



THE CRITICAL SUCCESS FACTORS FOR TRANSIT-ORIENTED DEVELOPMENT OF RAILWAY STATIONS IN MALAYSIA

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INTRODUCTION





Motivations of the Study



4th National Physical Plan (NPP4) or Rancangan Fizikal Negara Keempat (RFN4) is aiming for building a prosperous and resilient nation to ensure continuous well-being guided by 3 development thrusts that are aligned with TOD principles.

– PLANMalaysia (2021)



Motivations of the Study (cont')

TOD is gaining wide acceptance by the local governments, particularly in Selangor and KL due to benefits such as **mitigating urban sprawl, reducing traffic congestion** and supporting **sustainable development**.

—Gomez, Omar & Nallusamy (2019); Yap, Chua & Skitmore (2021).



Traffic congestion in Penang is getting worse



Motivations of the Study (cont')

However, not all states had formally initiated TOD projects **especially in the northern parts** of Peninsular Malaysia. Albeit northern states such as Perlis, Kedah and Penang are small in size and less busy compare to central regions, the problems of **traffic congestion** and **urban sprawl** are still evident and **getting worse**.



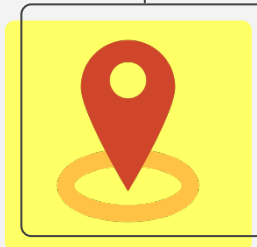
Motivations of the Study (cont')

In fact, Kedah State Plan 2035 and Penang State Plan 2030 highlighted **TOD planning as one of the strategic policies** towards smart growth and urban renewal visions



GAP 01

Most of the TOD studies in local context are devoted to railway stations in **urban areas**, while **suburban and rural stations are poorly investigated**.

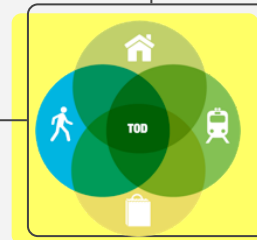


GAP 02

TOD studies focused on examining the success and performance of TOD adoptions are most often solely based on **experts viewpoints** or **spatial data**.

GAP 03

Most studies have not assessed TOD adoption in a comprehensive manner. **Only focused on certain criteria**; e.g., land-use diversity, demand management, walkable design.



1

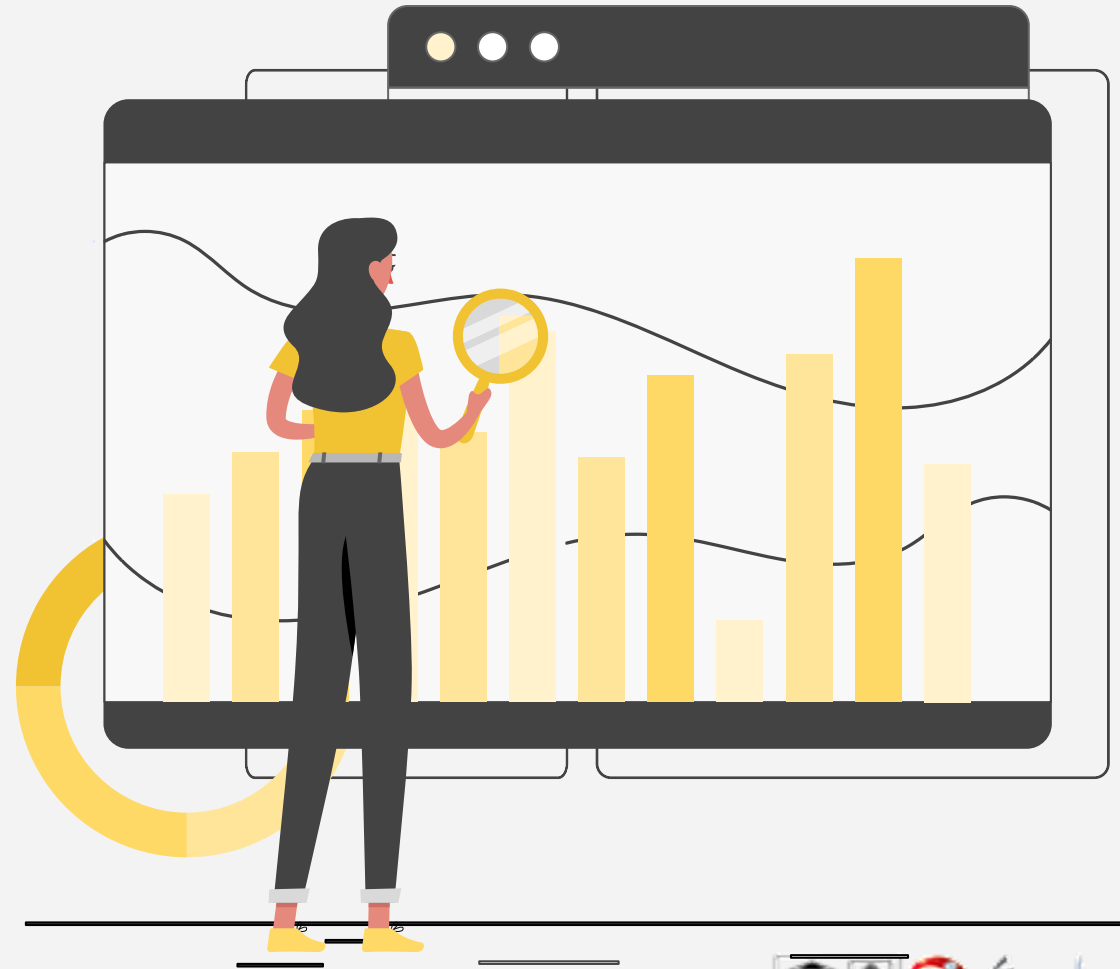
To identify the critical factors to successfully integrate residential and retail areas at the Northern Malaysia railway stations using TOD principles.

