

Tipping points on transport and behaviour

Examining Bus Rapid Transit system in Jakarta, Indonesia

Mega Primatama

Building and Urban Design in Development
The Bartlett Development Planning Unit
University College London
London, United Kingdom
mega.primatama.16@ucl.ac.uk

Abstract—This paper will examine the relationship between the human behaviour and its role in people's transport behaviour, using the case studies of Bus Rapid Transit (BRT) system in Jakarta, Indonesia. It departs from the idea that the human behaviour can be altered by certain triggers. In transport perspective, it means that behaviour of using private transport can be shifted into a more sustainable public transport. Using the thought of Saussure on “signs” and Bourdieu on “habitus”, it can be concluded that anything can be a trigger or “tipping points” to shape human behaviour. The expected result of the employment of public transport policies is the change in travel behaviour and modal shifting, from private transport mode to public transport mode. This paper will start with the understanding of habitual studies, transport provision in developing countries, and how the human behaviour can shape the unsustainable transport behaviour. It then moves to the emergence of Bus Rapid Transit system as the answer of providing affordable high-capacity transport for developing countries. Using the BRT guidelines, this paper will formulate the “tipping point” indicators, a set of indicators for a successful BRT system that can adjust people's behaviour from using private transport to public transport, and then interrogate it with the policies of Transjakarta. In the end, this paper will generally suggest what type of development and improvements to maximise the public transport ridership to generate a more sustainable and equitable transport system.

Keywords— *public transport; bus rapid transit; transjakarta; travel behaviour*

I. INTRODUCTION

Transport is viewed as a vital and important aspect as the main driver of the economic activities, as well as the engine of growth [1]. In the perspective of urban mobility, the demands of transport mode are dominated by how to construct a faster and more efficient mode of transport. This growing and unstoppable demands then generates the introduction of the automobile, which faster, reliable, and later praised as “the leading object of modern society” [2]. However, this mode of transport creates abundant of problems, mainly from environmental aspects. This concludes the private motorised transport as the unsustainable travel behaviour [3].

On the case of developing countries, transport provision's priorities are heavily focused on automobile provision. In

urban areas, recent transport provision is starting to change into a new perspective: the introduction (or re-introduction) of public transport mode that is efficient and environment-friendly. Thus came the introduction of Bus Rapid Transit (BRT) as the mass rapid transit for the urban area. BRT is now having gained popularity, mostly on developing countries, since this mode is relatively cost-effective rather than investing on urban rail scheme such as Light Rail Transit (LRT) [4]. But by introducing a new mode of transport, it suggests that there are policies regarding on how to change people's existing behaviour, transport-wise, from using an automobile to public transport.

The urban area that will be the main object of this paper is on Jakarta, the capital of Indonesia. With the population of 10.25 million [5], Jakarta takes the role as the centre of national government and economy. The capital is served by the BRT system called Transjakarta. It was introduced in 2004 and gives a new way of travelling and commuting in the capital. However, despite the expansion efforts, the rate of private motorised transport ownership in Jakarta still recorded an increase up to 10 percent per annum, and the Transjakarta ridership is fluctuating from its peak in 2011 [6], so it needs to be studied to look for what policies regarding the BRT system in Jakarta that need to be improved.

This paper will discuss on how the BRT system took place at the recent alternative for urban mobility in developing countries, as it intends to change travel behaviour in urban areas, shifting from the private to the public form of transport. This paper will also focus on the BRT's tipping point policies and regulations from works of literature regarding the successful features of BRT, then it will be interrogated to the policies for Transjakarta. This method of comparing and examining policies is set to provide policy recommendations for Transjakarta, based on the formulated indicators.

II. LITERATURE REVIEW

A. *Habitual Studies: A Short Brief*

In *Cultural Studies and Discourse Analysis: A Dialogue on Language and Identity* [7], Barker and Galasinski discuss the Saussure's understanding on “signs”, which are constituted by

signifiers (medium) and signifieds (meaning). These two terms are connected with each other, they organised and maintained through the social conventions. Thus, the social conventions then transformed into natural codes, which are the base of cultural habituation; for example, how we use the traffic lights and establishing the habit through the understanding on what colour signifies “stop” and what colour signifies “go”. Word and sequence of “signs” on the general behaviour can be translated on how rules (signifiers) can affect the people (signifieds), and people mostly depends on the “signs” on how we perceive things such as, on the transport perspectives, how we perceive cars or trains as the reliable transport medium.

