Effects of Psychological Factors to Adoption Public Transportation for Captive Riders: A Theory of Planned Behaviour Approach

Presented by

Rathod Rohit
Research Scholar, SVNIT, Surat

Co-Authors
Raj Prajapati, Mtech. Scholar, MSU, Baroda
Dr. G. J. Joshi, Professor, SVNIT, Surat

Transportation Engineering and Planning Section
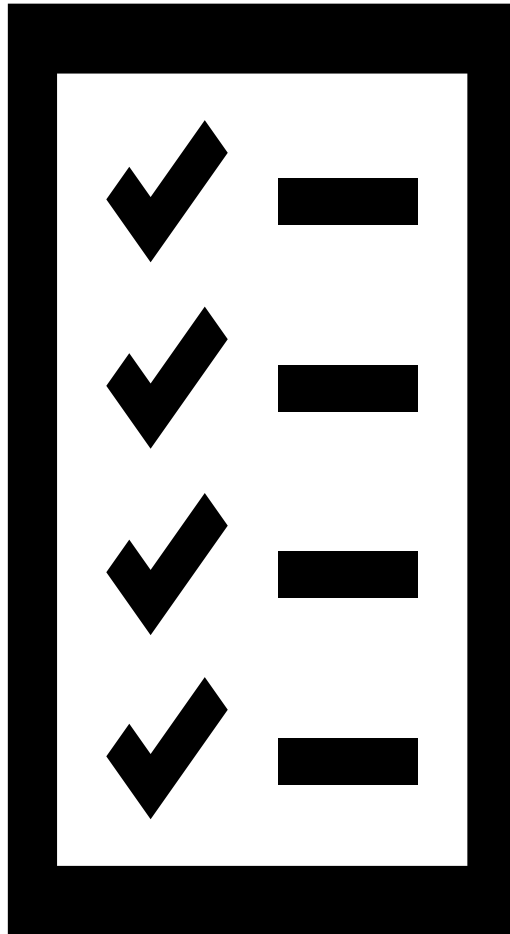**Department of Civil Engineering**
Sardar Vallabhbhai National Institute of Technology,
Surat - 395 007, Gujarat

Introduction
Literature Review
Research Gap
Aim of Study
Methodology
Study Area
Data Analysis
Conclusions
References

➢ India, as a substantial developing nation, relies heavily on transportation for economic growth

➢ Effective public transport can mitigate issues like traffic congestion, pollution, and economic loss caused by high levels of private vehicle usage

➢ Policies aimed at enhancing public transportation should focus on improving service quality

➢ Understanding the factors influencing commuter mode choice psychological aspects, is crucial for developing effective transportation strategies

➢ The Theory of Planned Behaviour (TPB) offers a framework to analyze the psychological factors affecting the intention to use public transport
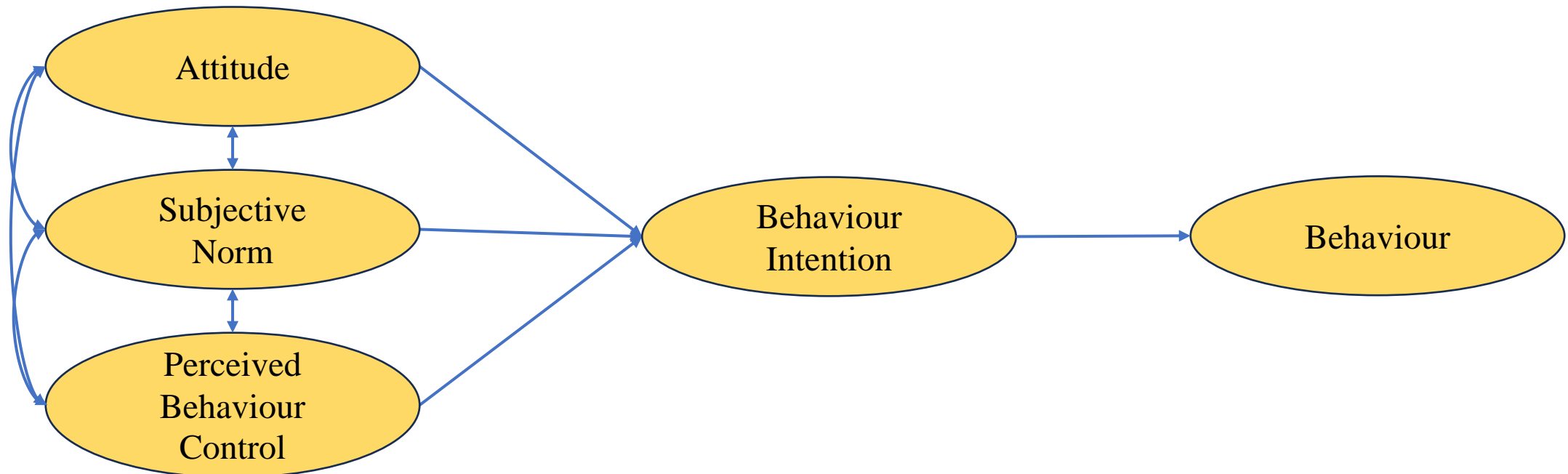
➢ The TPB theory is used to predict and explain human behaviour.

