

## Workshop 7: Assessing the Wider Benefits of Public Transport Projects

### ***Benefits of being close to the urban rail transit networks? Empirical evidences from South Korea***

[Kwangwon Ahn, Hanwool Jang and Yena Song](#)

Urban rail transit is often developed in densely developed metropolitan areas within which enough potential passengers exist. Once it is constructed, it provides mobility to passengers and improves local accessibility to various destinations inducing economic, social and health impacts. At the same time, well-functioning transit system can reduce the negativities of current urban transportation systems such as pollution and traffic jams.

This study aims to examine the economic benefits of the urban rail transit networks in metropolitan areas among various and wide effects occurred from the provision of transit networks. It is normally accepted that people appreciate better transportation accessibility and the rail transit system offers reliable mobility and accessibility to those locating nearby areas. In modern capitalist society, such appreciation is often reflected in prices of goods where applicable. Therefore, it can be reasonably inferred that the real estate assets nearby the urban rail transit networks are more expensive than those far away from them.

We look into the associations between the actual transaction prices of condominium and the access to rail transit networks in four metropolitan areas in South Korea. Because condominium is the most dominant housing type in South Korea, it can be a good proxy for housing prices. In fact, over 50% of households in metropolitan areas reside in condominiums. The case study sites are chosen under two criteria, existence of the urban rail transit system and independence to the Greater Seoul's transit system. This issue has been extensively investigated in Seoul metropolitan area providing strong evidences of positive economic effects of the urban rail transit system. However, our study sites, relatively small metropolitan areas with different levels of maturity of the rail transit system, have not been studied very well and therefore no consistent or concrete evidences of economic effects can be found. We analyse one-year transaction data for each metropolis employing the traditional hedonic analysis framework. In the modelling process factors known to have close relationship with housing prices are integrated along with the rail transit accessibility. Also, in order to effectively deal with the spatial patterns, spatially lagged models are developed and compared to the traditional ones. The results, based on one-year actual transaction data, address whether the expected positive effects can be found or not and what factors are closely associated with the condominium prices. From those, we can enhance our understanding on the economic effects of public transit systems in relatively small metropolitan areas with less complex rail transit systems.

### ***How are residential property values affected by the announcement, building and operation of transport projects? A case study of three transport projects in Sydney, Australia***

[Camila Balbontin and Corinne Mulley](#)

New public transport projects are expensive and long lived and their funding provides challenges for governments all over the world. This has led to an interest in the effect of new transport projects on residential properties as a potential source of funding. The way in which residential property price rises - or value uplift - can be attributed to the overall effect of having better access to public transport. However, understanding when and by how much value uplift occurs is a pre-requisite to 'capturing' this uplift. This study focusses on understanding the complexity of value uplift of public transport projects in Sydney, Australia.

This study uses data of residential property sales in Sydney for years 2006, 2011 and 2016 to analyse one heavy rail and two light rail projects. One project is already operating in Sydney, but the other two are under construction. The 2006 data is used to represent the "before" situation when none of the projects had been announced with the other years representing different stages of the project development. The modelling aims to identify differences in value uplift due to the announcement of a project, the start of the building process, and the start of the operation.

We will estimate two types of models to identify when and how much value uplift occurs: difference-in-difference models and a multilevel regression model. The main difference between these two models is that the latter considers an error term that varies across different areas (but it is the same between the houses in the same area). Both modelling approaches are quasi experimental, comparing a 'treatment' area with a 'control' area: the former relates to properties with enhanced accessibility as a result of the new public transport infrastructure whereas the latter are not so affected. Along with the two different methods, two different methods are used to identify 'control' areas. The first considers fixed distances around the new stations of the public transport infrastructure with control areas simply being further away. The second approach is referred to as Propensity Score Matching (Billings, 2011) and estimates a model to identify the

control area. In all models, interaction effects are incorporated to see if, for example, houses that did not have any train station within 600m have a larger price increase than the ones that did.

Preliminary results have shown a significant difference between houses and apartments. Also, as one of the light rail projects includes the CBD area in Sydney it has been possible to identify that the CBD exhibits different behaviour from other areas. The paper will discuss possible reasons for this difference and the other results presented.

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### ***Railway Network Design and Regional Labour Markets in Sweden***

Rosalia Camporeale, Erik Johansson and Carl-William Palmqvist

Investment in railways – and transport infrastructure in general - are often motivated because they are believed to improve peoples' accessibility to jobs. By linking together and increasing the size of labour markets, the matching between individuals and jobs is improved, and productivity increases. Communities and municipalities lobby for investments that lead to higher accessibility, and those that are successful often see inflows of people as a consequence.

