

MUSPP Graduating Class of 2023
Master Research Project
A Compilation of Students' Posters





YOU'RE INVITED!

MUSPP Class of 2023 Master Research Project - an Afternoon Soirée

15 August, Tuesday @ 2PM



SUTD Campus Centre Level 2

PROGRAMME

2pm

Welcome by Programme Director & Coordinators
3-Minute Individual Project Presentations

3pm

Poster Session (with light refreshments)

3.45pm

Pedestrianizing the City - Group Presentations

4.45pm

Award Ceremony

Closing remarks by Professor Cheong Koon Hean,
Chair of the Lee Kuan Yew Centre for Innovative Cities
Celebration & Networking



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Public Space and Placemaking

4. Creating age-friendly public outdoor spaces in Singapore: Current developments and challenges by Liu Manyinyang
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Transportation Planning and Policy

7. Going the Extra Mile: Transport Equity and Healthcare Access for Seniors in Singapore by Alice Lee
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Environment, Food, and Society

11. Exploring nudges that increase trash reduction and recycling in Singapore by Tay Kexin
12. Meal preferences, habits and perceptions towards novel foods and 3D-printed foods among night shift workers in Singapore by Janice Young
13. De-conflicting a city in nature: Understanding human-wildlife encounters and perceptions in Singapore by Nikita Choudhary

Pedestrianizing the City Group Presentations

14. Placemaking for mobility in pedestrianised streets in the urban tropics: Singapore case study by Cristina Nearing, Hana Richelle Tang Tan, Amelia Tan Hui Shan
15. Overcoming barriers by businesses to road pedestrianisation by Koh Lip Wee, Ruth Poh, Wong Yi Jie

Contemporary Urban Challenges

White Sites:

Adaptive Physical Planning for Market-Driven Urban Transformation

Reinvent

White Zone

Area for mixed use development comprising commercial, hotel, residential, sports & recreational, and other compatible uses.



MASTER PLAN

- 1998** Govt land sales (conserved shophouses at China Square) Marina Bay
- 2003** SOHO, Medical Centre Mixed developments at regional centres, business parks, MRT stations
- 2008** Integrated Resorts Jurong Lake District
- 2014** Integrated public transport hub (NEX) Vertical Village for senior (Kampung Admiralty)
- 2019** Nil

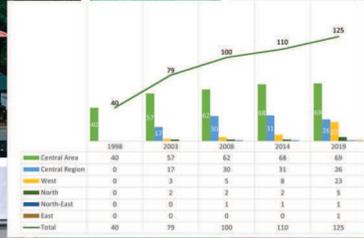
Reflect

Features of White Site

- New development areas
- Key transport hubs
- Central Business District, regional centres
- Preserved buildings
- Unique urban projects



Spatial & Temporal Distribution



Transit Oriented Development Principles

- High-density mixed development (GPR 8.6)
- Proximity to public transit hub (average monthly ridership of 829k passengers)
- Street connectivity (ave connectivity index of 1.6 within 400m)
- Ample green/ public space

Revolutionise

Adaptive physical planning in white sites could achieve policy outcomes:

- Champion public transport use to reduce carbon emissions and traffic congestion
- Elevate urban well-being and health through green connectivity



Master Plan of Jurong Lake District



What's Next?



MUSSP
Masters Research Project
Sarah Lim
Supervised by
Dr Jin Murakami

A Critical Review of the Impacts and Implications of Urban Redevelopment on Older Adults

By: Esther Chin

Project Advisor: Dr Felicity Chan

1. What are the **impacts** of urban redevelopment on older adults?
2. What are the **implications we can consider** if we want to **pursue ageing in place & urban redevelopment together**?

Ageing in Place | Urban Redevelopment



Gentrification

- Class inequality (-)
- Physical change in urban space: housing & built environment (+)
- 'Exchange' value over 'use' value (-)
- Displaced in place, improvements enjoyed by newcomers (-)

Relocation & Displacement

- Physical moving of people on either a voluntary or involuntary basis due to urban redevelopment plans (+/-)
- Magnitude of residential displacement (+/-)
- Different reactions, different degrees of reaction to changes (+/-)
- Communicating clearly the intent (+/-)
- Preparing older adults adequately for the transition; prior to, during & post transition (+/-)
- Reducing the hardship of an enforced move (+)

Health & Well-Being

- Changing dynamics of neighbourhood in localities with spatially differentiated socio-economic landscapes undergoing change (+/-)
- Frailty, cognitive & functional decline, impairment (-)
- Stressors & ways of coping (-)

Disruption of Social Ties

- Abrupt severance of ties, changes to social infrastructure (-)
- Risk of social stress, social exclusion, abandonment, even mortality (-)

Loss of Familiarity & Place Attachment

- Disoriented, loss of sense of belonging (+/-)
- Lack of feelings of happiness, control, agency, social connectedness (+/-)

Fit & Place Identity

- Regulate and re-negotiate meaning of place & feelings (+/-)
- Role in neighbourhood & sense of dignity (+/-)
- Independence to pursue daily activities, confidence in fulfilling aspirations (+/-)

Enabling Older Adults to Age in Place

- Mitigating discontinuities of place
- Encouraging dignity & autonomy in old age
- Developing supporting urban communities

Preparing a Nation for Meaningful and Successful Ageing

- Collective experimentation
- Embracing the human-centred design approach in design, policy and planning



Unleashing Urban Ingenuity: Exploring Resourcefulness in Jakarta's Urban Dysfunction

Angga Yudhiyansyah
Master of Science in Urban Science, Policy and Planning (MUSPP) Class Of 2023

Background

Tanah Merah, nestled on the fringes of North Jakarta, stands as a microcosm of urban fragmentation and administrative ambiguity. Its residents grapple with uncertain legal residency statuses. This predicament results in restricted access to essential services and inadequate infrastructure.

This study delves into the strategies employed by Tanah Merah's community members, exploring how they've harnessed scarce resources as a consequence of legal ambiguity, and create their own adaptive urban governance

Urban Fragmentation and Legal Ambiguity

Tanah Merah has been characterized by a legal dispute involving Pertamina, the state-owned oil company. This contention arose from the installation of a Pertamina oil depot in the vicinity during the early 1970s. Consequently, the oil depot's presence has engendered ongoing conflicts concerning land ownership, leading to a state of legal ambiguity for the residents. These legal uncertainties have further repercussions, as the government has refrained from providing access to basic services due to their perceived violation of official regulations of land titling.



Jakarta's urban sprawl. Source: Westend61de



The condition of legal uncertainty in Tanah Merah not only hinders effective urban governance but also presents obstacles to the implementation of development initiatives and equitable resource distribution. This contributes to a fragmented and unequal provision of services within the community.



A view of the Pertamina depot from the swamps of Tanah Merah village. Source: Rafael Martinez/LKYIC

Community Driven Urban Governance



The revitalisation of the Perjuangan Road was financed through tolls collected from passing vehicles. Source: Kompas.com



The leaders of Neighbourhood Units took the initiative to offer clean water, ensuring that residents can access safe drinking water. Source: Kompas.com

- **Emergence of Neighbourhood Associations and Community Units:** Facing administrative uncertainties and service gaps, Tanah Merah residents have established shadow Neighbourhood Associations (RT) and Community Units (RW). These administrative bodies facilitate local decision-making.
- **Alternative Decision-Making Structures:** These associations have introduced innovative decision-making processes that involve active participation from all community members. Through regular meetings and consultations, residents collectively decide on issues such as infrastructure development, waste management, and community events.
- **Resource Mobilization:** They have adopted innovative resource mobilization methods, such as implementing gate levies on vehicles passing through. These funds support community projects, infrastructure upkeep, and social welfare initiatives.
- **Collaboration with Local Authorities:** The United Tanah Merah Communication Forum (FKTMB), a community-political entity, acts as a liaison between residents and local authorities.



A social media update shared by the United Tanah Merah Communication Forum announces the enforcement of a COVID-19 lockdown. These local measures were initiated prior to the official government recommendations. Source: FKTMB Twitter Post



A makeshift bridge connecting kampung Tanah Merah with its adjacent upscale Kelapa Gading housing complex. Source: Rafael Martinez/LKYIC

The informal governance in Jakarta's urban kampung arises as a direct consequence of the ambiguous residential status and government's gradual withdrawal from its traditional roles as service provider, revealing a significant deficiency in its ability to deliver adequate urban services. This withdrawal exacerbates the existing duality in land titling, further leading to a skewed pattern of development, contributing to the emergence of an uneven urban service provision.

Public Space and Placemaking

Creating Age-friendly Public Outdoor Spaces in Singapore: Current Development and Challenge

MUSPP Masters Research Project
Liu Manyinyang 1007350

Introduction

The aging population has introduced numerous challenges to urban development, leading lots of cities to implement measures such as creating age-friendly public outdoor spaces (POS), in order to tackle these issues. This study uses Therapeutic Gardens in Singapore as a representative case to delve into the practices of creating age-friendly POS. Its aim is to gain insights into areas that could be enhanced and offer recommendations for future developments in this domain.

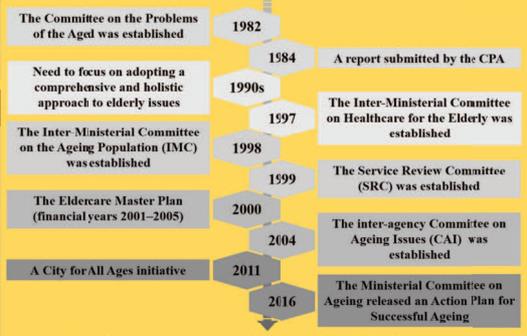
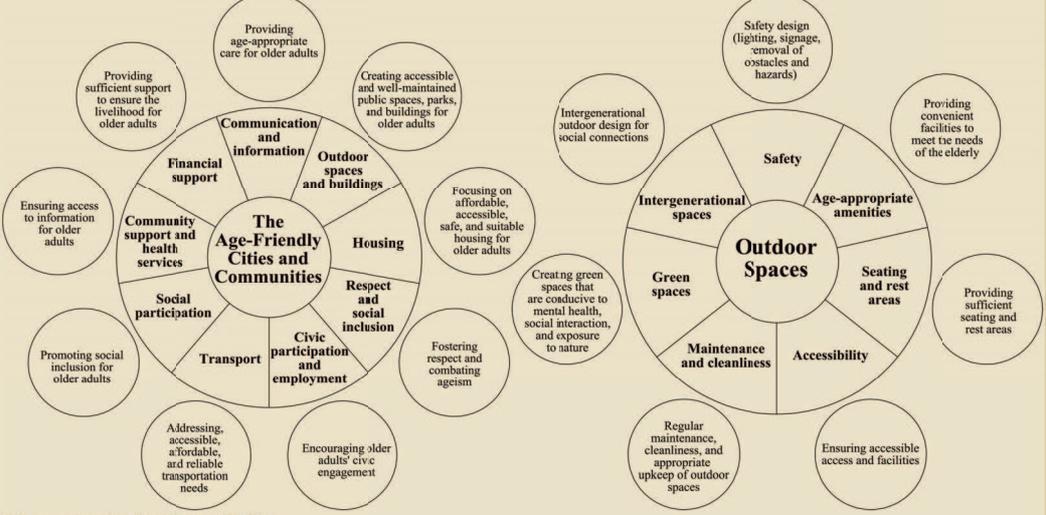
Research Methods

- Case study**
Select representative therapeutic gardens in Singapore for observation and research, collect information on the space, and check whether it meets the needs of users and whether there are challenges.
- Surveillance and observational study**
To examine the behaviors within age-friendly POS, this study employed a non-structural, observation-based monitoring approach.

