANO, PHD (THE UNIVERSITY OF QUEENSLAND, EMAIL: I.MATEOBABIANO@UQ.EDU.AU)

YUSAK OCTAVIUS SUSILO, PHD (KTH ROYAL INSTITUTE OF TECHNOLOGY, EMAIL: YUSAK.SUSILO@ABE.KTH.SE), TRI BASUKI JOEWONO, PHD (PARAHYANGAN CATHOLIC UNIVERSITY, EMAIL: VFTRIBAS@UNPAR.AC.ID)

ANH TUAN VU, PHD (VIETNAMESE-GERMAN UNIVERSITY, EMAIL: DRTUAN.VA@VGTRC.VGU.EDU.VN)

MARIE DANIELLE GUILLEN, PHD (ATENEO DE MANILA UNIVERSITY, EMAIL: DANIELLE.GUILLEN@GMAIL.COM)

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# **PERCEPTION TO CLIMATE CHANGE AND INDIGENOUS TRANSPORT IN DEVELOPING ASIA: A TRANSPORT USERS' PERSPECTIVES**

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*Iderlina MATEO-BABIANO, PhD <sup>1)</sup>, Yusak Octavius SUSILO, PhD <sup>2)</sup>, Tri Basuki JOEWONO, PhD <sup>3)</sup> Anh Tuan VU, PhD <sup>4)</sup> and Marie Danielle GUILLEN, PhD <sup>5)</sup>*

- 1) School of Geography, Planning and Environmental Management, The University of Queensland, St Lucia Campus, Brisbane, QLD, Australia, Email: i.mateobabiano@uq.edu.au*
- 2) Department of Transport Science, School of Architecture and the Built Environment, KTH Royal Institute of Technology, Teknikringen 10, 100 44 Stockholm, Sweden, Email: Yusak.susilo@abe.kth.se*
- 3) Graduate Program, Parahyangan Catholic University, Bandung, Indonesia, Email: vftribas@unpar.ac.id*
- 4) Vietnamese-German University, Hanoi, Vietnam, Email: drtuan.va@vgtrc.vgu.edu.vn*
- 5) School of Social Sciences /School of Government, Ateneo de Manila University, Pacifico Ortiz Hall, Loyola Heights, Quezon City, Philippines Email: danielle.guillen@gmail.com*

## **ABSTRACT**

This paper contends that indigenous transport, defined as those modes, which evolved in response to local demand, well-contextualized to local conditions and well-adapted to local culture, helps decrease the vulnerability of individuals as well as communities to better adapt to climate change impacts. First, this paper examines the concept of indigenous transport based on its defined attributes. Second, through a face-to-face survey of transport passengers in three developing cities in Southeast Asia, namely: Baguio (Philippines), Ho Chi Minh (Vietnam), and Bandung (Indonesia), this paper investigates the indigenous attributes of three types of indigenous transport and elicits transport passengers' thoughts on climate change, their perception towards indigenous transport service attributes, and the contribution of indigenous transport to climate change adaptation. This exercise, however, does not compare indigenous transport across diverse urban scales, instead it attempts to gain a better understanding of the indigenous qualities of public transport modes, generally considered informal, and attain enhanced insights to strengthen the evidence base that can inform a context-based climate adaptation policy aimed at the local community level in developing Southeast Asian cities.

*Keywords: local transport, informal transport, Asia, Vietnam, Philippines, Indonesia*

## **INTRODUCTION**

Communities around the globe are experiencing the impacts of climate change. Because of stronger and more frequent occurrence of extreme weather events, it became evident that focusing on mitigation alone has not led to a substantial reduction in greenhouse gases. Instead, mitigation strategies must be complemented with adaptation measures (COAG, 2007). From an adaptation perspective, it examines the concept as an alternative means of articulating public transport in developing cities. The paper introduces the concept of indigenous transport based on its defined attributes. Such attributes, the paper premises, may support a community in decreasing their vulnerability while also assist in improving their capacity to adapt. In this paper, indigenous transport is defined as modes that evolved in response to local demand, contextualised to local conditions and well-adapted to local cultures.