This paper combines two large datasets in a novel way, to quantify accessibility and connectivity via the railway network throughout Sweden, and their longitudinal effects (from 2011 to 2014) with regard to local and regional labour markets. The first dataset, Lupp from the Swedish Transport Administration, covers all train movements in Sweden, approximately 30 million per year, in detail. The other one, the Longitudinal integration database for health insurance and labour market studies (LISA), holds micro-data (annual registers) in Sweden, with employment status, income, home address, place of work, etc. for all individuals 16 years of age and older.

The rail data from Lupp are needed to identify all trips that are possible to make within one hour and at most two interchanges, during the morning rush hours on all working days. This creates a matrix of all feasible origin and destination pairs for commuters using railways and provides a measure of the accessibility from each station. From one year to another, an alteration in the railway network design (such as the addition of new stations, timetable changes, etc.) may have substantial impacts on the accessibility. For instance, between 2011 and 2012, the towns Oxie and Svedala, near Malmö, saw their levels of service more than doubled. Such improvements are likely to make these towns more attractive for people to live in, and to increase the number of jobs accessible to their inhabitants.

The administrative data from LISA are used for two main purposes. The first is to estimate the number of jobs close to different stations. As some stations are surrounded by more job opportunities than others, being able to access those stations is relatively more important than reaching other stations. In other words, it is not the number of stations that one can reach, per se, that is important, but what is on offer near those stations. The second purpose is to identify any changes in commuting behaviour, employment status, labour income levels, and relocation to and from communities, associated with the changes in accessibility by rail. In this way, we can measure some of the wider impacts of railway projects and network design, with a focus on their related distributional effects on the different segments of the population.

The method developed in this paper builds on Thredbo 15 (workshop 6), which identified a need for more longitudinal studies. We hope that the results can be communicated to planners and assist them in assessing and predicting effects of future railway measures – if they can help in closing social equity gaps or contribute to exacerbating them.

### ***Valuing Public Transport Customer Experience Infrastructure – a World Review of Methods & Application***

Graham Currie and Nicholas Fournier

One of the most significant contemporary trends in public transport systems internationally has been the refocussing of planning and operations on improving the customer experience. This has been matched by the work of transport economists who have been advancing the field of economic appraisals using willingness to pay methodologies to place a value on customer experience infrastructure so as to better

represent customer valuation of these amenities in project evaluation. This paper provides an international review of this field by reporting on a major international research program on this topic. The first phase of the program assembled the results of over 500 valuations to assess the general range and values for a range of amenity infrastructure including Information, Environment, Access, Customer Facilities and Security amenities. Values were normalised between currencies of the countries where they were measured and adjusted to create present value estimates. The second phase of the program sought to understand authority practices in using customer experience infrastructure valuations in practice using a survey of 12 cities in Australia, Europe, North America and Asia. This established patterns of use by breadth of modes evaluated, types of methods used and the degree of sophistication which valuations were undertaken. The third and final phase of the research program involved an international expert Delphi survey of researchers and practitioners involved in measuring values of customer experience infrastructure. The main focus of the expert survey was problems and issues in measurement methods and best practices in approaches to measurement. The paper presents an overview of all the phases of the research program and provides a view on best practices for industry in providing methods and estimates for valuing customer amenities in public transport into the future.

### ***Women on wheels: mobility through motorcycle in Brazilian rural areas***

Jessica de Lima and Maria Leonor Maia

Promoting mobility in rural areas is challenging in every country. In developing countries, such as Brazil, this challenge can be even greater. Until recently mobility in Brazilian rural areas depended essentially on precarious and mostly illegal public transport. In Latin American countries, women earn a fraction of men income, and thus tend to have less access to more expensive modes of transport, such as the automobile. Recently, government programs enabling access to motorcycles have changed this scenario. Although two wheelers are today the main vehicles in many regions of Brazil, little research has been conducted on the subject, especially regarding mobility and accessibility issues. This paper aims to understand the mobility and accessibility patterns and needs from women who live in rural and peripheral cities of the Northeast of Brazil, and commute by motorcycle. Four focus groups of five to eight women were conducted: women who drive motorcycles in the main urban area, women who drive motorcycles in a rural area, adolescents who use motorcycles and women who daily commute by motorcycle taxis. The groups were conducted in May 2018, in the city of Arapiraca, a city with 56% of the fleet composed by two wheelers. Results show that the fear of crime, specially rape, was very present. The fear of crime was more relevant than the fear of being involved in accidents. Fear of accidents was mainly reported as fear of bigger vehicles in roadways and fear of dogs. Most women started driving without a license and carried children younger than seven years with them. In general, the 'caring role' was very present in those women's lives. Our aim is to shed some light on the issue of motorcycle mobility in rural areas in the context of a wider set of policy discussions about how to protect the livelihoods and wellbeing these populations with a special regard to gendered issues.