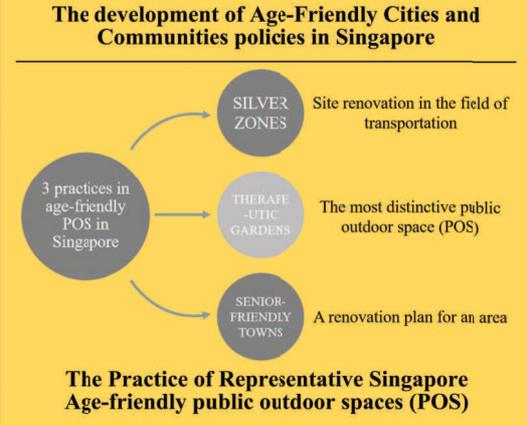
Research Questions

- How is the current research on age-friendly POS?
- What is the status and development level of age-friendly construction in public outdoor spaces in Singapore?
- How can we further improve Singapore's elderly-friendly infrastructure on the existing foundation and contribute to Singapore's proactive approach to addressing the challenges of aging?
- How can we derive recommendations for creating elderly-friendly infrastructure from Singapore's example, and how can we effectively tackle potential challenges and extend these ideas to benefit other cities or countries?

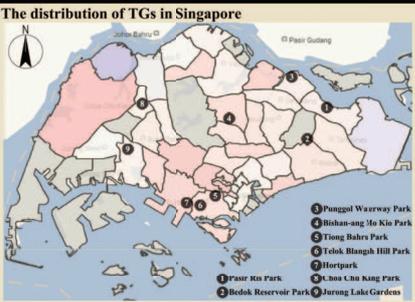
Literature Review



Therapeutic Gardens (TG):
TG are intentionally designed to create a profoundly nourishing environment that offers individuals a secure and comfortable setting. TG promote autonomy and sensory stimulation, presenting an economically viable, non-pharmaceutical approach to enhance the quality of life for individuals requiring such accommodations.



Results



TG in HortPark	TG in Choa Chu Kang Park	TG in Tiong Bahru Park	TG in Bedok Reservoir Park	TG in Pasir Ris Park	TG in Punggol Waterway Park
11 Jul	10 Jul	13 Jul	18 Jul	19 Jul	20 Jul
8 Aug	14 Aug	10 Aug	23 Aug	23 Aug	24 Aug
12 Sep	11 Sep	14 Sep	20 Sep	20 Sep	21 Sep
10 Oct	9 Oct	12 Oct	18 Oct	18 Oct	19 Oct
14 Nov	20 Nov	9 Nov	22 Nov	22 Nov	23 Nov
12 Dec	11 Dec	14 Dec	20 Dec	20 Dec	21 Dec

According to the information on NParks' official website, there are a total of 9 Therapeutic Gardens in Singapore.

- Summary of Results:**
- High site quality.
 - Relationship between Activity Crowds and Venue Location.
 - Limited Cross-Age Communication.
 - Limited Activities within the TG.
 - Observed TG users have good physical health, but no users with poor physical health have been observed, and it is not possible to determine the user's mental health.

Conclusion

Summary:
The primary challenge encountered by age-friendly POS has transitioned from a deficiency in physical infrastructure to a scarcity of social engagements and intergenerational interactions. Therefore, the emphasis of research and practical efforts must shift to address this concealed concern.

Recommendations:

- Robust political backing, ample economic assistance, and government-led collaborative efforts involving multiple parties.
- Prioritizing user needs to establish inclusive public outdoor areas.
- Enhancing the social environment and diminishing societal biases.
- Establishing a variety of universally embraced and accessible activities.
- Integrating local attributes to create distinctive zones, fostering a shared memory, unity, and a sense of belonging.
- Merging technology to extend the impact of age-friendly POS.



Placemaking in the Terrarium

Resident Perceptions of Public Housing Garden Spaces in Post-Pandemic Singapore

AUTHOR

Woo Ka Wai

MSc. in Urban Science, Policy and Planning Class of 2023

Under the Supervision of

Dr Jose Rafael Martinez Garcia



Fitness stations arranged linearly along the building orientation of Tampines Greenverge



Seating areas along walkway exposed to the units above at Tampines Greenverge

AS WE CONTINUE ELEVATING OUR CITY, WHAT DOES THE FUTURE OF PUBLIC SPACE IN HDB LOOK LIKE?

IS PLACEMAKING DICTATED BY PLANNERS OR DRIVEN BY INDIVIDUAL AGENCIES?



INTRODUCTION

Responding to density, **elevated public spaces** are becoming prominent features in developing new public housing estates in **Singapore**. How this evolving design affects the social dynamics of HDB parks and public spaces deserves an examination, especially potential **contradictions between planners' conceptions and users' perceptions of these spaces**.

TANGIBLES

Connection & Awareness

Elevation presented a notable disconnection from the daily corridor of activity that reduces users' awareness and willingness for deliberate usage.

Versatility & Fragmentation

Smaller scale and spatial layout limit the types of activity and appropriation by different users as facilities are perceived as singular in function and overly manicured.

Privacy & Observations

Intimate spaces must be coupled with visibility to observe the surroundings and not be isolated from the rest of other activities.



Children "invading" the fitness stations for their play in Tampines Central Park

OBJECTIVE & METHODOLOGY

Exploring the impact of elevation on perception and utilization, I study residents' experiences, focusing on environment decks and neighbourhood parks—representing elevated and at-grade park designs. Employing **structured observations**, **survey questionnaires**, and **in-depth interviews**, the data are analysed using **thematic analysis**.

INTANGIBLES

Ideals & Imagination

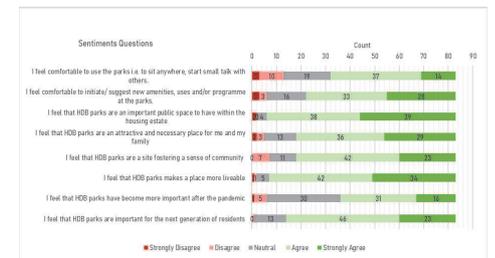
The preferences and ideals are influenced by nostalgia and experiences ingrained during formative years and mutate with each new encounter.

Pandemic & Influence

The pandemic imparted a new lens of viewing public space during this extraordinary time but did not fundamentally alter residents' perception.

Optimism & Indifference

Indifference is contradicted by optimism towards the importance and relevance of HDB parks and familiarity with the neighbourhood and happenings.



Collation of Sentiments Questions in the Survey Questionnaire

THE TERRARIUM

Plasticity

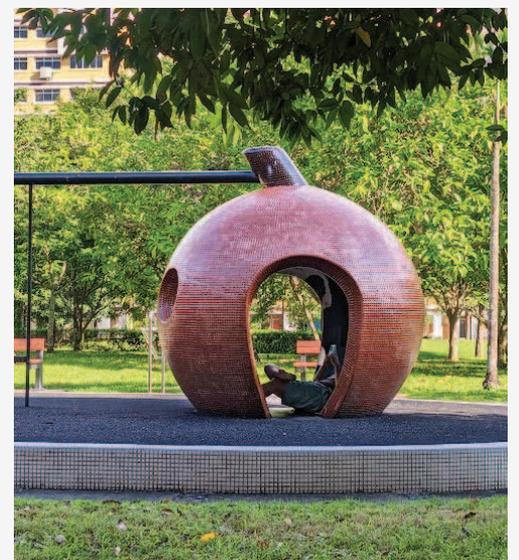
The inherent plasticity in shaping ideals imbues opportunities for experimentation of new typologies to create new experiences. It must consider beyond replicating desired architectural and spatial features with a deeper understanding of residents' reading.

New Form of Public Space

Physical presence and participation is not the only measure of public space success. Placemaking and community persist with individuals curating their level of involvement, empowered by new digital platforms. Space practitioners must acknowledge that placemaking exists on a spectrum influenced by individuals' agency.

Invisible Ownership

Ownership is practised through appropriation and co-existence. It is likewise exhibited through constant daily observations, familiarity with implicit norms and rules. These contribute to collective wisdom in an organised functioning public space unique to each HDB estate.



TAMPINES CENTRAL PARK
Man resting inside the mangosteen playground

NAVIGATING IDENTITY CORRIDORS: UNDERSTANDING USER TYPOLOGY AND SOCIAL CONCERNS ALONG THE RAIL CORRIDOR (CENTRAL)

Ysabelle Ho

Under the supervision of Dr Gordon Tan Kuo Siong
Master of Science in Urban Science, Policy and Planning, 2023



- 1) What is the typology of users along the Rail Corridor (Central)?
- 2) What social concerns may exist along the Rail Corridor (Central)?

BACKGROUND

The Rail Corridor's status as one of the five Identity Corridors in Singapore bears witness to its distinct character as a public greenway with a confluence of activities, including an abundance of recreational options, biodiversity and rich heritage. While diversity may make the space vibrant, the non-homogenous users and activities may cause social concerns to arise that may potentially lead to undesirable outcomes if not addressed.

Given the lack of research on the Rail Corridor after its reopening in 2021, this study first seeks to establish the profile of users along the Rail Corridor (Central). Subsequently, it analyses the social concerns of the users. This study focuses on the Rail Corridor (Central), or RCC, due to its centrality, accessibility and connectivity which leads to a higher expected footfall. (Fig. 1)

METHODOLOGY

A triangulation mixed method approach is adopted. Both methods sought to answer both research questions while reaching out to different user segments. Walkalong interviews provide a high level of detail and context, while being resource intensive. Surveys can reach out to a large audience to gather a mass perspective of users.

FINDINGS 1 - USER PROFILING FROM SURVEYS

a) **Access:** Most respondents accessed the Rail Corridor by foot (if living nearby) and by public transport. Only one-fifth of respondents use private transport due to limited parking options. Among survey respondents, access points near MRT nodes are most commonly chosen for both entry and exiting the Rail Corridor (Central).

b) **Motivation:** Most respondents are drawn to the Rail Corridor for recreation and for stress relief. Commuters are a minority. Main considerations are: Weather conditions, crowding and the schedules of their company (especially for those that come from afar).

c) **Usage patterns:** There is a mix of walkers, joggers, and cyclists, in this order. Usage is highest across all days in the early morning and evening, although usage in the late morning on weekends is also high. Users appear to avoid afternoons where it is hotter, consistent with how hot weather conditions discourage users in b). 16% of survey respondents are non-walkers, typically of a younger demographic.

FROM WALKALONG INTERVIEWS



Avid Adventurers

Engage in more than one form of activity
Use the RCC frequently, from a few times weekly to a few times daily
Typically stay nearby
May be solo/ in groups (families)



Neighbourhood naturewalkers

Engage in mainly walking as a discrete activity
Use the RCC frequently, daily/ a few times a week
Typically stay along the RCC
Usually solo



Weekend Wanderers

Engage in walking/ running as an exploratory activity
Use the RCC rarely, up to a few times a year
Typically stay far from the RCC
Usually in social groups of 2 or more

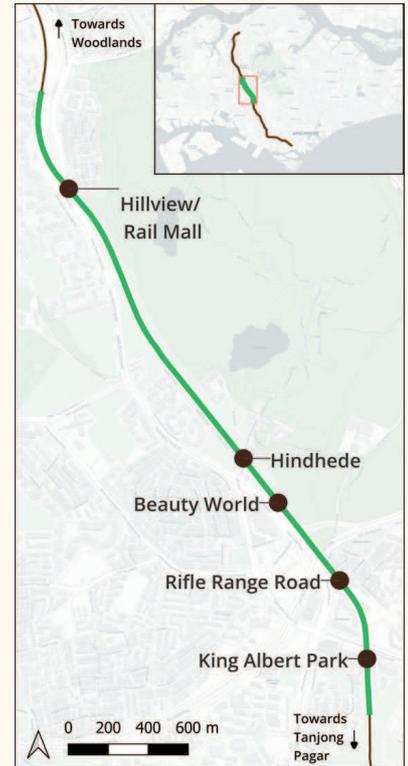


Figure 1: Map of Rail Corridor (Central) with key access points indicated (Data source: NParks)

FINDINGS 2 - SOCIAL CONCERNS

FROM THEMATIC ANALYSIS OF SURVEY AND INTERVIEW DATA

Reckless/speeding cyclists:
top concern by 1/3 of survey respondents includes speeding, not signalling, not dismounting and pushing (Fig. 2)

Crowds and congestion:
main deterring factor of usage among survey respondents while crowds are not preferred, many feel comfortable with some people around (Fig. 3)

Littering:
unpleasant; yet people do not seem to care enough

Man-introduced noise:
mixed opinions - noise pollution to some, music to others' ears. can serve as safety warning

What's next?