3

To provide comprehensive guidelines for developing potential railway station areas in Northern Malaysia into full-fledged TOD cities.



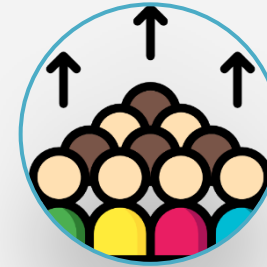
Literatur ur e Review



Critical Success Factors of TOD

Diversity

Land-use diversity: Different land uses in a buffer area & the degree to which they are present in that area

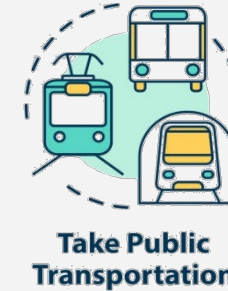


Density

Population & employment relative to the size of the buffer area

Design

Walkable design: Good street connectivity for pedestrian & cyclist to access resources within the buffer area



Destination

Destination accessibility: The ease of access to resources outside the buffer area without the need for personal vehicle trips.

Demand

Demand management: Strategies aimed at reducing the need for personal vehicle trips



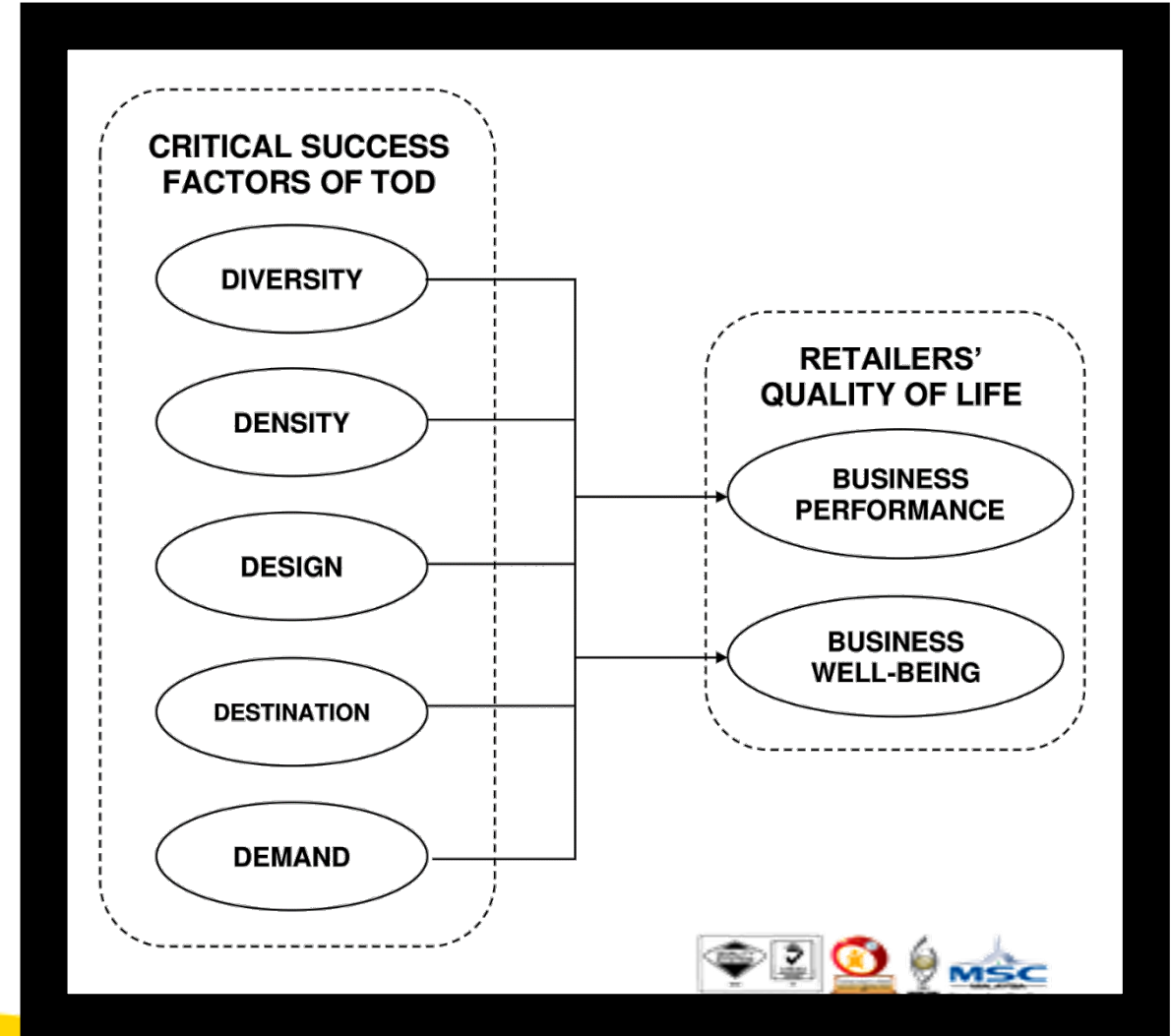
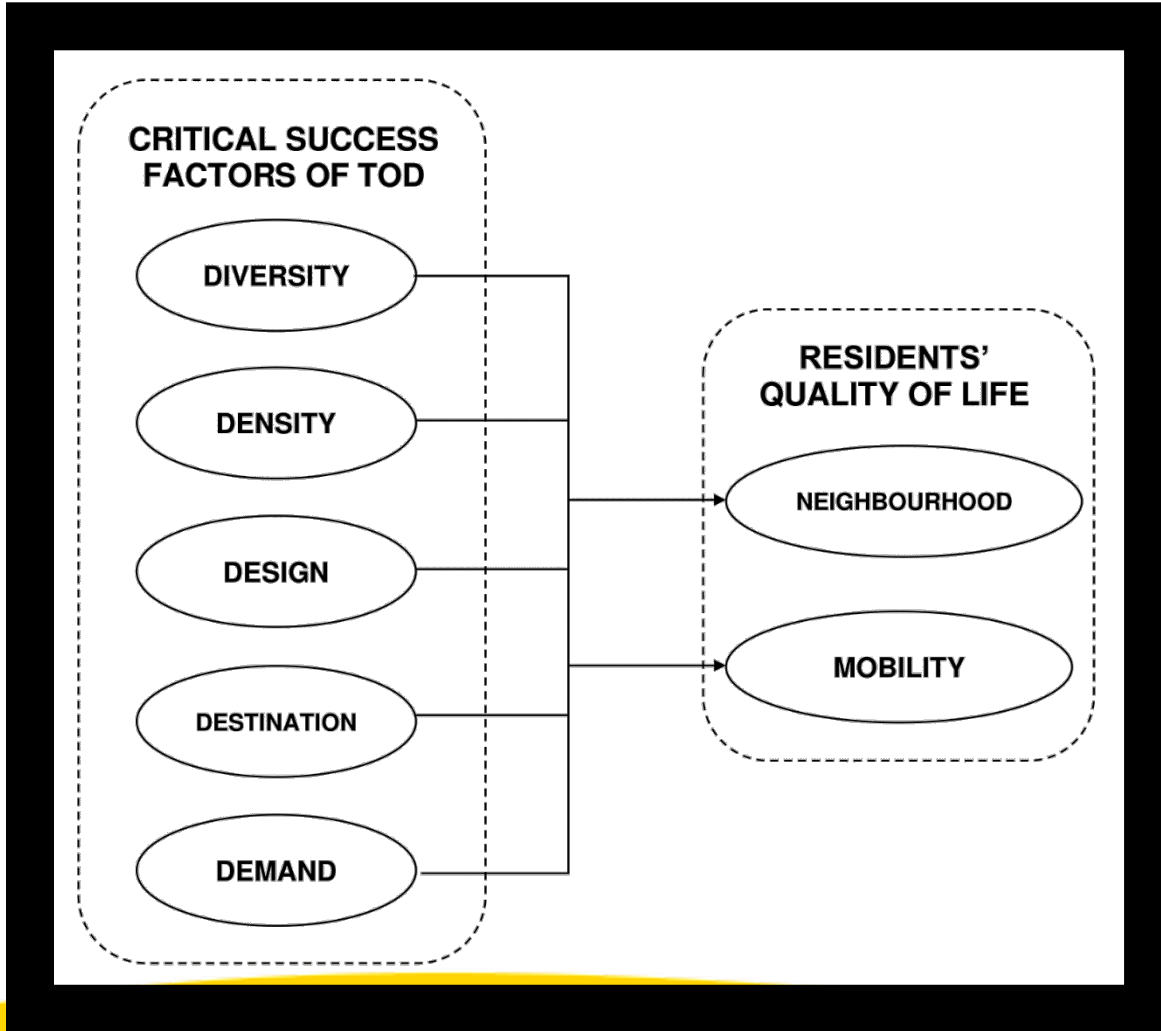
Dissonance