Attitude: A person's positive or negative evaluation of a behavior.

Subjective Norms: A Person's perceptions, from people who are important to me, about how he should or should not behave.

Perceived Behaviour Control: A person's belief about how easy or difficult it is to perform a behaviour.

Intention: How persons are willing to try, in order to perform behavior.

Source: Icek Ajzen-1991

Sr No.	Title of Paper	Author(s) Name	Journal & Year	Model	Finding
1	Mode Choice Model for Public Transport with Categorized Latent Variables	Jian Chen, ShoujieLi	Mathematical Problems in Engineering Volume, 2017	Structural Equation Modelling (SEM)	**Convenience** and Service latent variable has a major impact then comfort for choosing a public transport.
2	Model of personal attitudes towards transit service quality	Khandker M. Nurul Habib,Lina Kattan, Md. Tazul Islam	Advanced Transportation, 2010	Structural Equation Modelling (SEM)	Most importantly, it is found that the people of Calgary city is preferred **reliability and convenience** over ride comfort.
3	Influence of psychological factors in mode choice decision making: A structural equation modeling approach	Devika R, Harikrishna M, Anjaneyulu M V L R	Transportation Research (Procedia), 2019	Structural Equation Modelling (SEM)	The private vehicle users' favoring **attitude** was found to have a stronger influence on the intention to use public transit as compared to that of public transit favoring the attitude of the people.
4	Exploring the potential demand for Jakarta–Bandung high-speed rail	Muhammad Dimas Mahardika, Muhammad Zudhy Irawan, Faza Fawzan Bastarianto	Transportation Research Interdisciplinary Perspectives, 2022	Structural Equation Modelling (SEM)	The study found that the use intention of HSR is more influenced by **subjective norms, perceived moral obligation, and perceived behavioural controls rather than attitude variables such as comfort and reliability**. Among them, Subjective norms become the strongest determinant factor that influences the use intention of HSR.

Service Quality

- The service quality parameters change with the change the cities.
- **Comfort, Convivence, Safety, Affordability, Time Punctuality, Frequency, Speed, Inter-modality,** etc, are important parameters.

Theory of Planned Behaviour

- The **attitude, subjective norms, and perceived behaviour control** are different for different cities.
- These behaviour parameters are depend on cities' geography, awareness, cities' public transport system, and service quality of public transport.

➤ Concern about metro cities having a lower share of public transport.

City Viz % mode share of Public Transport

Chart showing % PT Mode Share by City:
- Surat: 3%
- Ahmedabad: 12%
- Chennai: 28%
- Banglore: 29%
- Delhi: 31%
- Mumbai: 45%

Y-axis: % PT Mode Share (0% to 50%)
X-axis: City
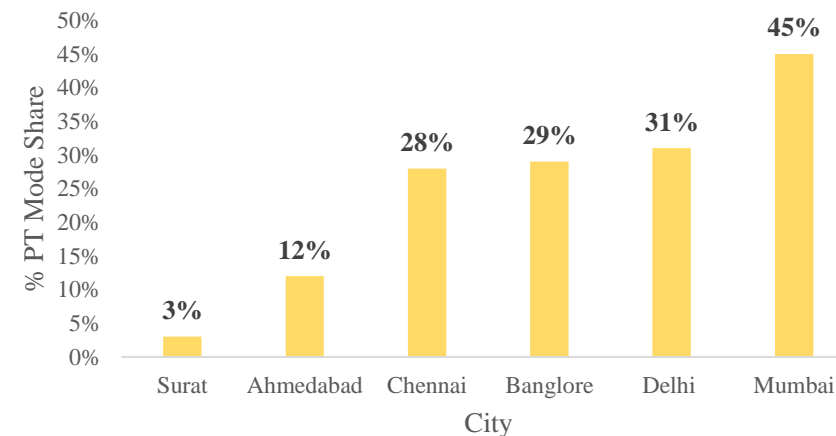
➤ Developing new policies to boost ridership can encourage greater use of public transport.