- Crowd management
- Parks as a place for top-down and bottom-up civic education
- Relegating some concerns to users to negotiate



Figure 2: Speed limit sign near Hindhede access point

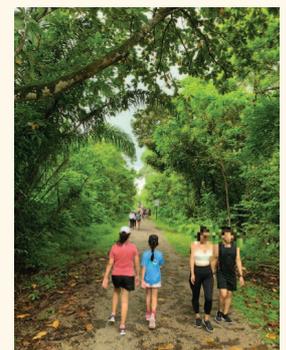


Figure 3: Rail Corridor weekend crowd

Transportation Planning and Policy

GOING THE EXTRA MILE:



Transport Equity and Healthcare Access for Seniors in Singapore

Alice S.H. Lee

Co-supervised by Lynette Cheah, Thi Anh Hong Nguyen



Promoting public transport (PT) access is vital for addressing social exclusion and facilitating a just transition towards low-carbon mobility. Research has shown that **increased travel time and costs and physical limitations in using PT can result in lower healthcare utilisation for seniors**. Using a **two-part mixed methods approach**, this study provides insights into **inequities faced by seniors who take PT to healthcare facilities**, thereby offering guidance for improving inclusivity of transport and healthcare systems.

1 Aims

ONE: Using freely available data, identify inequities faced by seniors in the ease of accessing healthcare services by **PT versus private vehicle (PV)** in terms of **relative travel times, costs, and walking distance from transit stops to healthcare facilities** in Singapore.

TWO: Using a walkability assessment, identify environmental barriers that seniors using PT might face when walking **from the nearest transit stop to healthcare facilities** in Singapore.

HOW LONG?
HOW MUCH?
HOW?



PART ONE: SPATIAL ANALYSIS

- Studied healthcare facilities**
- 8 Restructured Hospitals (RHs)
 - 9 Community Hospitals (CHs)
 - 23 Polyclinics
- Data sources**
- Google Distance Matrix API, LTA DataMall, physical on-site visits
- Data extraction**
- PT and PV travel times and costs from each subzone to healthcare facility
 - Walking times from nearest transit stop to each healthcare facility based on seniors' walking speed (58 metres/min)*

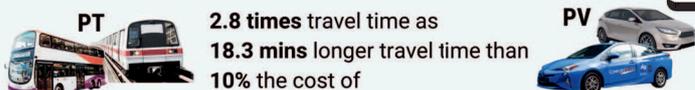
2 Methodology

PART TWO: WALKABILITY ASSESSMENT

Focus on **RHs**, which had the highest travel time and cost inequities in Part One. A **walkability study** of route segments from the **nearest transit stop to each RH's orthopedic clinic** was conducted by 3 researchers, on **3 dimensions** and **11 variables impacting seniors' walkability** based on research:

- Direct** Accessibility of bus stop in opposite direction | Obstacles | Level change between pavement and road | Stairs | Slopes | Wayfinding
- Safety** Protection from vehicular traffic | Pedestrian crossing quality
- Comfort** Pavement quality | Pavement width | Shelter/shade

1. Transport mode choice affects accessibility to healthcare facilities in terms of travel time and costs.



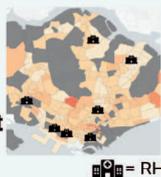
2. Extent of transport inequity depends on where seniors stay.

% of subzones within 20 minutes of travel time by:

to access a...	Public transport	Private vehicle
Restructured hospital	12.8%	91.1%
Community hospital	13.2%	91.1%
Polyclinic	37.6%	100%

Trips with highest travel time inequities, or PT/PV ratios, tend to be:

- In Central region (e.g., Outram, Bukit Timah, River Valley, Museum planning areas)
- Originate 1 - 2 subzones away from healthcare facility (see right figure)

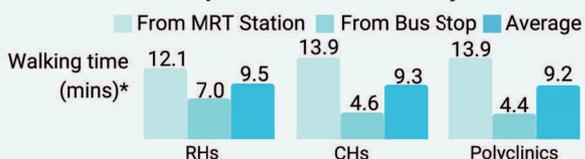


Trips with highest travel cost inequities, or PT/PV ratios, tend to:

- Have longer PT travel time*
- Originate 1 - 2 subzones away from healthcare facility

* attributable to cap of PT concessionary fares for seniors, at SG\$0.94 beyond 7.2km travelled, which is already lower than flag-down for taxis.

3. Seniors using PT walk significantly long distances from the nearest transit stop to a healthcare facility.



3 Findings

4. Key walkability barriers along routes from nearest MRT station/bus stop to RHs based on Walkability Assessment:

Lack of pictograms or staff to help illiterate seniors; low diversity of wayfinding locations causing signage to be easily missed (especially outdoor)



a) Wayfinding difficulties for seniors

Exposure to traffic along footpaths, posing risk to seniors who have decreased ability to detect and respond to traffic hazards



b) Safety risks for seniors

- Narrow paths; level changes between pavement and road; uneven pavements; lack of shelter/shade from weather elements
- Shuttle bus services available from MRT station for AH, CGH, KTPH were not always wheelchair-friendly or available from nearest bus stop

c) Accessibility issues for wheelchair users

Overall, the **FIRST** segment of the route from bus stop to every RH tends to score the **lowest** across walkability variables.

4 Conclusion

- Inequities exist between seniors with financial means** to take private vehicles, and **cost-sensitive seniors** who face more accessibility barriers due to taking public transport to access healthcare services.
- Future healthcare facilities** should consider proximity to transit stations or availability of disabled-friendly shuttle services, and eliminate walkability barriers for public transport users like insufficient wayfinding and shelter/shade.
- Study limitations** include potentially out-of-date data, unrepresentative healthcare trips and walking routes, differing perceptions with actual seniors for walkability assessment - attitudinal surveys of seniors might offer better insight.

Abstract

The study investigates **charging anxiety's** impact on **electric vehicle (EV)** adoption, recognizing it as a significant **psychological barrier**. It surveys **847 EV owners** in **Guangzhou** and **Taiyuan**, covering demographics, ownership details, charging preferences, and anxiety levels. Employing **SPSS** for rigorous analysis, the research uncovers intricate relationships between variables.

Findings reveal prevalent charging anxiety is common among EV owners. Notably, **familiarity** with EVs and extended **driving experience** correlate with heightened anxiety, while owning **multiple vehicles** and **private charging stations** alleviate it. **Longer daily driving distance** associate with **lower** anxiety levels, **defying the belief** that charging behavior, particularly state-of-charge management, substantially affects anxiety.

The study's practical implications stress the importance of addressing charging anxiety for EV market growth. **Policymakers, stakeholders,** and **manufacturers** can leverage insights to enhance charging infrastructure, promote private solutions, and optimize routines. Public awareness campaigns and incentives addressing EV range and charging convenience concerns are crucial.

In conclusion, the study **enriches EV adoption discourse** by examining **charging anxiety's impact on drivers.** By identifying influencers and proposing mitigation strategies, it contributes to a more focused approach towards sustainable electric mobility.

Research Questions

- To review the relevant **literature** and develop a **theoretical framework** for charging anxiety among electric vehicle owners.
- To identify potential underlying **factors** that contribute to charging anxiety.
- To distribute a **questionnaire** to find out the charging anxiety of electric vehicle owners.
- To **analyze** the data and makes possible recommendations to alleviate charging anxiety.

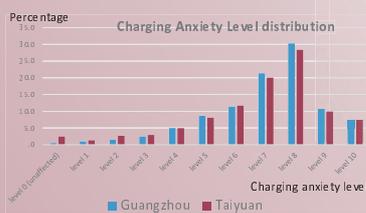
- A Survey-based assessment of -
Charging Anxiety among electric vehicle owners

Methodology

The study designs a questionnaire to explore charging anxiety, encompassing two dimensions. The **first part** gathers **demographic data**, while the **second** investigates **EV-related preferences and behaviors**, including vehicle ownership, familiarity with EVs, battery attributes, private charging stations, charging preferences, and driving distances. The **research sample** consists of **electric vehicle owners** from the cities of **Taiyuan** and **Guangzhou**. This selection is strategically made considering China's extensive geographical expanse, aiming to enhance the research's findings' generalizability. This study gather data through the distribution of an **online questionnaire** and subsequently analyzed the collected data using **SPSS**.

Results

The charging anxiety levels among electric vehicle owners in **Taiyuan** and **Guangzhou** exhibit a **remarkable similarity**, implying a consistent trend across these two cities. In both Taiyuan and Guangzhou, a substantial portion of respondents reported experiencing some form of charging anxiety. Notably, a considerable number of respondents fell **within the mid-range of the impact scale** (ranging from level 4 to level 8). This observation suggests that a notable portion of EV owners in **both cities encounter a moderate to moderately high level of charging anxiety.**



	Residence	Annual household income	Year of driving experience	Number of vehicles owned	Knowledge level of electric vehicles	Driving experience with electric vehicles	Whether to install private charging stations	Daily driving distance	SoC for charging electric vehicles	Charging Anxiety
Residence	Pearson Correlation 1									
Annual household income	Pearson Correlation -0.013	1								
Year of driving experience	Pearson Correlation -0.041	Pearson Correlation -0.080*	1							
Number of vehicles owned	Pearson Correlation -0.037	Pearson Correlation .148*	Pearson Correlation -.122*	1						
Knowledge level of electric vehicles	Pearson Correlation -0.023	Pearson Correlation .040	Pearson Correlation -.139*	Pearson Correlation -.119*	1					
Driving experience with electric vehicles	Pearson Correlation -0.003	Pearson Correlation .044	Pearson Correlation -.045	Pearson Correlation .242**	Pearson Correlation -.042	1				
Whether to install private charging stations	Pearson Correlation -0.032	Pearson Correlation .075*	Pearson Correlation -.216*	Pearson Correlation .342**	Pearson Correlation -.174*	Pearson Correlation .167*	1			
Daily driving distance	Pearson Correlation -0.033	Pearson Correlation .034	Pearson Correlation -.116*	Pearson Correlation .290*	Pearson Correlation -.136*	Pearson Correlation .124*	Pearson Correlation .220*	1		
SoC for charging electric vehicles	Pearson Correlation -0.018	Pearson Correlation .035	Pearson Correlation -.098*	Pearson Correlation .255*	Pearson Correlation -.208*	Pearson Correlation .098*	Pearson Correlation .121*	Pearson Correlation .197**	1	
Charging Anxiety	Pearson Correlation .061	Pearson Correlation -.055	Pearson Correlation .126*	Pearson Correlation -.162**	Pearson Correlation .079*	Pearson Correlation -.088	Pearson Correlation -.136**	Pearson Correlation -.269**	Pearson Correlation -.114**	1

The correlation analysis reveals links between factors and charging anxiety among electric vehicle owners.