### ***Using mobile network data to estimate social equity in infrastructure investments***

Richard Ellison and Adrian Ellison

Recently some attention has been given to the application of social equity and social exclusion in the appraisal of wider benefits (and disbenefits) of transport policies and investments.

However, the evaluation of the likely impacts of transport investments on social equity and social exclusion has been difficult to quantify and as a result often of limited scope.

Although to some extent it is possible to model social equity using existing household travel surveys, these have historically had relatively low participation rates from low socio-economic and other households typically of interest in analyses of social equity.

Furthermore, some of the key measures of social equity (and social exclusion) have been those that require longitudinal data of the sort that is rare among both household travel surveys and other surveys more generally.

However, the widespread prevalence of mobile telephones among most sections of the population, including disadvantaged households, provides the possibility of addressing some of these limitations in a more comprehensive manner.

This includes both a more cohesive measure of an individual's activities and travel to account for potential differences between social and economic equity, and the ability to identify subsets of the population who may

see a reduced risk in experiencing social exclusion as a result of investment in transport and infrastructure. It is also possible to extend this to look at specific transport nodes or activity centres to identify if specific locations may be more (or less) prone to potential issues of equity.

This paper uses data derived from over one year of mobile network traces and billions of observations per day to derive a set of measures of social equity in infrastructure investments using a method that is intended to be transferrable between locations and different contexts.

Some of the attributes that can be identified include both standard measures such as the trip rate and distance travelled, but also mode preferences, activity types and locations, frequency of visits to specific locations, and several measures of variability in travel patterns.

A set of illustrative examples are used from a variety of locations (both urban and rural) and from different countries in the Asia-Pacific Region.

The paper shows how mobile network traces, when processed appropriately, can provide measures with which social equity and social exclusion can be measured and then incorporated into the estimation of wider-economy (and social) impacts and then used within cost-benefit analyses.

The results confirm previous research that shows that the availability of transport infrastructure (and services) does have an effect on social exclusion, but also provide some evidence that social exclusion can involve a deferral of a trip or change to the destination or duration of activities.

The paper concludes by proposing some methods for incorporating these measures into estimates of wider benefits of transport infrastructure and cost-benefit analysis.

### ***Foreign influence and decision-making over megaprojects***

Lasse Gerrits, Sumet Ongkittikul and Nichamon Thongphat

Megaprojects concern those projects that require extraordinary financial investments, require considerable time to be planned, designed and executed, and that are generally considered to have a substantial impact on the environment. Although heavily criticized (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Flyvbjerg, Skamris Holm, & Buhl, 2005), governments worldwide are in fact increasingly engaging in such endeavours. Particularly the countries in South-East Asia, sound infrastructure is vital to their economic performance, as well as social coherence. Further, infrastructure development in this region also provides benefits to other nation states outside the region, such as China and Japan, regarding the increasing of their influence in an economically vital region.

Nonetheless, megaprojects are complex endeavours that are subject to many distorting influences. An undesirable situation emerges when front-end planning is scant, implementation phases and delays are long, cost increase, and benefits as well as revenue go down (Flyvbjerg, 2014). In the long run, such a decision-making process can be considered a failure. A state can increase its capacity to nurture such a project correctly, or to refrain from engaging with such a project if it deems the risks unacceptable. This capacity revolves around the four aspects mentioned above. However, the fact that state often develops megaprojects through the cooperation forms between a myriad of public and private actors (e.g. Beitsch & Lawther, 2015; van Marrewijk, Clegg, Pitsis, & Veenswijk, 2008) raises the question to what extent other states contribute to, or contravene, the capacity of the state to manage the decision-making over megaprojects properly. Also, the paper is interested in the driving forces behind the strategies of those foreign states and an in-depth investigation of a case study of transport infrastructure project in Thailand. The paper aims to analyse how to measure the influence of the foreign state in the decision-making process of states in South-East Asia on transport megaprojects, in general. This influence measurement will be focused on the change of each specific member state's objectives in four dimensions; goal, timeframe, procedures, and purpose business model. Furthermore, a case study will be selected at the implementation and monitoring phase of the transport infrastructure project management to see whether the project could be implemented or viability. A review of secondary data, as well as an in-depth interview with relevant stakeholder, are the main tool of the analysis. For influence measurement, first, the paper will review the decision-making process of the selected projects to see the goal and scope of the decision-making on each process, including regulatory and stakeholder involvement. Second, the paper will examine any potential influence occurred in which process and will consider whether it could change the state's decision in which dimension. Then, an in-depth investigation will be conducted to see whether the foreign state exerted the

occurred influence or not. Finally, a comparative study of different influence from a foreign state to each specific state capacity will be presented.