Through a face-to-face survey of transport passengers in three developing cities in Southeast Asia, namely: Baguio (Philippines), Ho Chi Minh (Vietnam), and Bandung (Indonesia), this paper investigates the indigenous attributes of three types of indigenous transport and elicits transport passengers' thoughts on climate change, their perception towards indigenous transport service attributes, and the contribution of indigenous transport to climate change adaptation. This exercise, however, does not compare indigenous transport across diverse urban scales, instead it attempts to gain a better understanding of the indigenous qualities of public transport modes, generally considered informal, and attain enhanced insights to strengthen the evidence base that can inform a context-based climate adaptation policy aimed at the local community level in developing Southeast Asian cities.

The research is significant because it aims to provide an objective perspective drawn upon empirical research on indigenous transport modes. In addition, this study offers a different perspective in exploring and understanding the meaning of these transport modes to people's daily life in developing cities. The results could therefore inform regulatory design and development which can affect the future of Southeast Asia's transport system.

## **INDIGENOUS TRANSPORT & CLIMATE ADAPTATION: A CONCEPTUAL FRAMEWORK**

The term indigenous transport was first mentioned by Cervero (2000), in the UNHabitat report titled "Informal Transport in a Developing World". The publication reviewed the market, organizational and regulatory attributes of the informal transport sector in various developing contexts. Cervero, in this seminal work, pointed out that some of these informal modes have indigenous and traditional attributes attached to them, which he strongly contends should be a more accurate descriptor of these modes. While a number of modal examples were provided to aid in describing the indigeneity of transport modes (including the *kuliglig* and *trolley taxis* in the Philippines), discussion was, however, limited to what constitutes indigeneity and the rationale for classifying such modes as indigenous. While it is acknowledged that indigenous transport may pertain to networks and systems as well as behaviours and practices, for the purposes of this article, indigenous transport will only focus on modes. Through a systematic review of literature, the main characteristics to describe indigenous transport are identified in Table 1.

**TABLE 1. Characteristics of indigenous transport**

<b>CHARACTERISTICS</b>	<b>DESCRIPTION</b>
Demand-responsive	Catering to the mobility and accessibility needs of local residents
Context-sensitive	suits specific local context such as a distinct geographic feature, climate, or air quality
Socio-culturally-appropriate	Responds to cultural mobility and accessibility practices
Locally-Operated	Owned and/or operated by local residents or within a local community/context
Socially-accepted	Widespread use of modes, popular amongst the populace

While there is yet no agreed consensus on the objectives of and what constitutes adaptation, making it difficult to define success or failure of adaptive actions (Doria et al., 2009), however, there is a general agreement that the scale of action must be very significant to adapt to future impacts of climate change (Parry et al., 2008). Indigenous transport actions and related strategies may serve as viable adaptive actions and can assist in minimizing community risks and vulnerabilities to climate change. A number of examples include: the various social benefits accrued from indigenous transport such as increasing access to opportunities and diversifying transport options help minimize risks; job opportunities, while indirectly, can assist in financially empowering communities as well as in increasing their security; post-disaster mobility with evacuation and goods distribution during disasters; enhanced mobility of different population groups who are most vulnerable to climate change impacts while also exceedingly dependent on indigenous transport such as the elderly, the

urban poor, the youth children and women; and improved access to services and increase their participation in the community as well as in higher levels of government. On the other hand, it is also important to acknowledge that the role of indigenous transport is only one of a suite of complementary interventions to be able to protect, retreat and accommodate (UNFCCC, 2006) so that adaptation strategies can provide diverse pathways to effectively manage risks (Sperling & Szekely, 2005). Figure 1 provides a hypothetical framework for indigenous transport as a potential climate adaptive mechanism that would assist in achieving climate adaptation goals, including: (1) reduce risks from present levels deemed unacceptable, or (2) to minimise exposure of the most vulnerable populations.