On transport provision perspective, some transit modes maybe unfavourable and signifies an unsafe and threatening transport vehicle. But although we quite dependant on “signs” as our cultural habit, it may be compromised by our own consciousness, so we keep using it despite the negative perspectives. This phenomenon can be because of some circumstances that force us to do it. This action, by any means, can be our “tipping point”, which is a spot where we need to act outside our habit due to the external force. This tipping point, on the perspective of public transport studies, can be interpreted as a circumstances where we experience transport modal as well as travel behaviour shift, from private transport mode to use public transport mode due to certain reasons, ranging from the voluntary change, government policies [8], popularity [9], or financial constraints on household level [2].

B. Transport Provisions on Developing Countries

To review on how transport shape people’s behaviour, in this part, we will take our scope into the developing countries. By the era of motorisation, starting from the 1960s, developing countries are mostly still in the early phase of development, which of course affect their budget. Taking examples in post-colonial countries such as Indonesia, the development on the urban area was severely restricted on the immediate and essential aspects.

On the transport perspective, they try to preserve what kind of transport mode that is still available and then utilises it. Developing a network of the modern era, rail-based mass transit system is deemed unaffordable, reviewing their budget constraints and their economic state was not strong enough to convince a formal public transit environment. Some transit mode even abolished due to its out-of-date state and never having any major refurbishment, such as tram services in Surabaya, Indonesia, which then replaced by the city bus [10]. The rise of the automobile in developing countries that backed with the advancing technologies and a new sense of personal freedom and independent [2] [11]. This new mode then became a trend and we saw rapid upsurge on this private motorised transport, which creates traffic problems and growing the demands for road improvement. The government with its constrained budget choose to go with the road improvement as the short-term solution, rather than improving transit mode or network. Road improvement itself will encourage people to use private motorised transport, which will generate another traffic problem, and the unsustainable cycle goes on. The automobile prioritisation policies resulted in the deterioration of existing public transport and creation of new neighbourhood being

further from the city, resulting in public transport inaccessibility. This triggered the emergence of the informal transport sector, in which they called “paratransit”, such as *becak* (rickshaws) and *bemo* (four-wheeled cars). Paratransit offers a wider coverage of service and taking advantage of areas unreachable by formal public transport since it can be adapted to narrower and less maintained streets [12].

C. Unsustainable and Sustainable Travel Behaviour

Historically, travel behaviour studies have been a great interest since the introduction of transport modelling in the 1950s. It usually goes as the outcome that exhibited by the traveller, and it captured by their own revealed or stated preferences and actions. It consists of modes, route, and time choices on people’s travel pattern, which will affect the transport systems and networks [13]. Regarding the developing countries’ travel behaviour, the circumstances and the policies in developing countries are creating “travel behaviour”, which dominantly consist of the culture of private motorised vehicle and paratransit services due to the government’s inability to formulate a proper public transport plan and budget constraints so they tend to go with short-term solutions. Even if some cities are heavily investing in road-based infrastructures, the motorisation rate always outpaces the supply of road network [14]. These pattern of motorisation then perceived as an unsustainable travel behaviour [3], due to the environmental, economic, and social problems it can be generated from.

Alteration of travel behaviour, besides using the argument of Saussure, it is also can be found in Bourdieu’s term of “habitus”, as discussed by Ritzer and Smart [15] as a “...form of improvisation that characterises daily life [...] which condenses tradition, knowledges, practices [...] without ever being strictly reducible to formal rules”. Since the “habitus” can be created and have a flexibility side on alteration, the idea of creating policies to generate “tipping point” can also be applied through this thought. Changing from unsustainable travel behaviour to a sustainable one requires not only physical-infrastructure and technological breakthrough, but also must address the behavioural aspect as well [16]. Generally, the effort to reach the tipping point also can be done by sets of transport policy measures. Möser and Bamberg [17] compiled two transport policy measures to curb the automobile usage, which are:

- Hard transport policy measures: through tough regulations and physical development, such as infrastructure and management improvement, increasing cost for car usage and prohibiting or rationing car usage.
- Soft transport policy measures: through psychological and behavioural strategies, such as encouragement to use public transport or increasing awareness of automobile travelling.

III. METHODOLOGY

This paper utilises secondary data that employs quantitative and qualitative analysis. The qualitative analysis consists of the literature review on habitual studies, transport provision in developing countries, understanding the travel behaviour, and the implementation of BRT system, using the study case of Jakarta with its existing BRT system, Transjakarta. Quantitative analysis will be used to support the argument for the importance of public transport provision, as well as providing data to illustrate the recent conditions. This can be gathered through transport ridership and statistics.