- > More driving experience associates with **higher** anxiety (correlation: 0.126**).
- > Higher EV knowledge also **increases** anxiety (correlation: 0.079*).
- > Owning more cars shows **lower** anxiety (correlation: -0.162**).
- > The private charging station ownership **reduces** anxiety (correlation: -0.136**).
- > Charging anxiety is **lower** when charging at higher battery levels (correlation: -0.114**).
- > Longer daily driving distance **decrease** anxiety (correlation: -0.269**).

Conclusion

By merging **range anxiety** and **smartphone charging anxiety** concepts, the study redefines EV owners' charging anxiety as unease from EV SoC drops during driving. The correlation findings reveal prevailing charging anxiety levels among respondents, which could deter potential EV owners. **EV knowledge** and **driving experience** correlate with **higher anxiety**, while **owning multiple cars** or **private charging stations** correlate with **lower anxiety**. **Longer commutes** are linked to **reduced anxiety**, and **proactive charging behavior** diminishes **anxiety levels**. **Regression analysis** highlights shorter daily drives as associated with higher anxiety, whereas private charging stations alleviate anxiety. **Unlike SoC's clear impact on range anxiety, specific charging preferences show less influence on charging anxiety.**

Selectivity and charging options impact anxiety more, emphasizing the need to enhance EV drivers' charging confidence for anxiety alleviation. Other factors like **daily driving distance** and **charging infrastructure availability** also shape charging anxiety, particularly for individuals with longer commutes or limited charging choice.

Findings underscore widespread charging anxiety, with experienced EV owners feeling higher anxiety due to range concerns. In contrast, those with multiple vehicles or private charging stations experience lower anxiety levels. Longer commutes correlate with reduced anxiety, linked to daily charging planning. Unlike previous studies, this research suggests charging behaviour's limited impact on overall anxiety. Charging infrastructure accessibility plays a pivotal role. **Implications encompass policy adjustments, refining technology, and expanding charging options for EV makers and policymakers.** **Future research pathways include policy impact and regional disparities.**

Limitation

While this study offers insights into EV owners' charging anxiety, limitations exist. The focus on select factors, like daily distance and private stations, within an 8.2% explained variance, neglects variables like mileage perception and charging infrastructure density. The limited sample size, concentrated in Guangzhou and Taiyuan, might hinder generalizability. Broader and more diverse samples could enhance external validity, especially when considering the preferences of potential EV buyers. Sampling bias may emerge from self-reported data, influenced by pro-EV bias or inaccurate recall. Social desirability bias might skew results, leading to under- or over-reporting of charging anxiety.

Charging Up ASEAN's Future: A Comprehensive Review and Assessment of Electrification Policies for Transportation

Author

Huang Jiahua Bernice (1007353) SUTD MUSPP 2023
Supervised by: Dr Samuel Chng & Dr Yunkyung Choi (Joy)

Objective

To assess current e-mobility policies in fostering EV adoption in ASEAN and propose effective strategies to expedite the uptake of electric vehicles in the region

Methodology

The evaluation process using the STEELUP framework involves grouping a total of 60 diverse indicators, categorised into sociocultural, technological, economic, environmental, legislative, urban design, and political aspects. Each ASEAN country's policies and strategies will be analysed against these indicators. The resulting scores will provide an overall assessment of each country's efforts towards electrification, with higher scores indicating greater coverage and effectiveness in their electrification endeavours.



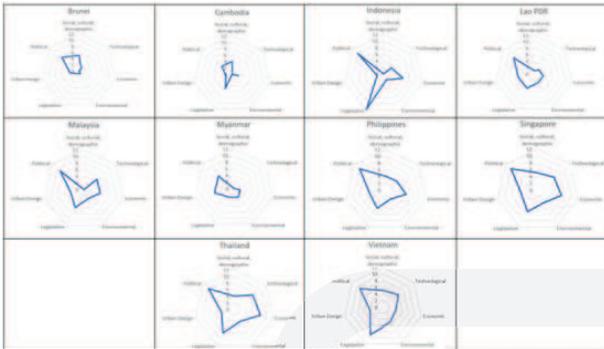
Abstract

With the recent emphasis on carbon neutrality following COP26, many countries prioritize shifting to electric mobility as a crucial strategy to combat carbon emissions. A significant portion of this comes from transportation. Countries like Norway, China, and the United States are at the forefront of the electric vehicle (EV) industry, driven by effective e-mobility policies. In contrast, the 10 Association of Southeast Asia Nations (ASEAN) countries are in the early stages of adopting this emerging trend. This paper evaluates the current e-mobility policies within ASEAN using the STEELUP framework, a comprehensive analysis tool encompassing sociocultural, technological, economic, environmental, legislative, urban design, and political aspects. By critically assessing the implementation of e-mobility policies in each country, this research aims to identify gaps and challenges that hinder the acceleration of EV adoption in the region.

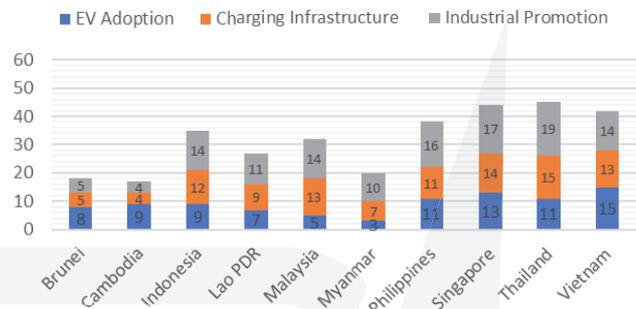


Results

BASED ON ASPECTS



BASED ON GOALS



Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
18	17	35	27	32	20	38	44	45	42



Key Policies

Myanmar

- Aim for a 20% share of clean energy by 2020
- Guidelines and emission standards for ICEVs
- Lease factory space for local EV assembly

Malaysia

- National Automotive Policy
- Target of 700,000 EVs by 2030 through government procurement
- Position itself as EV manufacturing hub through fiscal incentives

Thailand

- 100% EV sales by 2030
- 30% of locally produced vehicles being EVs by 2030
- Eight years corporate tax exemption for EV and EV battery manufacturers

Laos

- Target for at least 30% of automobiles to be EVs by 2030
- Electricite du Laos (EDL) to provide charging services without charging fees
- Power mainly from HEP

Philippines

- Electric Vehicle Industry Development Act
- Mandates at least 5% of the government fleet to be EVs
- Improve public transport by replacing old jeepneys with EVs

Vietnam

- Net-zero emissions goal by 2050
- Extra funding for R&D on EVs
- Regulations favouring local car manufacturers

Singapore

- Aims to reduce land transport emissions by 80% by 2050
- \$20,000 off the Additional Registration Fee for EVs
- 'Power Every Move' campaign to raise public awareness

Indonesia

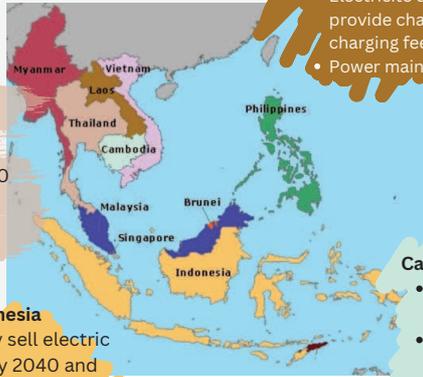
- Targets to only sell electric motorcycles by 2040 and electric cars by 2050
- Largest nickel exporter
- Involve national energy company Pertamina to develop EV batteries

Cambodia

- Long-Term Strategy for Carbon Neutrality
- Aim for 40% of EV cars and urban buses and 70% of electric motorcycles by 2050
- Attract FDI by lowering import taxes

Brunei

- Brunei Darussalam National Climate Change Policy (BNCCP)
- Minimum of 60% EV sales out of total vehicle sales by 2035
- Heavy reliance of private cars due to low fuel cost



Analysis

Strengths

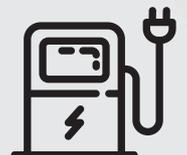
- 1) Political will for the government: Emphasis on political related policies implies most countries had set clear targets and revised their roadmap. Some nations included EVs as part of their government fleet.
- 2) Economic background: Higher GDP per capita countries investing in advanced technological resources like fast charging systems
- 3) Maintaining comparative advantage: Recognized globally as automotive manufacturing hub, countries find means to attract more FDI while protecting local production

Areas for Improvement

- 1) Public acceptance through sociocultural policies: educating public on the intangible benefits of embracing e-mobility
- 2) Reliance on fossil fuel for power generation: clean electricity forms the foundation for the successful adoption of EVs and the ultimate reduction of greenhouse gas emissions

Recommendations

- 1) Develop platform for data collection
- 2) Enhance regional cooperation
- 3) Establish centralised funding
- 4) Organise regional events



SEMANTIC SEGMENTATION OF PHNOM PENH' S STREETSCAPES

The utilization of semantic information from street view images (SVI) has been widely explored in city planning research. However, SVI-based methods have predominantly been trained and tested on SVI images from developed cities in the Global North, such as Western European or North American cities.

Currently, there exists a significant lack of findings regarding their effectiveness in Southeast Asian cities. Considering this knowledge gap, this study aims to evaluate the efficacy of semantic segmentation models in processing semantic information in Southeast Asian streetscapes.



- Road
- Sky
- Tree
- Building
- Base
- Wall
- Sidewalk
- Minibike
- Person
- Chair
- Pole
- Signboard
- Plant
- Streetlight
- Car
- Box
- Awning
- Table
- Rock

Segmentation Process



Static Image



Segmentation Results



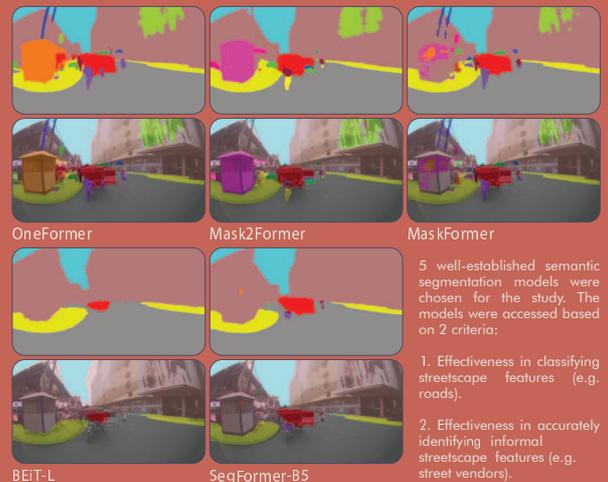
Image + Segmentation Overlay

In total, 24,986 images were collected from Mapillary, a crowdsourcing platform for image data. The Mapillary's Application Programming Interface (API) was used to download and access the images. Each image was identified by a unique image ID, which was utilized to obtain the images from Mapillary. Of the total images, 8,912 images were usable.

Semantic segmentation is an important computer vision task with the goal of categorizing each pixel in an image to a class or object. Each colour represents a distinct physical features of the streetscape. Semantic segmentation models are trained and fine tuned on large image datasets to perform semantic segmentation tasks.

After the semantic segmentation process, the segmentation results are overlaid onto the original static image. Visually, the overlaid image makes clearer the relationship between each street feature and its corresponding class in the image. The overlaid image also gives a clearer picture of how the street features are segmented, making it look more visually appealing.