Source: CMP of Surat, Ahmedabad, Chennai, Bangalore, Delhi, Mumbai

Literature Review → Need of Study → Define Study Area → Data Collection → Data Analysis → Develop Model → Results & Discussion → Conclusion

Define Study Area → Surat City

Data Collection → Primary Data

Data Collection → Secondary Data

Primary Data:
- Questionaries Form

Secondary Data:
- Socio-demographic Characteristics

Questionaries Form:
- Demographic & Travel Characteristics Analysis
- Exploratory Factor Analysis
- Confirmatory Factor Analysis

Develop Model:
- Structural Equation Model

Questions under different attributes of TPB

Subjective Norms

1. My family encourage me to use bus
2. My friends/colleagues would encourage me to use bus
3. I use bus more often when I see my neighbour use it
4. My social status affects my decision to use bus

Perceived Behavioural Control

1. Whether or not I use bus is completely up to me
2. For me, to take the bus to commute is easy
3. I would never be late when using the bus
4. Government policies attract me to use bus
5. It would be difficult for me to use the bus on a daily basis instead of a private mode

Behaviour Intention

1. I have a strong intention to choose bus for next trip
2. I have a strong intention to choose bus after 6 months
3. I would like to encourage people around me to choose bus

Attitude

For me... (attitudinal variable)
1. For me a comfortable seat is important
2. Overcrowding is discouraging to use bus
3. For me it is good to travel in an AC bus
4. Accessibility to reach bus stops is more important
5. I think bus is safer than other mode
6. At stop, safety at night time is more important to me
7. I feel uncomfortable while traveling with an unknown person
8. For me 2W/4W saves my travel time
9. Longer waiting times at the stop discourage me to use bus
10. It is more important for me that the bus comes on time
11. Bus is cheaper than other mode
12. Bus stops should be clean
13. Cleanliness of the bus is desirable
14. It is important for me to get a good response from the conductor in-bus
15. It is important for me to get a good response from staff at bus stop
16. The real-time information available at the bus stop is necessary
17. The real-time information available in- vehicle is necessary
18. The real-time information available in mobile application is important
19. I believe that bus has a positive impact on the environment
20. Using bus reduces traffic congestion on the road

SMC Area - 462.149 km^2

SUDA Area - 1351.00 km^2

- Population of 69,36,534 (2021)
- India's 8th most populous city
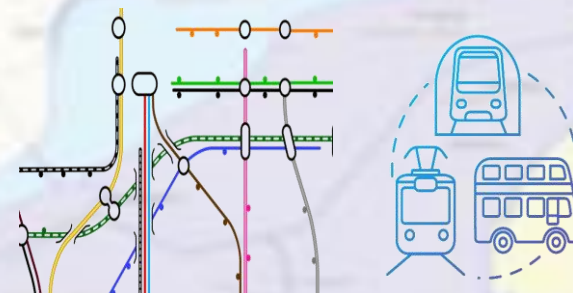- 2nd most populated city in Gujarat
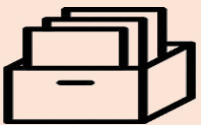
The average family size in Surat is 4.2

Average income per household is Rs. 31,300/month (SMC area)

- The growth in vehicles last 5 years has been around **9% per year**
- **30.09 lakh** vehicles registered (March 2018)

	BRTS	CITY BUS	Total
No of bus	166	575	741
Network(KM)	102	340	442
Routes	12	46	58

Source: CMP of Surat, 2046

Age Distribution (%)
- <18
- 18-30
- 30-40
- 40-50
- 50-60
- >60

Monthly Household Income (%)

Occupation (%)
- Private Job
- Student
- Business
- Others
- Govt. Job
- Housewife