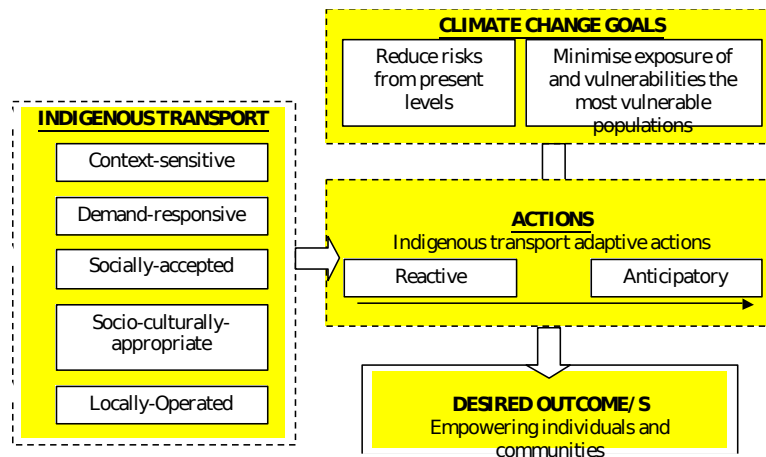


Figure 1. Indigenous transport framework for climate change adaptation strategy

## DATA AND METHODOLOGY

A face-to-face questionnaire survey implemented within identified transport terminals aimed to examine the perception of public transport users on existing indigenous transport modes and on climate change in three varying urban centres in Southeast Asia, namely: Baguio City (Philippines), Bandung (Indonesia) and Ho Chi Minh City (Vietnam). Table 2 compares the socio-demographic profile of the three cities.

TABLE 2. Physical characteristics of the three cities

ATTRIBUTES	Baguio (PHILIPPINES)	Bandung (INDONESIA)	Ho Chi Minh (VIETNAM)
Area (km <sup>2</sup> )	57.5	167.67	2,095
Elevation (above sea level)	1,500	768	19
Population (persons) (2009)	318,676	2,393,633	7,396,446
Density (persons per km <sup>2</sup> )	5,251	14,000	3,531
GDP per capita (US\$) (2009)		107.22	2,800.00
Climate	subtropical highland climate	Tropical humid monsoon climate	tropical wet and dry climate
Geography	Hilly terrain	Hilly northern portion with a 400 km <sup>2</sup> central Bandung plain	
Average temperature (°C)		23.6 °C (74.5 °F)	28 °C (82 °F)

Approximately 405, 397 and 408 respondent samples were collected in Baguio, Bandung and Ho Chi Minh cities, respectively. The questionnaire survey was designed to elicit the socio-demographic profile, the trip characteristics and the perceptions of transport users to

climate change and indigenous transport. It is important to note that this paper emphasizes that it does not empirically compare the perceptions to climate change and indigenous transport but rather provide a user perception in the context of developing Asian cities.

## RESULTS & FINDINGS

Survey respondents in the three case cities were asked to identify examples of indigenous transport within the cities. Table 3 provides a list of indigenous transport as identified by survey respondents in the three cities. Interestingly, while the different modes in all three cities vary physically, one common factor is that all the modes provide improved mobility of both people and goods.

**TABLE 3. List of indigenous transport identified by transport users in the case cities**

Ho Chi Minh	Xe om (motorcycle taxi) Ba gac (cycle rickshaw) Cyclo or Cyclo (bicycle trishaw) Xe Lam (paratransit) Canoe or inland water transport (IWT)
Bandung	Angkot (paratransit) Bus (minibus, microbus) Becak (tricycle) Delman (horse drawn carriage) Ojek (motorcycle taxi)
Baguio	Jeepney (paratransit/minibus) comboys (vegetable carts)