Model Comparisons



5 well-established semantic segmentation models were chosen for the study. The models were assessed based on 2 criteria:

1. Effectiveness in classifying streetscape features (e.g. roads).
2. Effectiveness in accurately identifying informal streetscape features (e.g. street vendors).

Understand



Interactions between streets and their users better

Complement



Existing approaches to urban studies (e.g., walkability indices)

Optimize



Future segmentation models to better suit the Southeast Asian street context

MUSPP Masters Research Project

Student ID: 1002667

Name: Darren Ho Di Xiang

Supervisors: Dr Samuel Cheng Hong Wei, Dr Choi Yunkyung

Title: Assessing the efficacy of semantic segmentation models in Southeast Asian cities: A case study of Phnom Penh

Environment, Food, and Society

Recycling & Waste Reduction

A Review of Policies and Behavioural Interventions

Research Aims

South Asia is experiencing one of the fastest growth in global waste. The World Bank estimated that 3.88 billion tonnes of global waste would be generated annually by 2050 (73% increase from 2020 and more than double of population growth). Waste indicates inefficiencies and misallocations of resources (Atiq & Steffen, 2012). Waste is also a third largest source of anthropogenic methane emissions. Increased waste volumes adversely affect climate and resource sustainability, requiring an urgent response to innovate waste processes and change behaviours towards recycling and reducing waste.

This research aims to explore prevailing waste strategies in three different cities that seek to reduce waste volumes and promote recycling. Through a discussion using behavioural analysis of individuals and households' responses and perceptions towards waste, it is hoped that significant factors and drivers of interventions could be identified and thereby help to develop recommendations to be suitably applied to the local context.

Research Methodology

This research uses a qualitative review of waste policies in the cities of San Francisco, Seoul and Singapore. Through document analysis of current waste practices and existing behavioural frameworks that discusses decisions relating to waste and recycling, recommended approaches for future local implementation are being proposed.

Research Questions

1. What are the waste practices in these cities that have increased recycling and reduced waste
2. What are the behavioural enablers and innovations that incentivises these actions?
3. What dis-incentivises these efforts?
4. How can Singapore learn from the best practices?

Image source: The World Bank

Discussions: Behavioural Frameworks

Nudge Theory

Based on studies by Mont, Lechner & Heiskanen (2014), there are four types of policy instruments that constitute behavioural interventions through 'nudging' - i) simplification and framing of information, ii) changes to physical environment, iii) changes to default policy and iv) use of social norms.

Nudges influence individual choices and are often done through methods that do not involve monetary incentives.

Ajzen's Theory of Planned Behavior

Intentions and resulting behaviours can be understood from i. attitudes towards the behaviour, ii. subjective norms and iii. perceived control. In addition, the stronger the intention, the more likely the outcome (Ajzen, 1991).

In the case of recycling and trash reduction, the strength of intentions could come from incentives such as monetary rewards. The intention can also be influenced by social norms such as greater environmental values.

Schwartz and Howard's Norm Activation Model

Based on Schwartz and Howard's norm activation model, behaviours are also reflected through a person's underlying values or beliefs and displayed where situations are conducive to the activation of these values and norms (Ebreo, Vining & Christancho, 2003).

This is consistent with studies by Oke, McDonald, Korobilis-Magas, Osobajo & Awuzie (2021) that the awareness of consequences influences consumers' personal norms and responsibility.

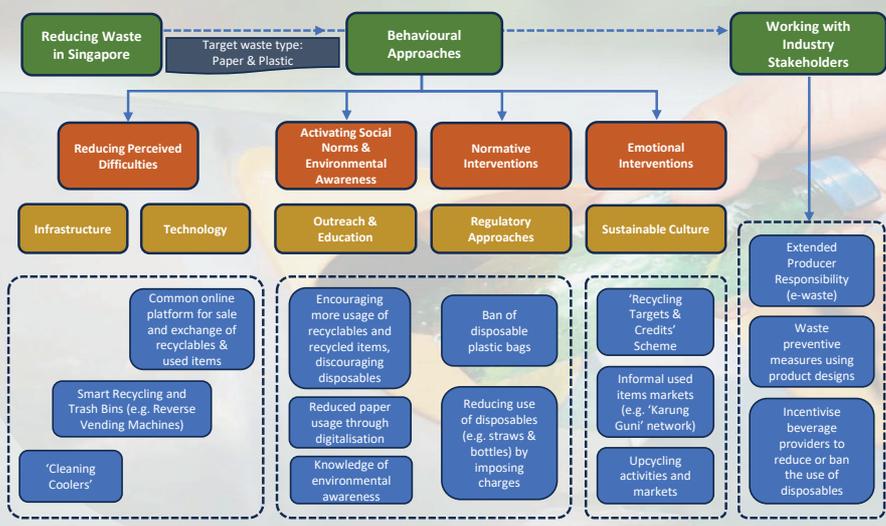
Focus Processing Theory

Consumers are believed to be led to actions through external incentives which increase commitment and extend outreach of initiatives.

According to the Separation-focus and Contribution-focus theory by Li, Yang, Sun & Wang (2021), financial incentives induces a focus on separating with belongings which have negative effect on recycling emotion-involved items, and non-financial incentives led consumers to focus on positive environmental contributions.

Individual choices and governance decisions about waste can determine how much waste is produced and how waste is managed to extend its value in the commodity chain. Behavioural interventions have been widely used recently as low-cost and effective approaches. It was also found that education, environmental changes and interventions through outreach campaigns have better effects while incentives and commitment seem to derive weaker effects (Xia, et. al, 2023).

Recommendations



Findings: Cities Case Studies

	Policies incentivising recycling & waste reduction	Technology & Innovation	Sustainable consumption & resource recovery
San Francisco	<ul style="list-style-type: none"> Prohibition of Styrofoam & Polystyrene foam usage in food services Ban of Plastic bags in 2009 and Plastic disposable water bottles in 2014 Increases in landfill levies 	<ul style="list-style-type: none"> AI-powered Waste Sorting 	<ul style="list-style-type: none"> Zero Waste Goal towards full-life cycle and reductionism Mandatory Recycling and Composting Mandatory Recycling of Construction Debris Ordinance for Environmentally Preferable Purchasing for Commodities
Seoul	<ul style="list-style-type: none"> Volume-based Waste Fees Gradual ban of single-use disposables Plastic reduction plan with industry stakeholders 	<ul style="list-style-type: none"> Smart RFID bins Information management & e-bidding platform for recyclables Reverse-vending machines 	<ul style="list-style-type: none"> Informal junk operators Seoul Upcycling Plaza Green Marketplace project
Singapore	<ul style="list-style-type: none"> Chargeable disposable Plastic bags and food containers Beverage Container Return Scheme 	<ul style="list-style-type: none"> Reverse-vending machines 	<ul style="list-style-type: none"> Extended Producer Responsibility for e-waste producers

Further research in this area could investigate the differences of financial incentives versus behavioural nudges in achieving waste reduction and increasing recycling efforts. In addition, there could be further exploration into the areas of waste minimization such as actively incorporating culture of sustainability and minimalism consumption.

Meal Preferences, Habits and Perceptions towards Novel Foods and 3D-printed Foods among Night Shift Workers in Singapore

AUTHOR: JANICE YOUNG
THESIS ADVISOR: DR HARVEY NEO

URBAN ISSUE: NIGHT SHIFT WORKERS AND POOR EATING HABITS

- Generally, night shift workers face limited food options at work. They tend to eat unhealthy food and have erratic eating patterns (heavy meals before bedtime).
- Novel foods -> can be more nutritious than normal food; can diversify crops in food-producing countries.
- 3D-printed foods -> highly customisable; efficient and convenient production method.
- Problem: Food neophobia (reluctance to eat food that is made of unknown technologies or ingredients (e.g. lab-grown meat, insects)).

OBJECTIVE

This study aims to gain deeper knowledge of the motivations and barriers towards adopting novel foods and 3D-printed foods among nocturnal workers in Singapore and understand the factors that can lead to commercialising novel foods.

METHODOLOGY

This mixed-method qualitative perception study is delivered through a short questionnaire as the pre-interview process, which guided the face-to-face interviews thereafter.

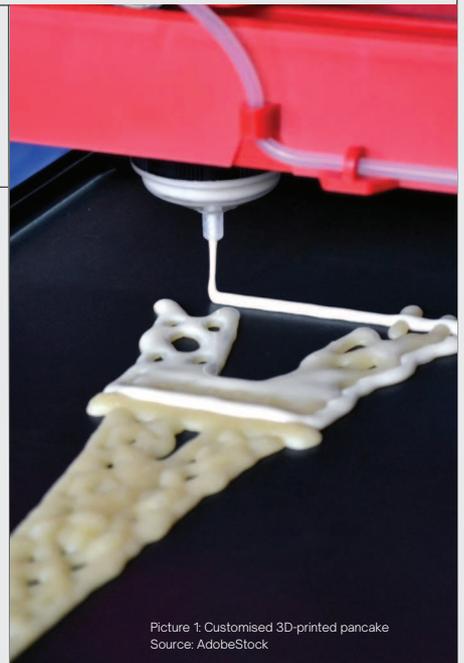
Snowball method was used to identify 20 participants from different industries from the author's network.

Adults aged 21 years old and above who work a full shift (≥ 8 hours) from the afternoon to late night, or beyond 12:00 a.m., and those who work extended hours from morning until past 11:00 p.m. are selected.

The baseline for night shift frequency is at least 5 nights worked in a month to be considered regular night shift workers.

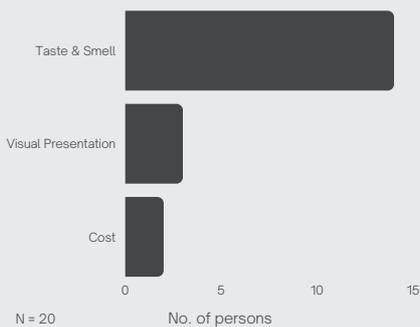
Among the sample, genders are evenly distributed at 10 females and 10 males. The respondents are aged between 24 years old to 56 years old, with a median age of 36 years old.

There are 5 media workers, 4 events and entertainment workers, 3 healthcare workers, 2 airport retail workers, 1 oil and gas worker, 1 seaport worker, 1 hospitality worker, 1 construction and engineering worker, 1 in the police force, and 1 in 24-hour private transportation.



Picture 1: Customised 3D-printed pancake
 Source: AdobeStock

Top 3 Factors to Try New Foods



FINDINGS

- Overall people are positively receptive to eco-friendly food products
- Night shift workers tend to eat light snacks during breaks; fast for hours until shift ends; eat heavy meals after work just before bedtime
- Top 3 factors to try new foods based on: **taste & smell, visual presentation and cost**
- Overall low awareness of what is novel food and 3D-printed food.
- Initial negative perceptions for both.
- After explanations: positive towards 3D-printed foods; less receptive of lab-grown meat; least receptive of insects as food.
- Most receptive of novel food from other countries (long history of eating); 3D-printed foods (plant-based or food waste products)
- Lab-grown meat: mixed reactions; willing to try; but not seen as long-term protein replacement
- Insect foods: most resistance; seen as a novelty, fun food but not for regular consumption
- Potential for convenience food products made of novel ingredients and 3D-printed technologies

CONCLUSION

A lack of understanding to harness 3D-printing food technology as a quick and convenient method to customise and tailor food items to suit different nutritional demands also contribute to the perception that printed food is "not food". These attitudes correspond with earlier perception studies on 3D-printed food (Brunner et al., 2018; Lupton & Turner, 2016) which found that the neophobia towards this technology can be countered with better communication about the technological process, the ease of production, the health benefits of customising the nutrients and creative aspects of making 3D-printed foods (Brunner et al., 2018).