Trip Purpose (%)
- Work
- Education
- Shopping
- Others

House Hold Size (%)
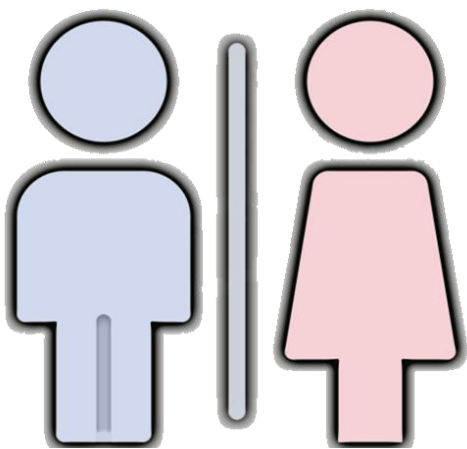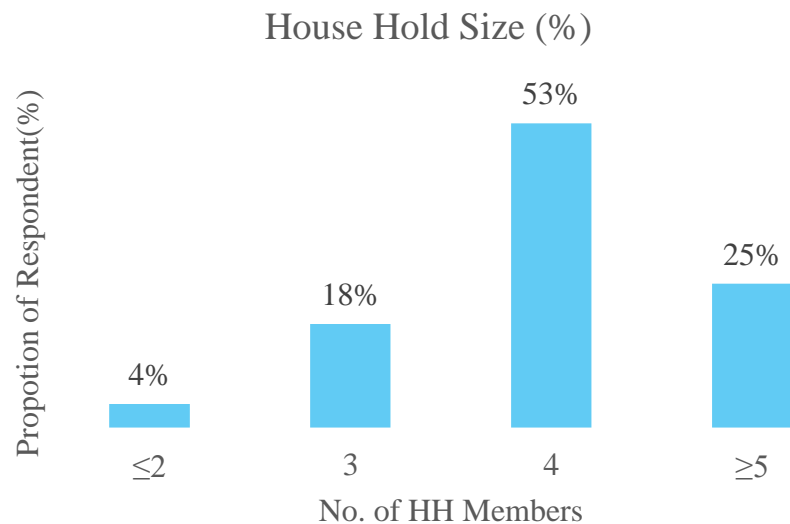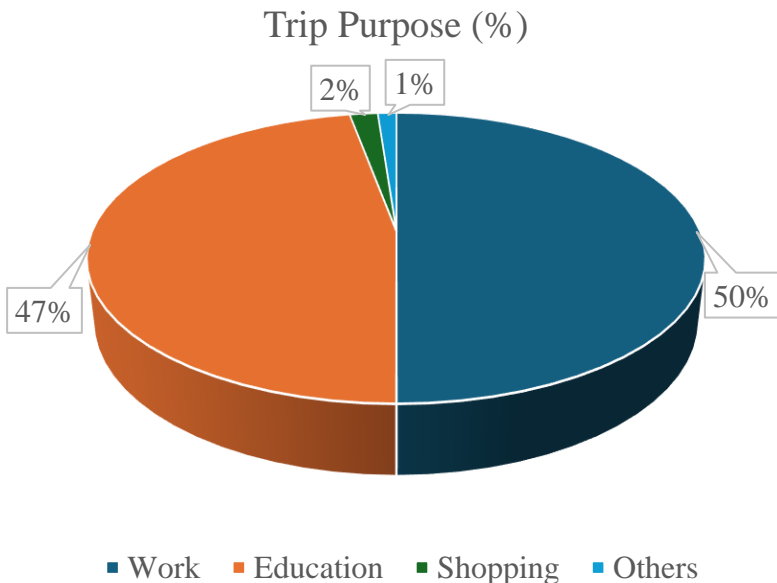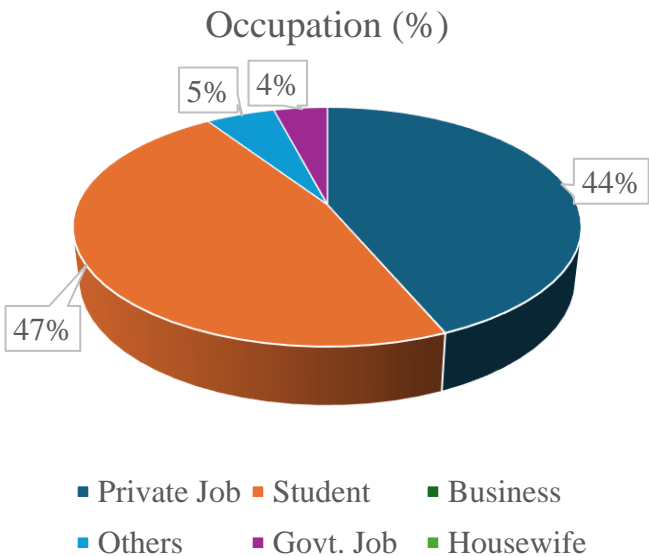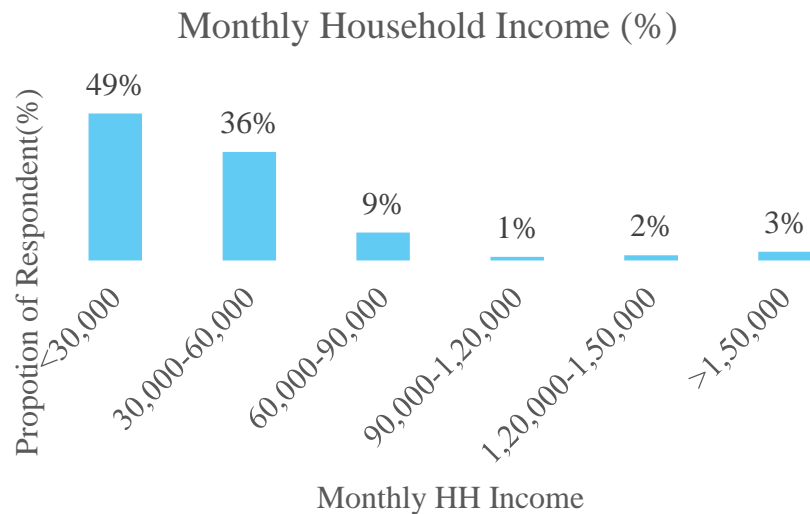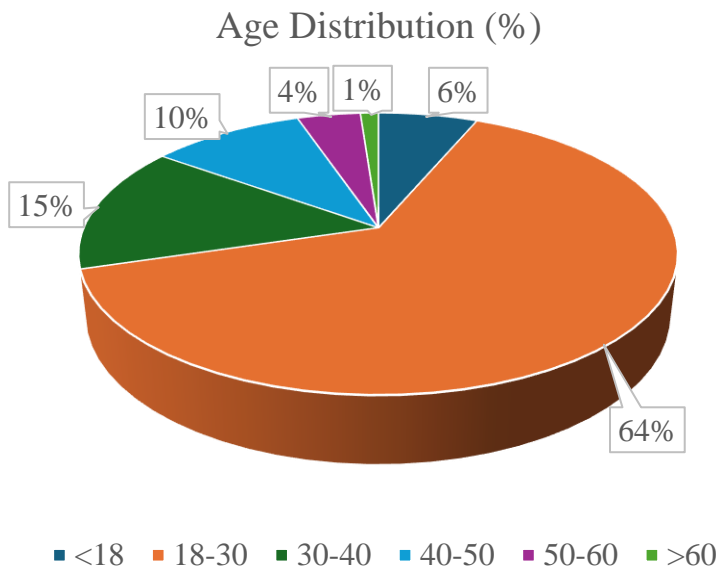
Cronbach's alpha was used to measure the internal consistency of data