**Figure 1. a) Angkot; b) Bicycle-Ba gac; c) Comboy**

In Baguio, the majority of the respondents identified jeepneys (minibus/jitney) as indigenous modes while 'comboys' were mentioned as well. Except for the jeepney, there are no alternative public transport modes to move passengers within the city. Non-motorised vehicles such as bicycles and cycle-rickshaws (a.k.a. pedicabs) are restricted due to the physical geography of the area. While jeepneys are utilized to ferry passengers, comboys are carts used for goods movement. In HCMC, survey respondents have identified five transport modes which they perceive as indigenous transport. These are: Xe om (motorcycle taxi), Ba gac, Xyclo, Xe Lam and canoe which are used to transport both passengers and freights. Figure 5 shows three of the five identified indigenous transport in Ho Chi Minh City. In Bandung, indigenous transport user survey respondents identified five modes which they



considered to be indigenous transport. These are: angkot (angkutan kota), medium-sized (bus), becak (tricycle), delman (horse drawn carts), and ojek (motorcycle taxi). The primary means of indigenous public transportation is by a paratransit or minibus called angkot (angkutan kota; angkutan = transportation and kota = city). While they may be considered as micro-enterprise, most of these modes are privately owned and operated.

## **Climate change and its potential impacts**

The three case cities have been continuously experiencing the impacts of climate change. HCMC is one of the 10 cities considered to be (most likely) affected by severe climate change impacts. This is because 45% of its land cover sits between 0 to 1-meter above sea level and no land is above 4 meters. Also, an extreme current climate and hydrodynamics have resulted in more severe storm, storm surges, and flooding which is expected to continue and intensify (ADB, 2010). Because Bandung is 768 m above sea level, the area is not likely to be affected by any coastal climate change impacts. However, climate variability and change have exacerbated areas that are prone to disaster risks. Floods have posed the greatest threat to Indonesia's urban centre, including Bandung. In the past four decades, the city has experienced a number of climate-related impacts including flooding, droughts, storms, and landslides, which posed the greatest threats to Bandung's economic growth, livelihoods, and environment. Similar to Bandung, Baguio with its high altitude is also considered an inland city, thus, without the possibility of experiencing coastal impacts of climate change. However, it still is within the Philippine typhoon belt. Historically, the city has experienced extreme rainfall, intensified tropical cyclones and flooding. It also has the highest average rainfall in the country, which has increased in volume and intensity in the last 100 years. In 1910, it established a Philippine record for highest annual rainfall at 9006 mm and, in 2001, Baguio City registered the Philippine record for highest rainfall in 1 hour at 1085 mm. Clearly, the three cities are experiencing different climate change impacts at varying levels of intensity.

## **Thoughts on climate change**

In the three cities, respondents were asked about their thoughts on climate change and indigenous transport. Variability in responses across the three cities can be observed. Baguio evidently presented the most homogeneous responses while HCMC has the most variable responses. This diversity seems to be an apparent reflection of the respondents' socio-demographic characteristics across the three cities. Baguio and Bandung have a predominantly homogeneously large student representation belonging to the age range 18-25 years of age. On the other hand, HCMC has a more uniform spread across the different age range and occupation groups but with a slightly higher percentage of employees/workers.

Posed with the statement "the world climate is changing", majority of the respondents in both HCMC and Bandung have strongly agreed/agreed while 96.8% of Baguio respondents answered YES. Additionally, there is also strong agreement/agreement that problems

associated with climate change pose a real problem to these cities (Baguio=YES, 86.9%; Bandung, SA=40.3%, A= 46.4%; HCMC, SA= 36.2%; A=48.5%). While there is a general agreement that climate change is both human-induced and also a natural occurrence in the three case cities, majority tend to strongly agree/agree that it is more of the former (human-induced) rather than the latter (natural occurrence). In Baguio, for example, while a little more than half agreed that this is a natural occurrence (54.6%), a greater majority felt that this is also human-induced (79.0%). Thus, the results across the three cities, while varying, strongly suggests that people are already aware of climate change, that it is a current threat to cities both as a result of human activities and natural climatic change, nevertheless its impacts are already being felt by individuals and communities.