Among night shift workers, the customisable nutritional aspect of 3D-printed food and novel foods may be the most pertinent feature for introducing novel foods and technology. Nocturnal workers lack nutritious food options during their shifts, the respondents are highly aware of the malnutrition they face during night shifts. The respondents also revealed that they prefer light food items and easily consumed foods during their late-night breaks. There is potential for nutritious novel food products in the form of convenience foods that can benefit and appeal to these night shift workers.

Insect-based food face the greatest resistance among the respondents, with many outright rejections of eating insects, while those who have eaten insects before tend to view them as fun, novelty foods and not a serious food source. As food choices are informed by habits and preferences, insect food may not be a compatible or marketable alternative protein source to be offered locally, although more comprehensive quantitative research is needed to explore consumer perceptions in this aspect.



Picture 2: Fried Silkworms in insect form
 Source: AdobeStock

References:

Brunner, T. A., Delley, M., & Denkel, C. (2018). Consumers' attitudes and change of attitude toward 3D-printed food. *Food Quality and Preference*, 68, 389–396. <https://doi.org/10.1016/j.foodqual.2017.12.010>

Lupton, D., & Turner, B. (2016). 'Both fascinating and disturbing': Consumer responses to 3D food printing and implications for food activism. *Digital Food Activism*, Edited by Tanja Schneider, Karin Eil, Catherine Dolan and Stanley Uljaszek, by Routledge, London, Forthcoming.

HUMAN WILDLIFE



DE-CONFLICTING A CITY IN NATURE: NAVIGATING THE APPROACHES TOWARDS UNDERSTANDING HUMAN-WILDLIFE RELATIONSHIPS IN SINGAPORE

1. INTRODUCTION

Increasing conflicts between Singaporean residents and wildlife, particularly macaques, otters, and wild boars, necessitate an in-depth investigation into **human-wildlife interactions**. Despite Singapore's "City in Nature" image and its green spaces facilitating encounters, there is a gap in understanding the **multidimensional factors** influencing human impressions towards these animals. As the study of **human-wildlife coexistence** remains limited and existing methods are inadequate, evaluating future prospects for harmonious coexistence is vital for Singapore's development trajectory and nature preservation.

2. OBJECTIVES

- Assess distribution and factors behind impressions formed towards macaques, otters, and wild boars as a result of human-wildlife encounters in Singapore
- Evaluate existing assessment methodology and suggest improvements to address the challenges posed

3. HUMAN-NATURE CONNECTEDNESS (HNC) THEORY

One's emotions, thoughts, and intentions affect their capacity to value nature, whether intrinsically (biocentric) or for self-preservation (anthropocentric). Their behaviors can be modeled from intolerance to stewardship, and from conflict to coexistence, providing a preliminary indication of one's relationship with wildlife. However, such **linear dichotomy** belies the underlying complexities. HNC is **physically context-specific**, influenced by the urban tropical environment of Singapore that features unforeseen wildlife interactions even in controlled settings. **Sociocultural contexts** also shape intolerances impacting behavior toward wildlife. Assessments of coexistence thus require a **holistic approach** to complement linear assessments by considering diverse dimensions like individual values, tolerance, and acceptance, illuminating potential pathways for harmonious interactions within Singapore's urban tropical landscape.

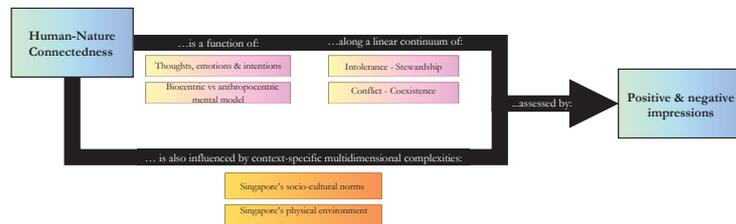


Figure 1. Conceptual framework: visualising the links between human-nature connectedness theory and assessing impressions towards wild animals

4(A). SINGAPORE BASELINE ASSESSMENT FOR IMPRESSIONS OF WILD ANIMALS: FREQUENCY AND DISTRIBUTION

Fig. 2: 58% of the respondents sighted macaque(s), 57% sighted otter(s), and only 42% sighted wild boar(s).

Fig. 3: Respondents only sighted macaques and wild boars once or rarely while otters were sighted between once to a monthly basis. 33% of respondents rated their impression of macaques slightly negative while 37% rated similarly for wild boars. Majority of responses rated all animals neutrally, with 44%, 37%, and 39% for macaques, otters, and wild boars respectively. **Otters have the most 'slightly positive' impressions**, with 35% rating it as such.

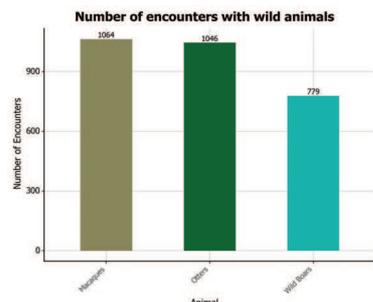


Figure 2. Barplot of residents who encountered each wild animal, of 1839 completed surveys

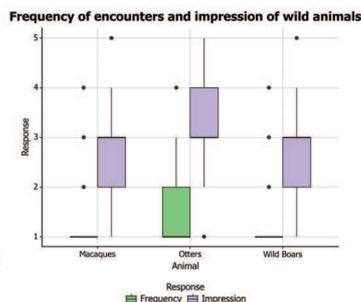


Figure 3. Boxplot of the spread of responses for the frequency of residents' encounters and their impressions of each wild animal.

4(B). SINGAPORE BASELINE ASSESSMENT FOR IMPRESSIONS OF WILD ANIMALS: FACTORS

Secondary data survey questions were grouped into 10 broader themes to analyse their effect on an individual's impression of each animal:



Regression modeling found **no significant effect of knowledge** on the impressions of any animals, suggesting strategies to educate are not effectively assimilating and altering behavior. Similarly, wealth is insignificant. **Values, sentiments, childhood experiences, and spirituality were significant** for all animals, factors that are deeply rooted in one's identity and mental models. Correlation coefficient values were < 0.2 indicating unclear correlation owing to **multicollinearity**.

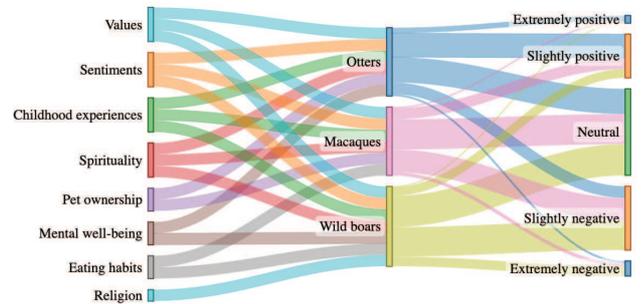


Figure 4. A Sankey diagram to visualise the factors which have a significant effect on impressions of wild animals.

5. THE SYSTEMS THINKING APPROACH TO HUMAN-WILDLIFE INTERACTIONS

Figure 5 visually emphasizes the **multidimensional complexity**. For example, a person's childhood nature experiences can lead to bonding through feeding animals, initiating a **chain of behaviors and interconnected variables**. The diagram underscores how childhood experiences, knowledge, and values are interlinked, influencing each other's outcomes. **Mapping** serves an educational tool, allowing wildlife managers to visualise **intricate cause-and-effect relationships**, and grasp action consequences within the complex environmental system.

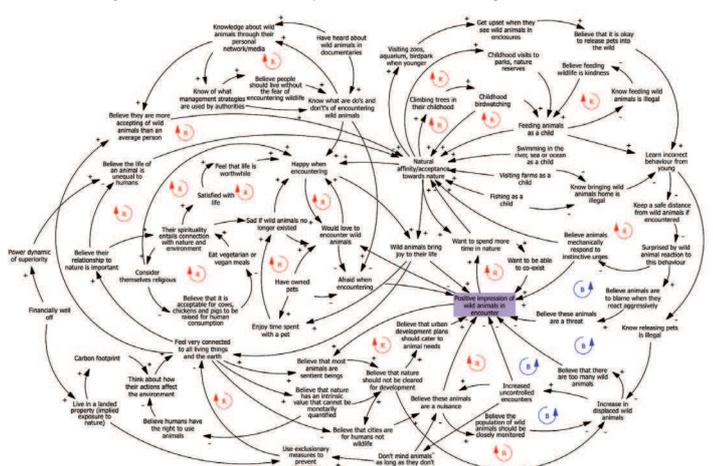


Figure 5. Causal loop diagram (CLD) to visualise the different factors contributing to positive impressions of wild animals. R in red represents a reinforcing loop while B in blue represents a balancing loop.

6. IMPLICATIONS FOR FUTURE INQUIRY

Conducting **longitudinal studies** will allow for more dynamic modeling to capture rapid behavioral system changes. Building on the CLD, temporal data allows the modeling of impressions with interlinked considerations and can better guide policymakers in assessing the absolute impact of their management strategies, as there are **reinforcing and balancing behaviors** that may have confounding implications on an otherwise direct relationship.

KEY REFERENCES

- Bruskotter, J. T., Singh, A., Fulton, D. C., & Stagle, K. (2015). Assessing tolerance for wildlife: clarifying relations between concepts and measures. *Human Dimensions of Wildlife*, 20(3), 255-270.
- Frank, B., Glikman, J. A., & Marchini, S. (2019). *Human-wildlife interactions: turning conflict into coexistence* (Vol. 23). Cambridge University Press.

ACKNOWLEDGEMENTS

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Pedestrianizing the City

Group Presentations

PLACEMAKING FOR MOBILITY IN PEDESTRIANISED STREETS: A TIONG BAHRU CASE STUDY

ABSTRACT

Focusing on the pedestrianised area of Eng Hoon Street in the Tiong Bahru neighbourhood in Singapore, this study investigates the impact of pedestrianisation on mobility patterns and assesses what and how placemaking features enhance walking experience. Results suggest that pedestrianisation has had a minor impact on changing mobility patterns.

Thematic analysis of open-ended survey questions identified the most frequently mentioned placemaking features that enhance or undermine walking experience at the pedestrianisation area. By integrating research insights from different methods, the study developed planning and design guidelines that planners can utilise for undertaking future placemaking in pedestrianised streets.

WHAT IS PLACEMAKING?

Placemaking can be defined as a process involving the reimagining of surroundings, which includes refurbishment, improvement and/or maintenance of everyday places (Eckenwiler, 2016), with the goal of creating liveable places high in quality (Wyckoff, 2014)

PLACEMAKING FOR MOBILITY

"When we think about mobility we don't always think about how the spaces we use to get around the city make people feel. Planning for mobility should include efforts to enhance the sense of place" - City of Boston, 2016

Placemaking for mobility broadens the concept of place

There is a need to design all parts of a city's mobility system so that travelling through the city is a positive experience for all

01 Getting to know Eng Hoon Street

Implementation of road-repurposing schemes by LTA

LTA 2040 to prioritise active mobility modes such as walking and cycling, and the use of public transportation.