### ***The effect of public transport quality on car ownership – a source of wider benefits?***

Johan Holmgren

In many parts of the world, there is a continued demand for new infrastructure from policy makers and many projects are carried out despite appearing very undesirable for society, when analysed using the standard tools of cost benefit analysis (CBA). Often, the reason for ignoring the results of cost benefit analysis is said to be the existence of wider benefits, i.e. effects not accounted for by conventional cost – benefit analysis. From a theoretical perspective, such additional effects might very well exist, but the empirical knowledge of the conditions under which they can be expected to be significant is not clear.

It is worth noting that so far, the discussion on wider impacts has been focused on the effects of investments in infrastructure. However, in order to allocate resources efficiently it is also necessary to recognise that projects including other improvements (changes) in the transport system might also have wider impacts. Such projects might include increasing frequency and/or coverage in public transport or reducing fares.

It is well known that car ownership is one of the most important factors determining the demand for public transport. However, despite the fact that it is reasonable to argue that access to good public transport (low generalized cost of using public transport) would reduce the need and demand for owning a car there is, by far, less research done on this relationship. If there is such an effect, it would be a potential source of wider benefits (compared to what is included in CBA today) from improving the public transport system. Part of this effect would be in the form of increased long run demand (willingness to pay) for public transport since reduced car ownership would further increase demand beyond what is caused by the initial improvement in the public transport system. (Note that since this effect occurs in the primary market, it is not part of what is traditionally labelled “wider benefits” but since it might not be included in the standard CBA there is an argument for calling it that.) Additionally, wider benefits of investing in public transport might occur from the reduced demand for cars (if market for cars is not functioning perfectly) and from reduced car use (if the market for car use is not functioning perfectly, e.g. due to non-internalised external effects).

Therefore, the aim of this paper is to estimate the effect of public transport quality on car ownership and demonstrate how the presence of such a connection affects the full benefits (including what is sometimes called wider benefits) of investing in the public transport system.

To be able to capture this effect, the estimated model will, in addition to car ownership, include equations determining the demand and supply for public transport and how these are interrelated. The analysis will be carried out using yearly observations from 1986 to 2017 from 21 Swedish counties.

### ***Land characterized transit: Case of Kochi***

Angel Joseph and Dennis Jose

Public transport is a linked and interconnected system, the success of which largely depends on factors which are both ‘external’ and ‘internal’ to the system. The external factors being the land use, population density, employment density and the internal factors includes the quality and quantity of the service offered in terms of trips, frequency, fare, comfort, last mile connectivity and marketing. The system responds differently to these factors. The slight increase in the employment in central business district (CBD) along the transit corridor may produce better results compared to densification of households along the transit corridor. Disruption of services will reduce the reliability and lead to modal shift to aggregators or intermediate public transport, even when the fares are higher compared to public transport.

It is imperative to design a system which is harmonious with the city and its unique urban form. There is no one point solution of public transport for all cities and this indeed is a late realization when our cities are trying to build metros, even at tier three cities like Kochi and Lucknow. Even when the metro policy has mandated the need of public-private partnership in financing and alternative analysis as a must for the approval of metro to the cities, a question that still linkers is whether the metro a need of the hour for Indian cities. It is right to predict a greater population demand and need of public transport system in years to come, but when we ourselves admit of being weak in predicting the nature of growth it is always good to predict the

system that will sustain the present and future travel needs of people. An effective and strategic planning should be carried out considering the character of the city and the nature of commuters. Along with this, the system should be enhanced with environmentally efficient rolling stock, smart technology, incentives to passengers with reduced fare for travel, marketing and branding.

The study takes Kochi, a city in Kerala, India as the case for analysing the travel demand based on the land use character and design the optimum public transport mode. Kochi, the commercial capital of Kerala, is a rising city with historical and cultural importance. It has also become a service sector hub with IT parks established in the city. The cities in Kerala have meagre distinguishable lines between the city and villages. The land use character varies along the distance from the city centre and thus the need for travel to work and allied activities. Even with a fairly good economic base the people largely depend on public transport system for the daily commute. The character of the city is such that it has medium density settlements at two to three-kilometre distance. The study analyses the nature of commute based on the adhering land use and determines the travel demand based on the concept of route PHPDT to further design the system critical for the city of Kochi.

### ***Interpretations of Downs-Thomson Paradox with Median Bus Lane Operations***

[Donggyun Ku, Jooyoung Kim, Seungjae Lee and Sungyong Na](#)

Travel costs incurred from traffic congestion can be social costs to impact all the travellers of using private cars and public transport altogether. Policies of relieving traffic congestion in order to decrease total trip cost are commonly road capacity enhancement policies, which build roads or expand road lanes. However, capacity enhancement policies can increase paradoxically total travel costs by giving false signals to encourage to use cars rather than public transport, which lead to modal change towards cars from public transport. This phenomenon is called Downs-Thomson paradox. Downs-Thomson paradox means the bi-modal equilibrium between car and public transport users in terms of trip costs of each mode. Since 2004, Seoul city has been implementing public transport-oriented policies using median bus lane operations. It has operated total 121.1km in Seoul, including median bus lane. Median bus lane operation is a policy of relieving traffic congestion that reduces the total trip cost by allocating and prioritizing road capacities to buses in the traffic network, thereby encouraging public transport and limiting private car trips.