## **Perception on indigenous transport**

On the question that there is a need for “the promotion of indigenous transport,” the majority of respondents in Baguio agreed that the use of indigenous transport should be promoted (Baguio=YES, 83.1%), while a total of 80.1% of Bandung respondents are in agreement (SA=25.7%, A= 54.4%) that indigenous transport be promoted. On the other hand, less than 50% of HCMC respondents (HCMC, SA= 5.3%; A=39.8%) are in agreement that indigenous transport should be promoted. Scholarly literature has identified both the benefits and costs of indigenous transport. For example, indigenous transport is claimed to provide a safer, secure and comfortable transport option (Rahman et al., 2009); it also provides job creation to drivers and operators (Guillen, 2008; Hossain & Susilo, 2011); and, in the case of non-motorised rickshaws, presents a low-carbon transport option. They also play a critical role during monsoon flooding as these modes can easily be utilised to access inundated areas (Hossain & Susilo, 2011). This illustrates that such system is more robust and fit-for-purpose. In addition, these modes have been part and parcel of the way-of-life of developing communities, and have improved both community accessibility and individual mobility. Thus, these modes have increasingly contributed to empowering the communities by improving their poor accessibility, therefore, increasing their access to potential opportunities. While positive social contributions of indigenous transport have been extensively documented so are its negative impacts on the environment. Thus, when posed with the next three questions on improving indigenous transport, a majority of respondents across the three cities were in general agreement to them. These included: (1) improve the physical design of indigenous transport (Baguio=80.9%, YES; Bandung = 35.3%, SA; 51.6%, A; HCMC= 25.5%, SA; 67.5%, A); (2) reduce emissions of indigenous transport (Baguio=88.6%, YES, Bandung = 57.3%, SA; 38.0%, A; HCMC= 26.0%, SA; 65.3%, A); and (3) utilise clean fuels for motorised indigenous transport (Baguio=80.9%, YES, Bandung = 39.2%, SA; 49.3%, A; HCMC= 19.0%, SA; 52.5%, A). As shown from these figures, majority of the respondents indicate a strong agreement/agreement to these three points. This is expected given that a number of indigenous transport modes (e.g. auto rickshaws and tricycles) have been considered to be environment-unfriendly because they contribute to air and noise pollution. Moreover, the choice of using diesel to fuel paratransits (e.g. jeepneys) also contributes to environmental degradation and higher GHG emissions. This is further compounded by its health disbenefits wherein prolonged exposure to emissions has led to a number of health problems. A study concluded that pullers of rickshaw and jeepney drivers are more prone to health problems



associated with their constant exposure to environmental air pollution which then contributes to the increase in health risks combined with health shocks (Begum & Sen, 2004).

The use of cleaner fuels has become a direct response to address these environmental issues associated with these modes. This shift towards cleaner transport technology is becoming rampant in various Asian developing cities (Hook, 2007). Pilot electric jeepneys are being implemented in the cities of Makati and Puerto Princesa in the Philippines, retrofitting the motorcycles to direct injection. In Bicol, electric tricycles have been rolled out (Ibay & Bathan, 2008). The aim is to reduce emissions from two-stroke tricycles. The design and development of the next generation electric auto-rickshaws is considered as a potential improvement as well as the development of solar-powered battery recharging stations at the city outskirts (Lukic, 2007) while electric scooters or e-scooters which is a two-wheeled motorized vehicle operated solely on battery power is being encouraged by international organisations such as the Asian Development Bank as an alternative to its gasoline-powered counterpart as they have zero local tailpipe emissions, virtually silent and contribute to air and noise pollution reductions (ADB, 2009). However, with new technology, it also becomes imperative to ensure a community's physical and social readiness to adapt and use the new technology especially in addressing technical and mechanical problems.