March 2022 Trial of Pedestrianisation

Trial on a 10-metre wide 60-metre stretch of Eng Hoon Street

October 2022 Pedestrianisation made permanent

Pedestrianisation with pavement and street furniture

02 Participant Observation

4 days of Data Collection

- 2 weekdays and 2 weekends
- 9am to 8:30pm
- 15-minute intervals
- Morning, Afternoon, Night

4 days of Pedestrian Count on 9am, 12pm, 3pm, 5pm, 7pm

- street / sheltered corridor
- mode of transport
- perceived race, gender
- perceived age range
- size of group
- activities
- weather conditions

03 Pop-Up and Intercept Survey

4 days of Intercept Surveys (103 respondents)

- 2 weekdays and 2 weekends
- 3 hours
- 25 questions on demographics, mobility patterns, opinions and experiences at the pedestrianised street

+ Pop-Up engagement inspired by Participate in Design (PID)

- colourful board with stickers, balloons, and sticky notes visuals showing
- 'hardware' such as seating, tables, and greenery were displayed.
- 'software' which included programming chalk and chairs

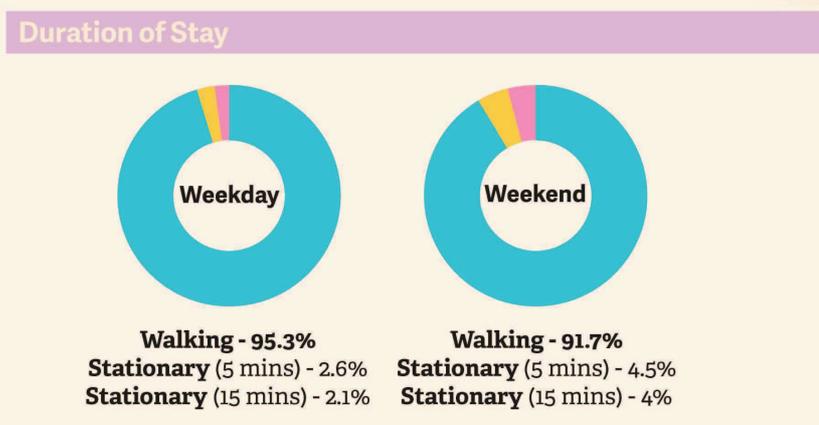
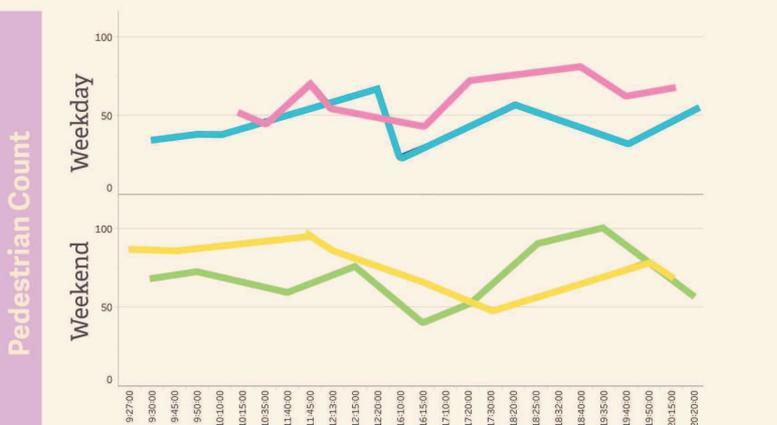
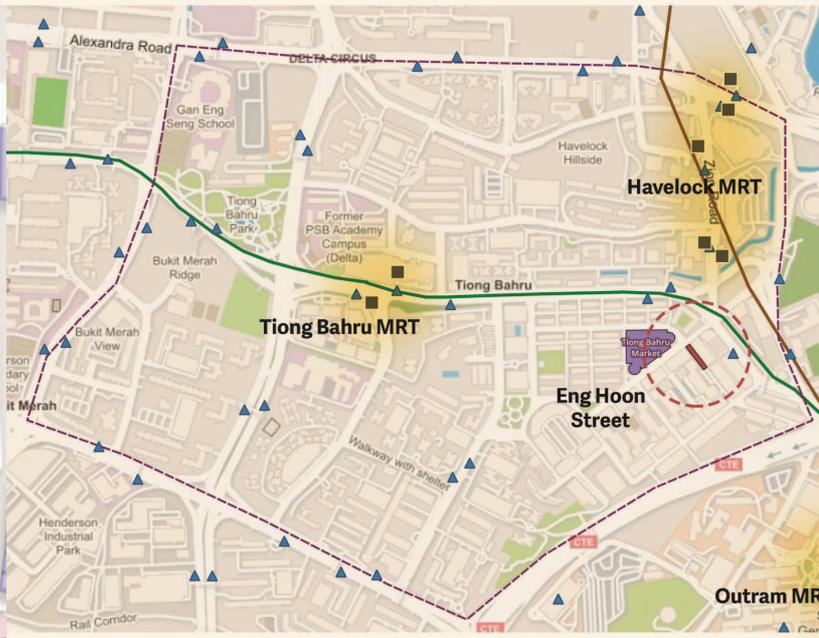
04 Placemaking for Mobility Guidelines

PPS's Placemaking Framework

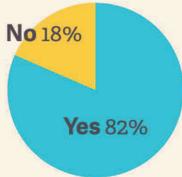
URA's Placemaking Framework

Boston's Placemaking for Mobility Guidelines

EHS's Placemaking for Mobility Guidelines



What's Next for Tiong Bahru?



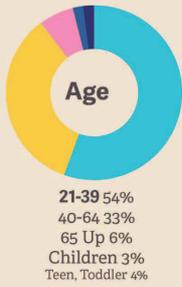
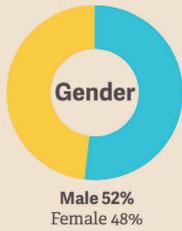
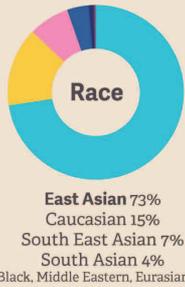
Expand Pedestrianisation?



Placemaking features under Place Attributes

Sociability/Welcoming

Diversity

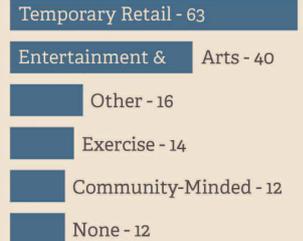


Uses and Activities

Types of Observed Activities

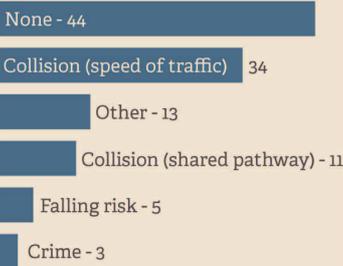


Types of Activities (Survey)



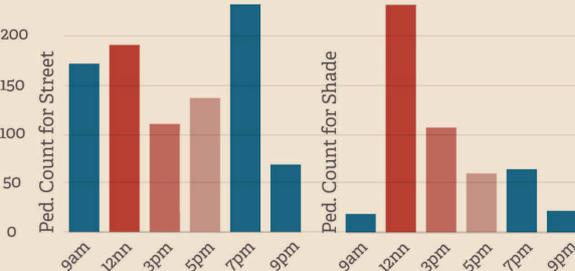
Safety and Image

Safety Concerns



Pedestrian Street/ Shade

Thermal Comfort



Thermal Comfort Interventions

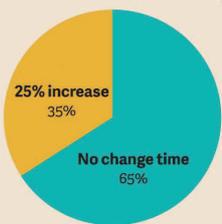
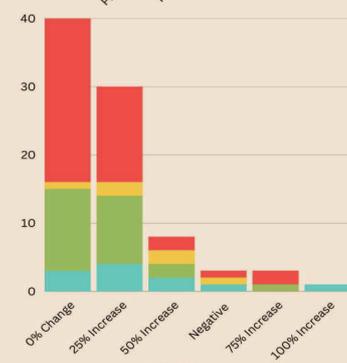


Access and Linkages

Modal Share



Change in Time Spent Walking after Pedestrianization at Eng Hoon St



Place Eng Hoon Street under the responsibilities of an **established community** or neighbourhood group/body to **formalize place management**

Provide stakeholders with **opportunities to participate** in the placemaking process in multiple ways e.g. online survey, pop-up, focus groups

Devise a strategy to support **long-standing and cultural significant businesses** to remain rooted in the Tiong Bahru neighbourhood

Provide **modular and flexible furniture** on the street that different groups of people can utilise to meet their needs

Incorporate the needs of different mobility users by providing **bike parking infrastructure**

Install permanent and moveable **furniture to suit different needs**

Create a **green landscape** with trees and plants to **mitigate heat**.

Develop **continuous, unobstructed paths** that connect to transport nodes

Install **information boards** in the area

Implement a **pedestrian crossing** from Tiong Bahru Market to Eng Hoon Street

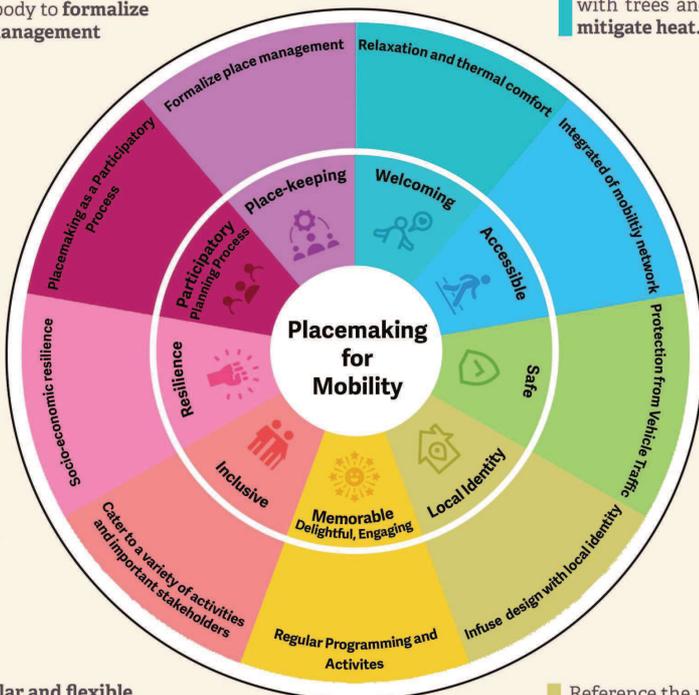
Provide **seperated bike lanes** at Eng Hoon Street and the neighbourhood that **connect to the park connector system**

Reference the unique **architecture and history** of Tiong Bahru

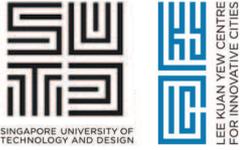
Consider integrating Eng Hoon Street into the **Tiong Bahru Heritage Trail**

Enhance and **support existing activities** on Eng Hoon Street such as chalk drawing

Consider holding the locally run **Seng Poh flea market** on a regular basis and extending it to Eng Hoon Street



Overcoming Barriers By Businesses To Road Pedestrianisation



Wong Yi Jie | Ruth Poh | Koh Lip Wee



Under the Supervision of Dr Yang Xin
In partnership with LKYCIC, SUTD & LTA

Research Questions & Abstract

There is a lack of research on business impact of pedestrianisation schemes in Singapore

Countries around the world have used pedestrianisation to make places more attractive & revive business. Research has shown that business typically drops significantly in the short term but increases in the long term; & businesses tend to overestimate the spending by driving consumers. Singapore's aim for pedestrianisation is to go car-lite. Research on the business impact of pedestrianisation schemes is nascent in Singapore. This research aims to address this gap & address the following questions:

What is the effect of pedestrianisation schemes on businesses in Singapore?

What are the business, socio-economic & contextual factors to consider? How does consumer behaviour shift, if any? What affects support by businesses? How might we improve business support?