Sr No	Variables	No of Items	Alpha
1	Attitude (ATT)	14	0.700
2	Subjective Norms (SN)	3	0.729
3	Perceived Behaviour Control (PBC)	4	0.706
4	Behaviour Intention (BI)	2	0.746

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**0.605**
Bartlett's Test of Sphericity	Approx. Chi-Square	1415.877
	df	435
	Sig.	<0.001

> The Kaiser-Meyer-Olkin's (KMO) sampling adequacy test was employed to check **the suitability of data for factor analysis.**
> **KMO value >0.5 (Required)**

Communalities		
	Initial	Extraction
ATT1	1	0.666
ATT2	1	0.575
ATT3	1	0.684
ATT4	1	0.568
ATT5	1	0.716
ATT6	1	0.693
ATT7	1	0.736
ATT8	1	0.757
ATT9	1	0.831
ATT10	1	0.775
ATT11	1	0.772
ATT12	1	0.699
ATT13	1	0.675
ATT24	1	0.644
SN1	1	0.748
SN2	1	0.773
SN3	1	0.665
PBC1	1	0.595
PBC2	1	0.675
PBC3	1	0.687
PBC4	1	0.548
BI1	1	0.731
BI2	1	0.784

Source: (Taber, 2018), (Nguyen et al., 2023)