The purpose of this study is to analyse and interpret Downs-Thomson paradox by examining the change of the total trip costs in transport networks before and after operating median bus lanes. Furthermore, the purpose of this study is also to investigate the equilibrium of each mode claimed by Thomson, which means travel speeds of public transport and travel speeds of private vehicles maintains states of equilibrium, by transit priority policies. Interpretation of Downs-Thomson paradox by comparing total trip costs is separated in three steps. First, determine influence areas by operating median bus lanes in which we expected to result in traffic volume changes due to median bus lane operations. Second, this analysis includes the bus speed, the number of passengers, the speed of private vehicles and the traffic volumes before operations. In addition, it includes the bus speeds and the number of passengers inside median bus lanes and the speed of private vehicles and the traffic volume outside median bus lanes after operations. At this time, analysing of speed and traffic volumes are four links inside influence areas including operation route, and the speed data of private vehicles use the taxi DTG data to analyse the speed of each link. Taxis operates outside median bus lanes like private vehicles, and Taxi DTG data has strength to check travel speeds in each link without establishing loop detectors by using GPS. Finally, it includes investigating the equilibrium of each mode and analysis effects of transit priority policies based on comparing analysis of total trip costs. This research can lead to see if transit priority policies which reduce allocated capacities of private vehicles can help policies of relieving traffic congestion by showing Downs-Thomson paradox of total trip costs comparing of median bus lanes.

### ***Policy roadmap to prevent social exclusion of ageing population caused by limited accessibility***

[Rosario Macario](#)

Good health, quality of life and independence are fundamental values for the life of the individual. Mobility is characterized by the capacity to travel by all modes of transport, including walking, cycling, driving his own vehicle or use the public transport. The integration of good conditions of mobility and resulting accessibility are crucial for the ageing segment of the population because it will provide easy and convenient access to desired services.

One of the causes for the deterioration of the elderly lifestyle is likely to be related to the decrease of mobility, in other words, difficulty in using satisfactory transport alternatives to access services. Citizens' ageing process leads to an increase difficulty to access resources, and experience declining quality of life, resulting often in serious problems of social exclusion. The growing number of the population aged over 65 is a cause for concern in many parts of the world, but very specifically in Europe where it represents a change of scale in an old problem. Some years ago, this would be an issue addressing minorities but now it faces a very significant part of the population and in future might represent a majority in some EU countries.

Directed to countries around the world and international organizations, the United Nations Population Fund (UNFPA, 2012) and HelpAge International in its report of 2012 "Ageing in the Twenty-First Century: the Celebration and Challenge" called for the sensitivity and the importance in relation to global ageing, defending urgent progress at the level of policies to enhance the quality of life of elder population. From the relatively reduced number of studies addressing this issue it is obvious that the link between health, social exclusion and mobility in the ageing segment of population has been neglected. This work aims to offer an in-depth analysis of the problem and develop a roadmap for policy action to address it and assess the institutional and business model implications for the provision of transport.

### ***The Johannesburg BRT negotiated contract: How has it benefited the stakeholders?***

[Tatenda Mbara and Ben Maseko](#)

In August 2009, the City of Johannesburg in South Africa introduced the Bus Rapid Transit (BRT), locally (known as Rea Vaya) through a negotiated contract. The BRT system was envisaged to contribute to economic growth, poverty alleviation, sustainable development and good governance. In order to reduce the resistance to the project, the City of Johannesburg negotiated with the minibus taxi operators who were operating on the route corridors that were earmarked for the BRT. The negotiations, which were protracted, culminated into the displacement of about 900 minibus vehicles and the creation of two operating companies on two route corridors. The mechanism used was to negotiate with the minibus taxi operators and pay for their participation and for the surrendering of vehicles and operating licenses to make way for the BRT system. It is nearly nine years now since the BRT system was implemented in the City. The objective of this paper is to assess how the stakeholders have benefited from the implementation of the BRT. The key stakeholders are the City of Johannesburg, taxi operators and drivers. A mixed-method research paradigm will be used. Quantitative data will be collected from operators and drivers concerning the changes that have occurred to their management skills and welfare as a result of the implementation of the BRT project. Structured/unstructured questionnaires will be used to obtain qualitative data from the City of Johannesburg and representatives of taxi associations. The qualitative information will be valuable in cross-checking the data obtained from operators. The study, which is ongoing will be the first to assess the benefits that have been realised as a result of BRT implementation in Johannesburg. The findings will be of immense benefit to all the stakeholders' especially the City of Johannesburg as it intends to create new agreements and develop new BRT routes.