Site Context & Relevance of Site

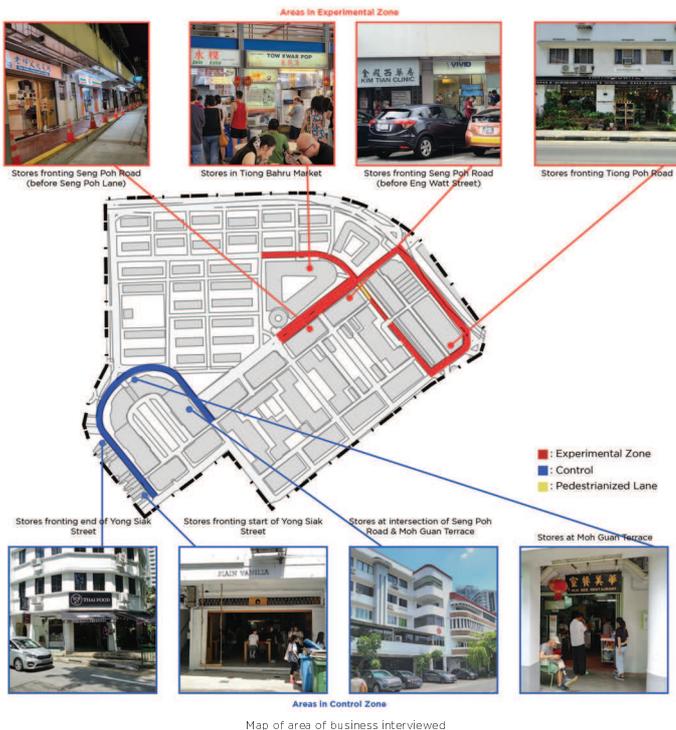
Study site: Tiong Bahru's Eng Hoon Street

Tiong Bahru is a charming housing estate with historical heritage & significance as it is the oldest public housing area in Singapore. Public housing in different Art Deco styles mark the different eras in which they were built - pre-War & post-War. Unlike modern public housing in Singapore, the houses are low-rise, with ample garden & walking space in between the rows of flats. The residents in Tiong Bahru are diverse. While Tiong Bahru has a significantly high percentage of elderly, there are also young families, & expats.

Around Tiong Bahru Market are rows of shophouses, homes & some hotels. A walk down Seng Poh Road & Eng Hoon Street will reveal a mix of units interspersed with each other - residential units frozen in the 1980s, modern rental homes, house temples, home-based businesses, modern cafes, hawkers. Modern restaurants & cafes catering to expats & yuppies exist side by side with hawker stalls & Chinese restaurants which have served loyal local customers since the 80s. The business at the shophouses generally follows Tiong Bahru Market which peaks at lunch & drops thereafter. Business is highest on the weekends & holidays as Tiong Bahru becomes a hive of activity with locals & tourists visiting the area for shopping, food, & walking tours.

Pedestrianisation works undertaken in Tiong Bahru

- a) Eng Hoon Street - 60m paving over of a two-lane road
- b) Seng Poh Road - Removal of a stretch of carpark lots for walkway widening works
- c) Lim Liak Street - Repositioning of the taxi stand & widening of pavement

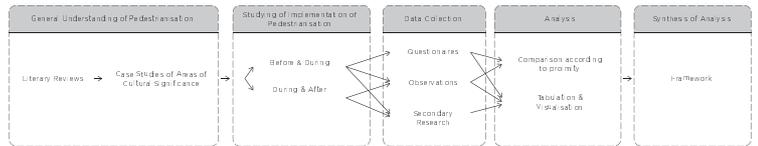


Methodology

A Quantitative & Qualitative Approach

The quantitative approach allow us to understand the behaviors on-the-ground as it is, through results such as footfall, revenue & average consumer expenditure. These objective results can be obtained & interpreted readily through graphical visualisation.

The qualitative approach allows us to pick up nuances & suggestions from the ground that might have been overlooked. For example, in open-ended survey questions, consumers & business feedback have provided valuable insights that went on to inform the framework & proposal.

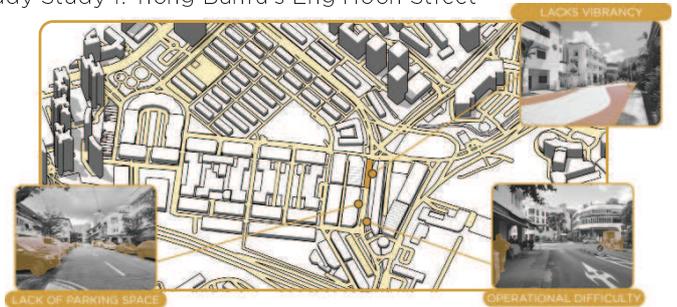


Case Studies

Pedestrianisation across different development stages

Streets across Singapore have been pedestrianised in the effort to create more people-friendly urban spaces. With LTA's pivot towards an increasingly Walk-Cycle-Ride vision, pedestrianisation efforts have taken place over the years. Notable examples besides Eng Hoon Street include Campbell Lane & Haji Lane. These streets share similarities in historical significance, mixed land use, & cultural identity, making them ideal sites for studying the efforts of pedestrianisation on community life & business across different timeframes.

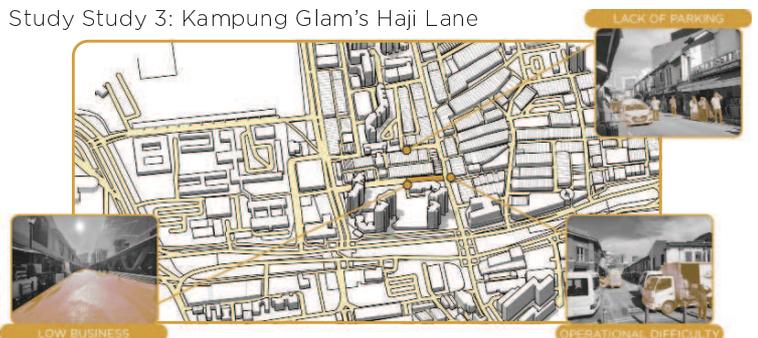
Study Study 1: Tiong Bahru's Eng Hoon Street



Study Study 2: Little India's Campbell Lane



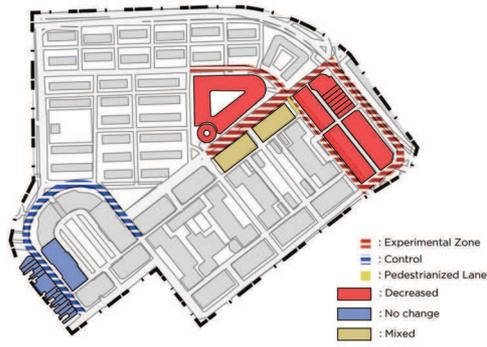
Study Study 3: Kampung Glam's Haji Lane



Results & Analysis of Site

Results from Questionnaires & Various Demographics

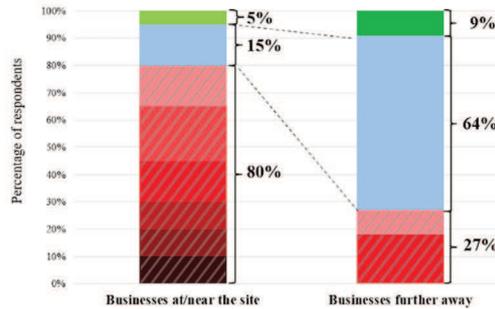
Not all the permanent features have been installed. Businesses (N=31) & consumers (N=102) were interviewed in Jun - Jul 2023 on their perceived impact of pedestrianisation in Tiong Bahru on footfall & business revenues, as well as their support for the scheme.



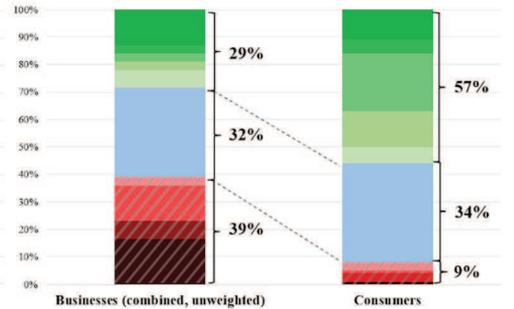
1. Car-driving culture remains strong.

Drivers spend more than non-drivers
 Drivers are uninclined to change to more active modes of transport
 Drivers comment that they will drive elsewhere should there be no parking

How have the road changes affected your sales? (%)



How supportive are you of the road change (0 to 100)?



2. Pedestrianised area is underused, lacks vibrancy

Surveys have suggested:
 Sheltered pathways, seating area
 Hosting events like night-markets, festivals, ground-up activities along street
 Signages around area to educate infrequent users on changes

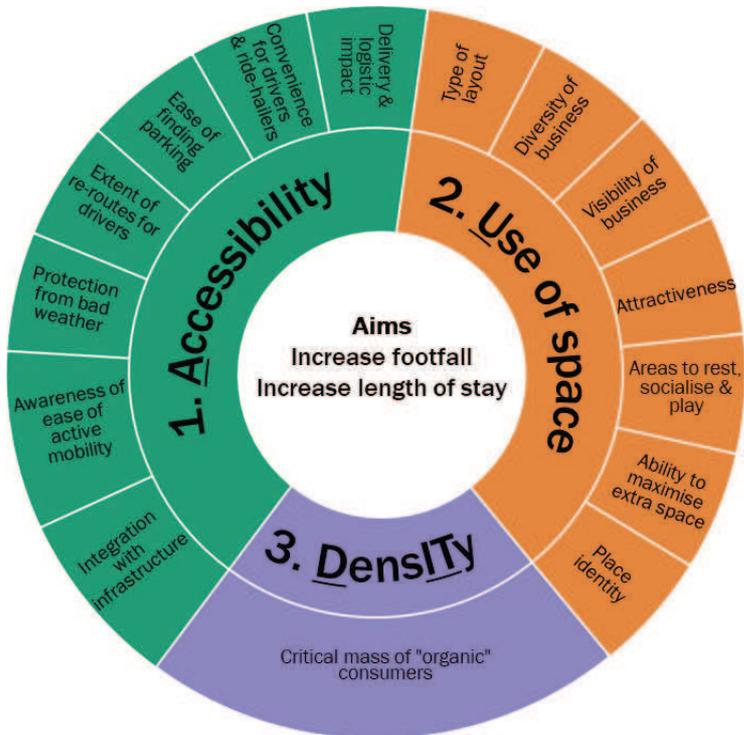
3. 80% of business respondents experience a drop in footfall & revenue

Consumers perceive a significant drop in parking lots
 Consumers unhappy with changes may turn to other locations for their errands

AUDIT Framework

Framework for assessing impact of road pedestrianisation on business

Findings & insights were distilled to create a generalisable framework for assessing the business impact of pedestrianisation schemes. The framework considers the consumers experience as well as its effects on spending behavior. Besides the quantifiable measures like revenue, footfall count & rental price, there are also qualitative benefits to pedestrianisation. For example, the experience economy suggests that tangible value (economic) is derived from intangible factors like quietness of area, less air pollution, sense of safety.



Comparisons between Control & Experimental Zone

A distinction was made between business near Eng Hoon's pedestrianised street, & business further away. This was done to identify whether the changes in business was due to the road repurposing, or other confluent factors (Covid-19, macro economics upturn or downturn).

Recommendations for Tiong Bahru

Application of Framework in Tiong Bahru

While this study suggests that pedestrianisation efforts have a negative impact on businesses in the short term, the team is of the view that this should not be the sole consideration in determining whether areas should be pedestrianised. Other important metrics such as pedestrianisation's impact on people's quality of life, safety, community bonding, environmental sustainability, noise & air pollution, should be considered as well. On balance, residents & the Government may still find such schemes worthwhile as Singapore's population ages & calmer streets are needed.



Phases of Implementation