Rotated component matrix / Anti Image covariance

Variables	ATT1	ATT2	ATT3	ATT4	ATT8	ATT9	ATT10	ATT12	ATT13	ATT14	ATT15	ATT16	ATT17	ATT19	ATT20	SN1	SN2	SN3	PBC1	PBC2	PBC3	PBC4	BI1	BI2
ATT1	0.541	-0.132	-0.090	-0.101	-0.006	0.026	-0.023	-0.014	0.006	-0.102	0.072	-0.022	0.053	0.044	-0.088	0.050	0.029	-0.096	0.024	0.054	-0.055	0.012	0.051	-0.020
ATT2	-0.132	0.557	-0.111	-0.128	0.072	-0.133	0.004	-0.016	-0.005	-0.040	-0.017	0.080	-0.017	0.004	-0.001	0.060	-0.007	-0.086	0.043	0.015	0.036	-0.092	-0.047	0.034
ATT3	-0.090	-0.111	0.531	-0.131	0.043	0.040	-0.048	-0.070	0.044	-0.068	0.047	-0.044	-0.057	0.061	-0.056	-0.011	-0.024	-0.002	0.006	-0.057	0.070	0.131	0.098	-0.084
ATT4	-0.101	-0.128	-0.131	0.555	-0.148	0.026	-0.001	-0.002	0.035	0.079	-0.061	-0.078	0.014	-0.071	-0.006	-0.041	0.007	0.058	-0.016	0.035	0.039	0.014	-0.027	0.049
ATT8	-0.006	0.072	0.043	-0.148	0.649	-0.186	-0.049	-0.071	0.031	-0.081	0.102	0.089	0.017	0.000	-0.042	0.071	-0.009	-0.020	-0.015	0.045	0.056	0.055	-0.028	0.018
ATT9	0.026	-0.133	0.040	0.026	-0.186	0.559	-0.244	0.065	0.003	0.023	0.014	-0.057	-0.009	-0.071	-0.033	-0.048	-0.001	0.055	-0.026	-0.028	0.008	-0.024	0.094	-0.022
ATT10	-0.023	0.004	-0.048	-0.001	-0.049	-0.244	0.575	-2.269E-05	-0.026	0.004	-0.055	0.013	-0.044	0.062	-0.065	0.051	-0.035	0.008	-0.002	0.025	-0.104	0.012	-0.036	0.048
ATT12	-0.014	-0.016	-0.070	-0.002	-0.071	0.065	-2.269E-05	0.621	-0.235	0.134	-0.082	0.022	-0.037	-0.035	0.034	-0.033	-0.051	0.094	-0.024	-0.110	0.043	0.020	-0.044	0.053
ATT13	0.006	-0.005	0.044	0.035	0.031	0.003	-0.026	-0.235	0.697	-0.112	0.114	-0.073	0.107	0.018	-0.109	-0.025	0.014	-0.048	0.014	0.012	-0.046	0.035	-0.068	0.062
ATT14	-0.102	-0.040	-0.068	0.079	-0.081	0.023	0.004	0.134	-0.112	0.385	-0.280	0.000	-0.035	-0.062	0.073	-0.031	0.001	0.108	-0.050	-0.026	0.007	-0.060	-0.076	0.025
ATT15	-0.072	-0.017	0.047	-0.061	0.102	0.014	-0.055	-0.082	0.114	-0.280	0.439	-0.026	0.070	-0.004	-0.046	0.015	0.006	-0.027	0.013	-0.006	0.031	0.041	0.093	-0.055
ATT16	-0.022	0.080	-0.044	-0.078	0.089	-0.057	0.013	0.022	-0.073	0.000	-0.026	0.624	-0.305	-0.052	-0.070	0.051	-0.037	0.007	-0.017	0.024	0.019	-0.006	-0.005	-0.069
ATT17	0.053	0.017	0.057	0.014	0.017	0.009	0.044	0.037	0.107	0.035	0.070	-0.305	0.649	0.059	0.016	0.001	0.042	0.025	0.018	0.005	0.015	0.016	0.042	0.081
ATT19	0.044	0.004	0.061	-0.071	0.000	-0.071	0.062	-0.035	0.018	-0.062	-0.004	-0.052	0.059	0.757	-0.208	0.059	-0.057	0.007	0.044	-0.047	0.024	0.018	-0.005	-0.009
ATT20	-0.088	-0.001	-0.056	-0.006	-0.042	-0.033	-0.065	0.034	-0.109	0.073	-0.046	-0.070	0.016	-0.208	0.626	-0.007	0.010	0.110	-0.026	-0.076	-0.024	-0.013	-0.090	0.009
SN1	0.050	0.060	-0.011	-0.041	0.071	-0.048	0.051	-0.033	-0.025	-0.031	0.015	0.051	-0.001	0.059	-0.007	0.408	-0.244	-0.066	-0.087	0.041	-2.143E-05	-0.037	0.025	0.015
SN2	0.029	-0.007	-0.024	0.007	-0.009	-0.001	-0.035	-0.051	0.014	0.001	0.006	-0.037	-0.042	-0.057	0.010	-0.244	0.386	-0.066	0.059	0.050	-0.005	-0.046	-0.026	-0.064
SN3	-0.096	-0.086	-0.002	0.058	-0.020	0.055	0.008	0.094	-0.048	0.103	-0.027	0.007	-0.025	0.007	-0.066	-0.066	0.502	-0.013	-0.087	0.037	0.043	0.015	-0.034	
PBC1	0.024	0.043	-0.006	-0.016	-0.015	-0.026	-0.002	-0.024	0.014	-0.050	0.013	-0.017	-0.018	0.044	-0.026	-0.087	0.059	-0.013	0.626	-0.164	-0.116	-0.066	-0.011	-0.045
PBC2	0.054	0.015	-0.057	0.035	0.045	-0.028	0.025	-0.110	0.012	-0.026	-0.006	0.024	-0.005	-0.047	-0.076	0.041	0.050	-0.087	-0.164	0.556	-0.150	-0.112	-0.035	0.043
PBC3	-0.055	0.036	0.070	0.039	0.056	0.008	-0.104	0.043	-0.046	0.007	0.031	0.019	-0.015	0.024	-0.024	-2.143E-05	-0.005	0.037	-0.116	-0.150	0.564	-0.085	0.058	-0.082
PBC4	0.012	-0.092	0.131	0.014	0.055	-0.024	0.012	0.020	0.035	-0.060	0.041	-0.006	0.016	0.018	-0.013	-0.037	-0.046	0.048	-0.066	-0.112	-0.085	0.678	0.033	-0.070