### ***Social Inclusion through Play: A New Methodology for Public Transport Planning in the Indian Context***

[Bharath Palavalli, Harsha Krishna, Srijan Sil and Anirudh Thimmaiah](#)

We present a methodology to address two critical gaps in transport planning: including marginalised communities in the transport planning process and creating plans that are responsive to their needs. This methodology makes use of gaming simulations whose results are then used in an agent-based simulation to present trade-offs between various plans and scenarios under consideration offering planners a low-cost risk-free context to plan for different scenarios by examining trade-offs, thereby increasing their capacity to plan for increasingly diverse demand conditions making the plans more inclusive and responsive. Finally, using this approach we propose a trade-offs based framework as an alternative to the traditional Cost-Benefit Analysis (CBA) assessment for evaluating the wide-ranging socio-economic benefits of public transport systems.

The Indian context is characterised by three features: supply paucity (infrastructure), affordability and accessibility (diversity of needs), and rapid changes in conditions (increased private vehicle use, co-existence of multiple technologies, and deployment of mass transit and increased infrastructure for private

transport use). In a context where there is a large power differential between planners and those affected by the plans, such as the Indian context, participation does not translate into inclusion always. Therefore, planning approaches in the Indian context require a way to include the needs of marginalised communities, as well as 'play' with different scenarios that allow combining tangible data and intangible data, such as needs, preferences, and priorities to test trade-offs.

'Transport Trilemma', a game-based tool for public transport planners developed by Fields of View offers an alternative approach to planning and assessment. This gaming simulation is based on a model that incorporates all data that conventional methods rely on and also allows planners to 'play with' intangible data such as needs, preferences and priorities that conventional methods fail to capture. The collected results and strategies in the game are used in an agent-based simulation to understand these trade-offs. Planners can experiment with different choices, explore alternative planning scenarios, and consider different trade-offs through the agent-based model. Finally, this combination of methods also provides a low-cost and risk-free environment to test new strategies for planners.

We will elaborate on how the transport needs of women who work in garment factories in Bangalore who depend on the public transport provider BMTC (Bangalore Metropolitan Transport Corporation, the government-run public bus transportation system in Bangalore) for their mobility in Bangalore could be incorporated into the planning process using the gaming-simulation based approach. We will demonstrate how game-based planning tools such as 'Transport Trilemma' can be used as a participatory mechanism to elicit and model nuances in transport demand and generate multifarious context-specific planning scenarios based on diverse stakeholder engagement. Using this approach, we will show how the trade-offs framework can be used as an alternative to CBA for identifying and assessing both tangible and intangible benefits of public transport systems to increase participation and social inclusion in public transportation.

### ***Wider Economic Impacts in Strategic Transport System Planning and Policy Making - The Case of Impact Assessment in Finland***

[Niko-Matti Ronikonmäki](#)

Economic impact assessment faces pressure to evolve and develop, also in Finland. Pressure is built by different stakeholders, which are lobbying for their own projects to compete for public funding. Also, politicians are actively yearning for a wider perspective for economic impacts in addition to the traditional cost-benefit analysis. Due to this, there is a major need to develop common methods in Finnish context, which help to identify wider impacts reliably and credible.

There are only few studies made related to wider economic impacts assessment in the Finnish context, e.g. Laakso et al. 2016. Theoretical framework is built on the urban and transport economics literature on wider economic impacts. Venables 2007 and 2016 have influenced in major way for the studies in Finland, why in the core of the wider economic impacts are the connections of transport market into labour markets, real estate markets and agglomeration.

At this stage, the first official instructions from the state-level authorities are under constructions. This work is a continuum for the earlier work and it aims to take control the wider economic impact assessment, which are partly a wild playground for different stakeholders. The perspective for the instructions will be on the wider perspective on the economic impact assessment, rather than the traditional aim to include wider impacts into the traditional cost-benefit analysis. First application for the newly built instructions and its theoretical framework are currently underway for a major rail project proposal and I present results and implications from this paper proposal.

My aim in the paper is to introduce the current status of wider economic impact assessment in Finland and discuss its applicability in policy making and strategic transport system planning. As this paper is a case study, I will use constructive research method in order to find key issues related to institutional setting related to wider economic impact assessment in Finland. I will also recognize key development areas, which are necessary in order implement wider economic impact assessment broadly in transport sector.