Residential dissonance: Mismatch between current residential neighbourhood & the preferred one

Outcomes of TOD Adoption:

Quality of Life







RESEARCH METHODS

1. Multi-Method Design
2. Population & Sampling
3. Data collection mode



POPULATION & SAMPLING

SURVEY



POPULATION

Passengers of KTM Commuter Northern Sector

SAMPLING FRAME

Not available: Kept private & confidential by KTMB.

SAMPLING TECHNIQUE

Purposive sampling:
Specific group of people on some rational criteria (Sekaran & Bougie, 2016; Memon, Ting, Chuah, & Cheah, 2017).

UNIT OF ANALYSIS

Individual

DATA COLLECTION MODE

Personally administered: Drop-and-collect

MINIMUM SAMPLE SIZE

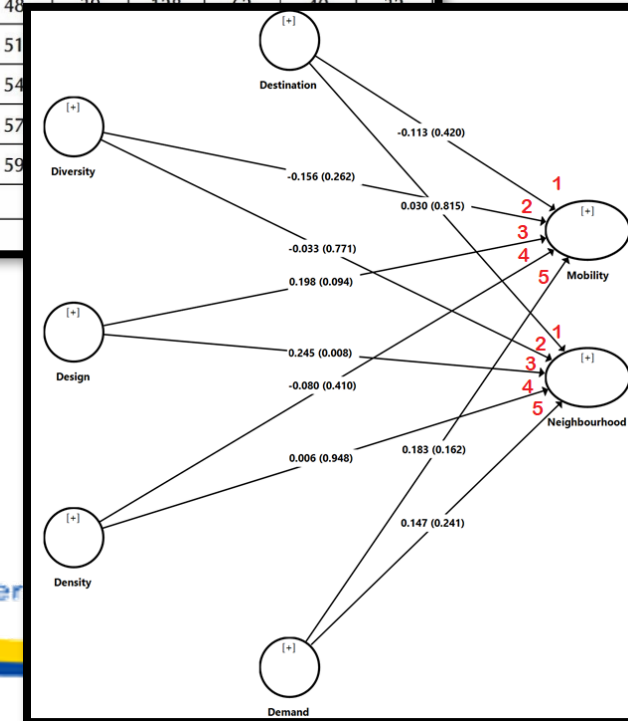
Exhibit 1.7 Sample Size Recommendation a in PLS-SEM for a Statistical Power of 80%