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

RCM: Rotation is the procedure in which factors are rotated to achieve a Simple Structure means that each factor should have a few high loadings with the rest of the loading being zero or closer to zero. In the orthogonal method, we use the **Varimax method, assuming that factors in the analysis are uncorrelated.**
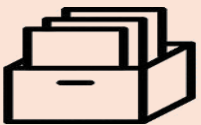
1. Focuses on relationship between observed and latent constructs

2. Determines how items reflect each factor

Variable	<---	Latent Variable	Estimate
PT Attitude	<---	Comfort	0.57
PT Attitude	<---	Travel Time Reliability (TTR)	0.34
PT Attitude	<---	Cleanliness	0.33
PT Attitude	<---	Staff Behaviour	0.22
PT Attitude	<---	Real-Time Information	1.01
PT Attitude	<---	Environmental Sustainability	0.88
Behaviour Intention	<---	Subjective Norms	0.37
Behaviour Intention	<---	Perceived Behaviour Control	0.54
Behaviour Intention	<---	PT Attitude	0.89
ATT1	<---	Comfort	0.48
ATT2	<---	Comfort	0.65
ATT3	<---	Comfort	0.12
ATT4	<---	Travel Time Reliability	0.4
ATT5	<---	Travel Time Reliability	0.87
ATT6	<---	Travel Time Reliability	0.45
ATT7	<---	Cleanliness	0.07
ATT8	<---	Cleanliness	0.43

Variable	<---	Latent Variable	Estimate
ATT9	<---	Staff Behaviour	2.5
ATT10	<---	Staff Behaviour	0.25
ATT11	<---	Real-Time Information	0.4
ATT12	<---	Real-Time Information	1.18
ATT13	<---	Environmental Sustainability	0.18
ATT14	<---	Environmental Sustainability	1.04
SN1	<---	Subjective Norms	0.86
SN2	<---	Subjective Norms	0.78
SN3	<---	Subjective Norms	0.35
PBC1	<---	Perceived Behaviour Control	0.16
PBC2	<---	Perceived Behaviour Control	0.25
PBC3	<---	Perceived Behaviour Control	0.54
PBC4	<---	Perceived Behaviour Control	0.5
BI1	<---	Behaviour Intention	1.44
BI2	<---	Behaviour Intention	0.88