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### ***The place of informal and community transport in future transport systems***

Janet Stanley

Land passenger transport is expected to undergo considerable change in the future. The necessity to respond to climate change, particulate and other pollutants, growing transport inequality, technological development and the population movement to urban centres, will influence this change. However, many governments around the world are unprepared to meet these challenges, with transport planning still largely dominated by business as usual car-based commuter travel, in many countries. This paper will consider a particular sector of public transport that has traditionally catered for those who do not have car availability. This sector covers active transport, community or paratransit and a growing informal sector in developed countries, and informal transport in developing countries. These forms of transport are already changing, such as the increasingly rare use of animal-based and human-powered transport in developing countries, while widening to include other forms of transport, such as motorcycles in Vietnam, mini-buses in Africa and place-based Total Transport options in UK and Europe. These changes reflect wide variation in safety, organisation, pollution and greenhouse gas outputs, and the degree to which they meet the needs of those at risk of social exclusion, in both urban and rural environments. The paper will look at the changing face of this often-overlooked transport sector, overviewing its place, role and viability in future anticipated transport systems.

### ***Economic Assessment of a Dynamic Autonomous Rapid Transit (DART) System for Singapore***

Shanshan Sun, Yiik Diew Wong and Andreas Rau

The advent and deployment of autonomous vehicles (AVs) is triggering disruptive opportunities and fresh challenges among user (consumer), operator and regulating agency in the public transport sector. An innovative public transport system by way of Dynamic Autonomous Road Transit (DART) is being developed in TUMCREATE which can bridge the gap straddling high-capacity urban rails and lesser-capacity but more pervasive bus services in Singapore. Operationally, DART comprises a platoon of AVs coupled into a road-train, with the number of AVs in each road-train configured for optimum capacity to match trunk-service as well as on-demand service. DART engenders a myriad of benefits which are being evaluated, with interim findings reported in this paper.

For user, a total mobility cost (TMC) model was applied to demonstrate a traveller's typical costs from an economic perspective. Therein, fare is assumed to be the same with existing bus system. An intercept survey was designed and administrated in Singapore in which 204 respondents were interviewed to state their preferences towards a trade-off between fare and time. A utility function was established by regarding individual's stated-preference as an indicative factor influenced by fare and time. An averaged value of S\$18 per hour was found as the value of time (VOT) based on Singapore's context. The DART system is shown to be able, on the average, to move faster (+47.5%) than conventional bus system. It can be assumed that DART benefits users with 67.8% less travelling time that is equivalent to S\$12.2/hour savings for each passenger. Taking consideration of the claimed in-vehicle activities, 35% of respondents asserted that they would do work-related activities which would further increase the overall economic benefits of DART system. For operator, a cost analysis was undertaken in comparing the total cost of ownership (TCO) between DART as compared to the conventional bus system. Therein, the acquisition cost of one unit of the DART module has been costed by Individual Mobility Vehicles & Services (IMVS) Group in TUMCREATE. Maintenance and operating costs including road tax cost, insurance cost, energy/fuel consumption cost and drivers' cost were estimated based on Singapore's context. Each module of DART is assumed to bear the same maintenance and operating cost as a single-decker electric bus module. Taking consideration of operational specifications, the DART system is justified to perform more efficiently than the current bus system in terms of annual operating days, average running speed and average running distance.

Lastly, the present study explores the potential opportunities of implementing AVs in Singapore and provides policy recommendations to improve AV applications as the next-generation transport.

## ***The impact of regional railways on social capital***

Kiyohito Utsunomiya

The wider social impacts of public transportation have been discussed in academia for decades, but policy makers as well as transport practitioners are still sceptical about the effects, especially of regional railways. This is because most people rely heavily upon cars in those areas and only a limited proportion of residents near train stations use them. While sufficient empirical studies have not been made to persuade them, many railway lines in developed countries have been in danger of closure and quite a few of them, so far, have actually closed down in line with the recommendation of cost benefit analysis. However, if social impacts had been taken into consideration, policy decisions would have been different in some cases. This paper therefore focuses on the impacts of regional railways on social capital to describe quantitative analyses based on our survey research of residents in communities along two regional railways, the Mariazell Railway and the Pinzgau Railway in Austria. Because the service levels of these two railways, including frequency, speed, vehicle comfort, and accessibility have greatly improved in recent years, we asked residents whether their daily trips and lifestyles or relationships with others have changed since the improvement of railway services in the form of multiple-choice questions. As a result, around 50 to 60 percent of respondents reported “some changes” in lifestyles and 30 percent in relationships respectively for both railway lines. These numbers are similar to my prior research carried out on the Toyama Light Rail in Japan. Furthermore, we analyse attributes of residents that replied positively to “change” using a logistic regression model. Although the results vary between the two cases, it is notable that retired or unemployed people significantly gave positive replies to “some changes” and “meet with relatives more often than before” for the Mariazell Railway, and that age is a significant positive variable that explains “meet with friends and acquaintances more often than before” for the Mariazell Railway and “meet with relatives more often than before” for the Pinzgau Railway. It should also be noted that car availability shows a significant negative sign to “expand new networks” for the Pinzgau Railway. These indicate that regional railways have considerable positive impacts on the social capital of residents along their lines and possibly reduce the risk of social exclusion of retired or unemployed people or people without cars in regional areas through the improvement of social capital.