Besides the habitual studies as one of the main thought, it will also take a light on the developing countries with its problem of rapid motorisation, continuous road improvement, and the constrained budget issue of the government. From the problem of developing countries' transport provision, it will turn to the understanding that the transport behaviour in most developing countries is affected by the "signs" that shaped our daily activities and habit. From this understanding, this paper also employs Bourdieu's thought on changeable habitus by the internal or external encouragement in the form of tipping points, which is believed to be the key to change the habit from private transport to public transport.

Using the BRT as the solution of mass transit for developing countries, this paper then continues to examine the tipping points that results in a set of indicators to formulate a successful BRT system and modal shifting. Employing the case studies of Jakarta, These indicators will be interrogated with field conditions, based on statistics and studies. The framework of a successful BRT system on Transjakarta will identify what has been done and what should be improved for a more sustainable travel behaviour in the future.

IV. EFFORTS OF TIPPING POINT AND TRAVEL BEHAVIOUR ALTERATION: BUS RAPID TRANSIT AND THE CASE STUDY OF JAKARTA

A. Emergence of Bus Rapid Transit

The bus rapid system (BRT) emerges as the solution to provide and improve the existing formal public transport and can generate a more sustainable urban transit system, which can trigger a more sustainable travel behaviour through the less dependency on the private motorised vehicle. Recently, it grows rapidly, mainly in developing countries, since it can provide a more appropriate transit mode at a reasonable cost [18]. The BRT system itself is promoted as the system with lower fares and cheaper construction cost, which significantly potential on major transport transformation for budget-constrained governments, mainly in developing countries, so it can provide self-sustaining finance, and also due to its inexpensive cost, can be built and expanded quickly [4] [19] [14]. It first emerged in Latin America, implemented by the city of Curitiba. At first, the system did not gain significant substantial interest until the system was introduced in Bogota in 2000, which cited as an example of state-of-the-art BRT system and triggered a worldwide interest. Its popularity is inseparable from Bogota's former mayor, Enrique Peñalosa.

This clearly shows the political will as the most significant factor in its successful implementations [19].

B. The Predecessors: Jakarta's Pre-BRT Transport Provision

During the Dutch administration era, the main public transport mode in Jakarta (then Batavia) was mainly rail-based transport, which are railways and trams with frequent services, although motorbuses are starting to take a major role since the 1930s [20]. Jakarta's tram service as the rail-based mass transit was abolished in the 1950s without any transit mode to replace the trams, resulting in the rises of motorbuses and paratransit such as *opelet* and *bemo*. Attempting to modernise the system, the local government launched buses as the intra-urban transport in the 1970s. By 1979, the operating bus unit was registered as many as 2400 units. Despite the efforts, the growing economy in the 1980s saw the emergence of private motorised vehicles that demand the road improvement and expansion. By 1996, private automobile ownership has risen nine folds since 1970. Public transit conditions on some years before the emergence of BRT system was overwhelmingly depended on road-based transport such as buses and paratransit [19].

C. Jakarta's BRT Today

By 2013, Transjakarta that have been in service since 2001 has operated 12 main corridors of services with the total length of 202.9 kilometres and serving 370000 people per day [21]. Beside the main corridor, Transjakarta also operates the feeder services to increase the coverage and accessibilities. Feeder service itself consists of the intra-urban feeder, border services that connect Jakarta's peripheries to the main Transjakarta corridor, and Transjabodetabek, which connects the less accessible part of Jakarta's buffer zones, which consists of urban and semi-urban regions, to the mainline corridors. Transjakarta's total annual and daily passengers are steadily increased since its opening until 2011 and become fluctuated in recent years (see Table 1), despite its plan to reach 600000 people per day [21].

TABLE I. STATISTICS OF TRANSJAKARTA'S PASSENGERS, 2007-2014

No.	Passengers of Transjakarta		
	Year	Annual passengers	Daily passengers ^c
1	2007	61.446.336 ^a	202.000
2	2008	74.619.995 ^a	245.000
3	2009	82.377.690 ^a	271.000
4	2010	86.937.487 ^a	286.000
5	2011	114.769.431 ^b	378.000
6	2012	111.260.869 ^b	366.000
7	2013	112.522.638 ^b	370.000
8	2014	111.630.305 ^b	368.000

^a. [22] ^b. [6] ^c. [21]

V. ANALYSIS

A. Examining Tipping Points of the BRT System

On the context of developing a high quality BRT system, tipping points are the sets of requirements, regulations, and recommendations to create a “signifiers”, as well as the shaper of “habitus”, so that the modal shifting will happen and more people will use the public transit system as the main choice for traveling in urban area. Formulation of tipping point indicators for a successful BRT system will be mainly based on the BRT features stated on *Bus Rapid Transit Planning Guide* [23]. These features are usually found on the successful and sustainable BRT system implementation. BRT system itself are varied, depends on the locality, but the establishments of key characteristics will be helpful, mostly for system designers and developers. Some important features are as follows:

- Dedicated segregated busways
- Integrated network of routes and corridors
- Rapid boarding and alighting
- Clean, secure, and comfortable stations and terminals
- Efficient pre-board fare collection
- Universal design attributes providing access for all

These provided indicators can be the step on how the BRT system can be the trigger (signifiers) on the existing “habitus” (signifieds), to change the habit of using the private motorised vehicle as the only options on travelling. By employing all indicators on Transjakarta, it will show which indicators have been successfully achieved and which indicators that need improvement in the future.

B. Interrogating and Analysing the Indicators for Tipping Point

TABLE II. INTERROGATION ON TIPPING POINT INDICATORS TOWARDS TRANSJAKARTA

No	Indicators	Implementations on Transjakarta
1	Dedicated segregated busways	Since its initial project in 2004, most corridor of Transjakarta is situated on dedicated lines, separated from the mixed traffic. The newest line is constructed as fully elevated line. But on some part of the road such as intersection or roundabout, it merges with the traffic
2	Integrated network of routes and corridors	Some stations are designated as the central station where a lot of corridor meets, ensuring the integrated services within the system.
3	Rapid boarding and alighting	It provides elevated platform for the convenient boarding and alighting [19], but due to its undersized infrastructure, the service is easily down to the overcrowding [21]

No	Indicators	Implementations on Transjakarta
4	Clean, secure, and comfortable stations and terminals	All of the stations and terminal are in adequate condition, mostly on the transit stations. But on the field observation, there are still long queues, probably due to the design that caused in inefficient passenger loading [21]. But the supporting infrastructure such as pedestrian way, in some places, does not provided appropriately.
5	Efficient pre-board fare collection	All main corridor requires pre-board fare collection through the ticketing gate.
6	Universal design attributes providing access for all	Many stations did not have proper universal design. For example, some BRT stations are using stairs as the only access to and from the pedestrian way.

VI. RECOMMENDATIONS

Based on the analysis conducted on chapter 5, Transjakarta's effort to formulate tipping point regulations for creating modal shift still requires improvement on many aspects. In general, there have to be an appropriate approach if the government fully committed to public transport provision. Below are recommendations for Transjakarta based on the analysis results that classified into several aspects. BRT stations need to be expanded to accommodate the boarding, alighting, and transferring passengers. The plan of 600.000 daily passengers cannot be met if the today's infrastructure provision for 370.000 daily passengers is still in poor performance. Besides, the universal design must be implemented in at least all of BRT station's infrastructure (for example, lift, ramp, and all wheelchair-friendly infrastructure). Provision of proper, connected, and durable pedestrian way network across the capital must be implemented to increase walking trips and feeder service usage so it will affect the daily ridership of BRT corridor as well. The biggest obstacles to the public transport provision in the middle of rapid motorisation rate are how to create a modal shift towards public transport. On the beginning of the Transjakarta operation, a study revealed that the modal shifting is dominated by people previously using the existing city bus (67 percent), meanwhile, the modal shifting from the private motorised vehicle only counts as many as 20 percent [19]. If providing public transport system is the government's priority to ease the traffic problem, the government should run stricter policies regarding the private motorised vehicle, such as rationing new car, prohibiting on-street parking, building park-and-ride facilities close to the transit hub, pedestrianizing street, and more progressive tax for car ownership. The transit-oriented development plan that mainly focused on the mixed-use high-density development close to the transit hub should also concern the low-middle income class, so all mode of transport can be reached easily by all income class to create an equal and sustainable policy.

VII. CONCLUSIONS

Today's Transjakarta has been a great solution to tackle the traffic problem. However, with its recent fluctuating passengers' statistics despite its effort to expand the network, Transjakarta has to improve its service and doing more efforts to increase the ridership and encourage more modal shifting, based on the tipping point indicators. Reviewing the methodology, the literature review has been a major input on this paper, which helped the understanding of the author, mainly on the study of human behaviour and how it shapes our daily activities. Sets of statistics provided by the local government have been quite helpful, although, in another source, the data is quite sufficient to gather so the author requires other studies to confirm the data. The planning guide for the BRT system in the world appears to be confirmed as guidelines for the successful system. Applying the system in Transjakarta's plan and policies, helped by the local government, will help make Jakarta's transport provision to be more sustainable through the implementations of the tipping point indicators.

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