The succeeding two questions relate to the possibility of indigenous transport to be (1) a key component in disaster mitigation plans (Baguio=85.4%, YES; Bandung = 37.2%, SA; 45.1%, A; HCMC= 4.5%, SA; 25.0%, A); and (2) the possibility of incorporating indigenous transport in the country's national and local regulations/strategy/plan (Baguio=83.1%, YES; Bandung = 44.8%, SA; 47.8%, A; HCMC= 4.3%, SA; 41.0%, A). In both instances, the elicited responses were more positive in Baguio and Bandung while to a lesser extent in HCMC. At least for HCMC respondents, the possibility of indigenous transport in becoming a significant component in disaster risk mitigation is not considered as one of its potential future role. This may be due to a number of reasons. Given the low-lying physical area of HCMC, the role of indigenous transport becomes limited especially in the event of flooding. On the other hand, it has been documented that in Dhaka, a city which experiences seasonal rains and flooding, they have utilised versatile rickshaws to pass through narrow roads and access isolated parts of the city. Their role has become more crucial during heavy rains, typhoons and flooding (Hossain & Susilo, 2011). Thus, can it then be justified that indigenous transport must therefore be integrated into the policy climate or framework? The possibility of empowering the local government by increasing awareness and knowledge on the potential of indigenous transport, may be a possible pathway especially with the identification of local knowledge especially in the transport system and the need to mainstream indigenous knowledge may be a plausible approach to counter climate change impacts through adaptation strategies that aims to alleviate transport disadvantage in developing cities. While possibly not deregulation, mainstreaming may be in the form of identifying and sharing of information, advocacy and lobbying for their presence and protection both of its operators and users, and development of best practice principles which may be adopted within the local context.

## **Indigenous transport and their contribution to climate change adaptation**

To the question of the kind of outcomes that indigenous transport contributes to society and environment, there was general agreement across respondents from the three cities that indigenous transport (1) promotes public transport to public transport users (Baguio=81.0%, YES; Bandung = 39.3%, SA; 47.7%, A; HCMC= 17.3%, SA; 57.5%, A); (2) an essential source of income for the poor/many people (Baguio=69.9%, YES; Bandung = 35.9%, SA; 44.7%, A; HCMC= 36.8%, SA; 45.5%, A); and (3) provides alternative travel options to transport users (Baguio=68.4%, Yes; Bandung = 38.0%, SA; 50.1%, A; HCMC= 19.0%, SA; 58.5%, A). On the other hand, perception towards these contributions resulted in variability of responses across the three cities, with significantly lower proportion of HCMC respondents (slightly less than 50% of the sample) strongly agreeing/agreeing to these different contributions. It is therefore implied that, across the three cities, indigenous transport is perceived to not only have positive but also negative contributions to the community. While indigenous transport is perceived to encourage public transport, income provider and provides alternative transport options, they are not currently perceived as an adaptation measure. This indicates that while they are aware of the benefits of indigenous transport, they could not see its relationship to climate change. This is further exacerbated by the fact that the concept of climate adaptation remains vague and unclear to many, even as discussed in academia. Thus, the basic lack of knowledge on the need to adapt makes it a very critical barrier, as individuals are not aware that there is a need for such intervention or such intervention could actually contribute towards climate adaptation are areas that still need to be further addressed.

## **CONCLUSION AND RECOMMENDATIONS**

Within the context of a changing climate, the paper was able to provide an initial understanding on the extent to which informal public transport can be described as indigenous. Through the results of a face-to-face survey of transport passengers in three developing cities in Southeast Asia, it was also able to elicit the respondents' perception to climate change, indigenous transport service attributes and the extent to which indigenous transport contributes to climate change adaptation. Interestingly, while some variables were perceived homogeneously, most variables elicited a diverse response from across the three cities, with HCMC respondents presenting a more variable cohort. Moreover, it becomes evident that climate change, as a global problem, has moved from being a scientific to a policy one. Everyone is in agreement that the threat is at hand, and both mitigation and adaptation must simultaneously be pursued. As the focus of this paper was on climate adaptation, a framework was developed and put forward which illustrates the potential role of indigenous transport and how it assists in increasing resilience of individuals and communities to address climate change impacts. However, the survey results showed that the concept is still unclear to many, and while indigenous transport is seen to provide many benefits to the community (promoting public transport, creating job opportunities, providing transport options), it was not perceived to increase resilience nor contribute to climate adaptation. Thus, while there was a general agreement on the need to adapt for climate change impacts, there was a lack of knowledge on what adaptation measures are out there

and on which adaptation methods are workable and therefore should be pursued. Thus, the challenge is to find ways and means on how to overcome these barriers and challenges in the most effective and efficient manner.

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