## ***Property Value Assessment in Rio De Janeiro: The Effects of Transport Investments***

Edmilson Varejao

This research assesses the effects of public urban transportation investments on property prices. Our main research questions are: the recent Rio de Janeiro’s transport investments affected real estate prices? Is this effect related to the distance from the property to the station and/or the increased accessibility to the city? Are there differences between Subway and BRT stations regarding the effect on property prices? How to evaluate transport investments’ social benefits? We consider as real estate the home-sharing market (Airbnb) and the traditional market (rent and resale).

Our hypothesis is that opening a new transportation station increases access to the city for properties in their vicinity. The closer to the station, and the more accessibility to jobs and education the station offers, the more likely it is expected to be valued. In order to estimate the effects of the geographical distance between property to new station, we use a continuous treatment variable, comparing observed differences in neighbourhoods’ samples that receives the new transport infrastructure to observed differences in a control sample that does not. Alternatively, we adopt a quasi-experimental approach to determine control and treatment groups. This is done by using the variation in distances to stations across neighbourhoods and properties from before to after the opening of new stations.

The study uses geolocated micro-level data for the entire city of Rio de Janeiro. For accessibility, the research use geolocated timetables of Rio’s public transport organized in GTFS format to conduct a before-and-after comparison of Rio’s transport system to estimate the change in accessibility that resulted from the new station.

Our contributions for this literature are threefold: first, we assess together two types of service, Subway and BRT, which allows to take account on the difference of quality that each type provide, on the perspective of property prices. It is possible because both types of service were open almost at the same time in Rio. Our second main contribution is to test the impact of station accessibility to jobs and education on property prices. A growing number of transport agencies, particularly in North America and Europe, use similar accessibility analysis to compare the benefits of potential transportation investments and evaluate their social impacts.

The third contribution is being an empirical research on ex-post effects of transport improvements in a Latin

America city, particularly for transport infrastructure. There is lack of such empirical literature in development countries.

Our findings are related to at least two literatures. One is the body of work on transportation investments capitalization effects and transport in developing countries, especially in Brazil. The results may guide the debate on Land Value Capture (LVC) tax applied to transportation public investments.

A second broad literature is related to policy evaluation of transportation investments. There is lack of evidences in Latin America's cities, despite the recent rise in new projects. These results can provide important insights on what type of service one city might choose, subway or BRT. The accessibility parameter can be helpful to assess ex-ante and ex-post investment evaluations

### ***How do we evaluate public transport policy in developing country? Recent Development of Public Transport Policy in Malaysia and its evaluation***

Sotaro Yukawa, Sivapalan Selvadurai and Wan Fairuz Wan Chik

Malaysia, a country located north to Singapore, most motorized country in south-eastern Asia. Because of low fuel price, growing domestic automobile production and motor based urban planning, number of cars per 1000 population is now 350. Especially local cities, most people use private car in everyday life. Even the poor people, they do not live without motorcycle.

Motorized society is vulnerable to the problems of traffic congestion, fuel price increase and global climate change. It also brings urban sprawl, which situation made worse at an accelerated rate. Taking these factors into consideration, Malaysian government focusing on developing public transport system after 2000. Government conduct establish urban rail network and nationalized bus operator in Kuala Lumpur (Capital city). In local cities and rural areas, bus supported fund was established in 2011. In addition to these physical changes, government had implemented the reform plan of administrative agency. In 2010, they aggregated administrated agency related to public transport (LPTC: Land Public Transport Commission, in 2018, it is changed Land Public Transport Agency) which was scattered and reinforced authority in planning. Government reports that their policy is going to more meaningful direction than before.

But how do we evaluate these policies? As often happen with developing countries, statistical data is limited, and process of the policy formation is not so clear in Malaysia. Only fragmentally study focused on the institutional aspect of the public transport in Malaysia.

It is difficult to extricate from the problem. But we try to focus on the institutional aspect of the public transport policy there in the following way. Also, it is conceivable that the approach is useful to analysis public transport policy in Asian developing countries.

Firstly, we try to do a comparative analysis between South Eastern Asian countries. When compared with Thailand and Indonesia, Malaysia is the different in level of the decentralization or approvals of para-transit system. Among the 3 countries, regulatory system of the bus operation in Malaysia is the most accordance with Japan. And it takes significance in comparisons with Japanese system, too. We find both countries face same problems and policy reform in regulation and planning though accuracy and credibility are different. Secondly, we focus on the developmental process of the public transport policy by referring several transport studies and discussion of the parliament. Though we do not have a large variety of the materials, public transport policy of Malaysia is the accumulation of 50 years of experience though it makes limitations by path dependency.