Measurement Model
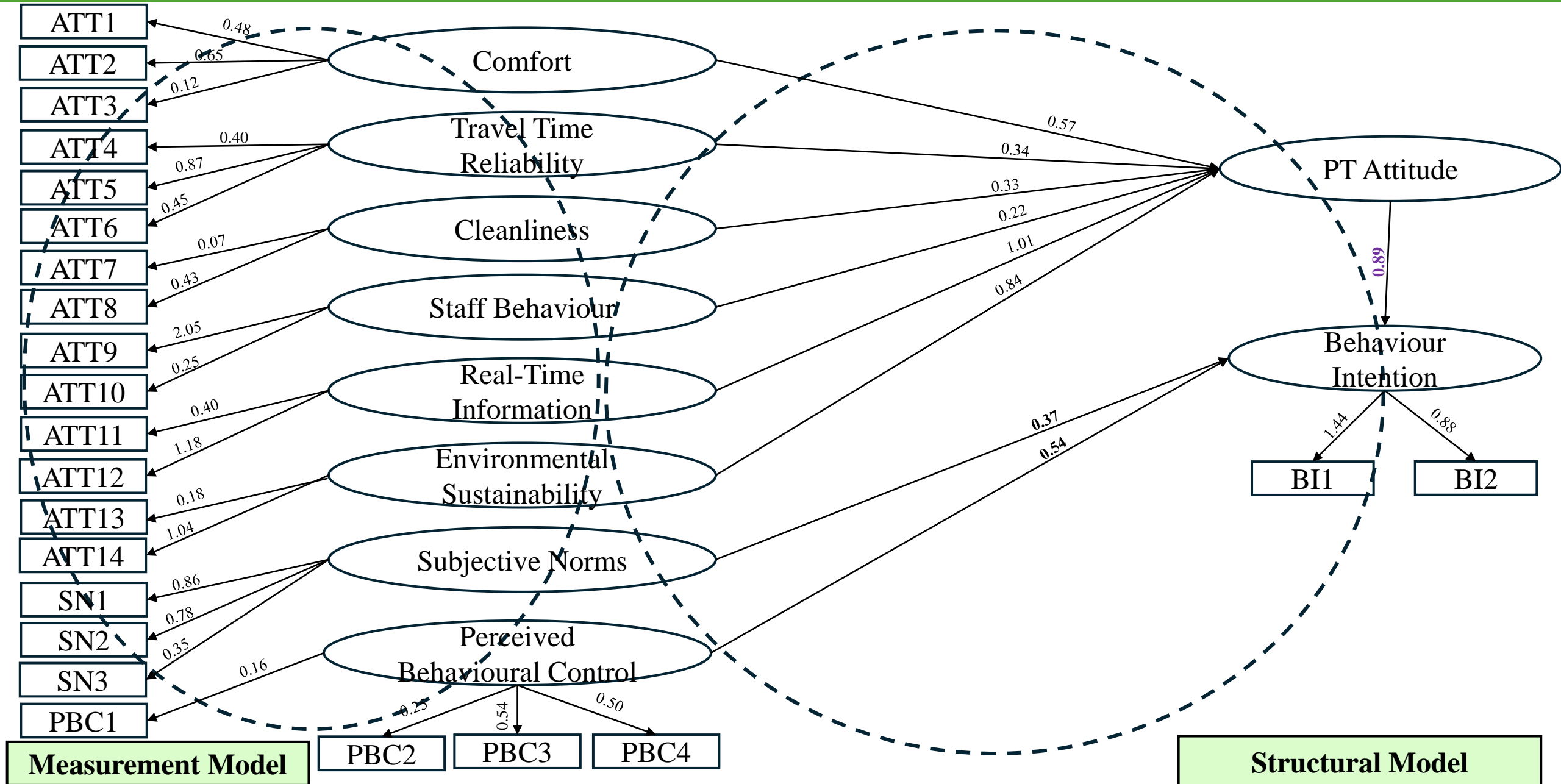
Structural Model

| | Structural Model | | | |
Index	Recommended Value	Model Value	Saturated Model	Independence Model
Probability value (p-value)	< 0.05	***	-	-
C-Min	Min	256.55	0.000	979.53
Degree of Freedom	-	177	0.000	253
Goodness-of-Fit (GFI)	> 0.90	0.947	NA	3.870
Comparative Fit Index (CFI)	> 0.90	0.928	0.000	0.650
Adjusted Goodness of Fit Index (AGFI)	> 0.90	0.920	NA	0.620
Tucker-Lewis Index (TLI)	> 0.90	0.903	1.000	0.000
Root Mean Square Residual (RMSR)	< 0.08	0.043	NA	0.000
Root Mean Square Error of Approximation (RMSEA)	< 0.08	0.043	NA	0.130
Chi−square minimum (CMIN)/DOF	< 5	1.868	0.000	0.096

Subjective Norms = 0.86* SN1 + 0.78* SN2 + 0.35* SN3 — Family encourage to use PT

Perceived Behavioural Control = 0.16* PBC1 + 0.25* PBC2 + 0.54* PBC3 + 0.50* PBC4 — Never late when use

1 From the path diagram of SEM, it is evident that the highest coefficient is **PT attitude (0.89)**, followed by **perceived behaviour control (0.54)**, and **subjective norms (0.37)** have significant positive direct effects on behaviour intention.

2 More focus should be on solving real-time information and crowding issues by adopting new technology.

3 Government and local bodies should be involved in raising awareness, promoting advertisements, and encouraging participation through workshops.

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