Maximum Number of Arrows Pointing at a Construct	Significance Level											
	1%				5%				10%			
	Minimum R ²				Minimum R ²				Minimum R ²			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	62	40	32
7	228	109	69	56	166	80	51	42	136	66	42	34
8	238	114	73	59	174	84	54	45	144	70	44	36
9	247	119	76	62	181	88	57	48	152	74	46	38
10	256	123	79	64	189	91	59	51	160	78	48	40

Source: Cohen, J. A power primer. Psychological Bulletin, 112, 155-159.

Cohen (1992) as recommended by Hair et al. (2012)

5 arrows pointed at Quality of Life constructs (Mobility & Neighbourhood)



POPULATION & SAMPLING

CASE STUDY

POPULATION

KTM Commuter Northern Sector railway stations

SAMPLING FRAME

22 stations from Padang Besar, Perlis to Padang Rengas, Perak.

SAMPLING TECHNIQUE

Purposive sampling: 7 potential stations

UNIT OF ANALYSIS

Individual location

DATA COLLECTION MODE

Site observation and request from PLANMalaysia Perlis, Kedah & Penang





FINDINGS

1. Demographic information
2. Construct validity & reliability
3. Level of Financial Well-Being
4. Significance of hypothesised relationships

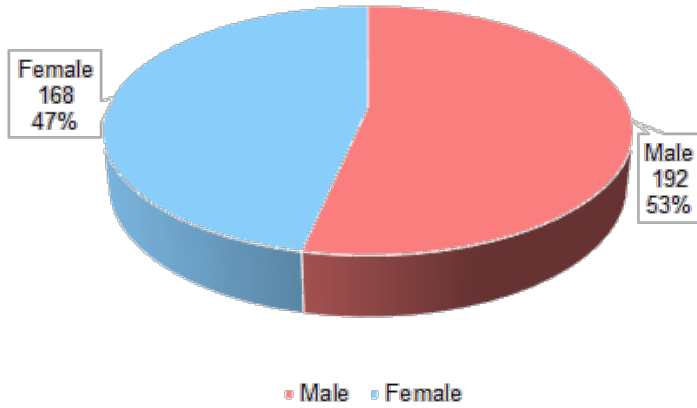


DEMOGRAPHIC INFORMATION

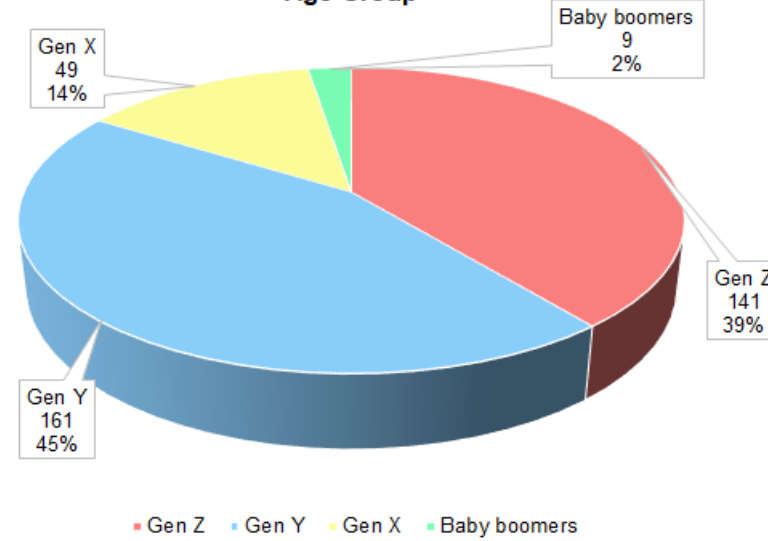
RESIDENTS



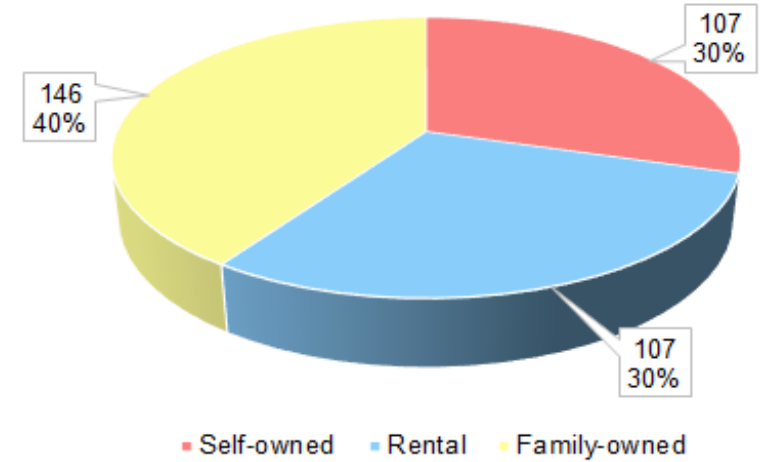
Gender



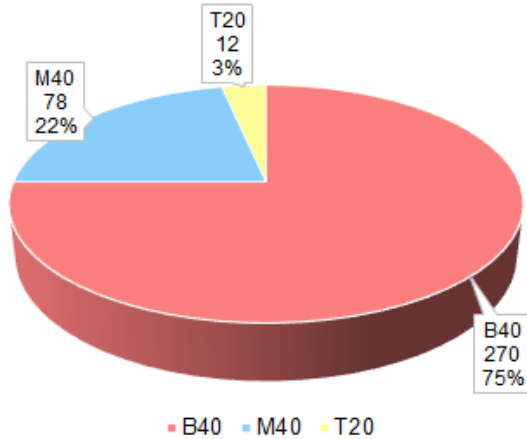
Age Group



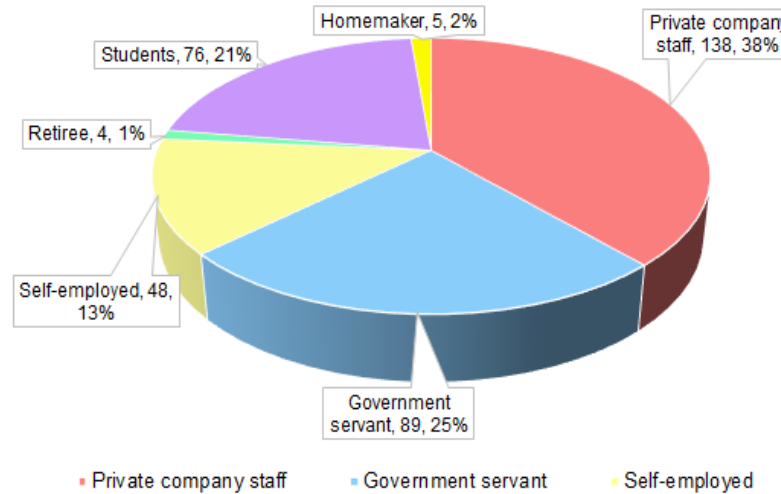
Home Ownership



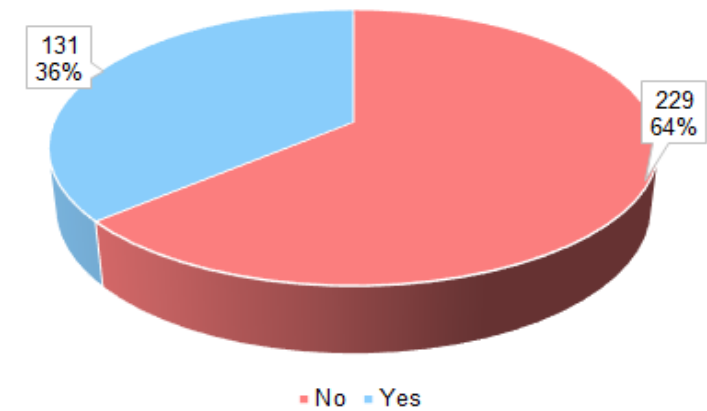
Household Group



Job Group



Head of Family

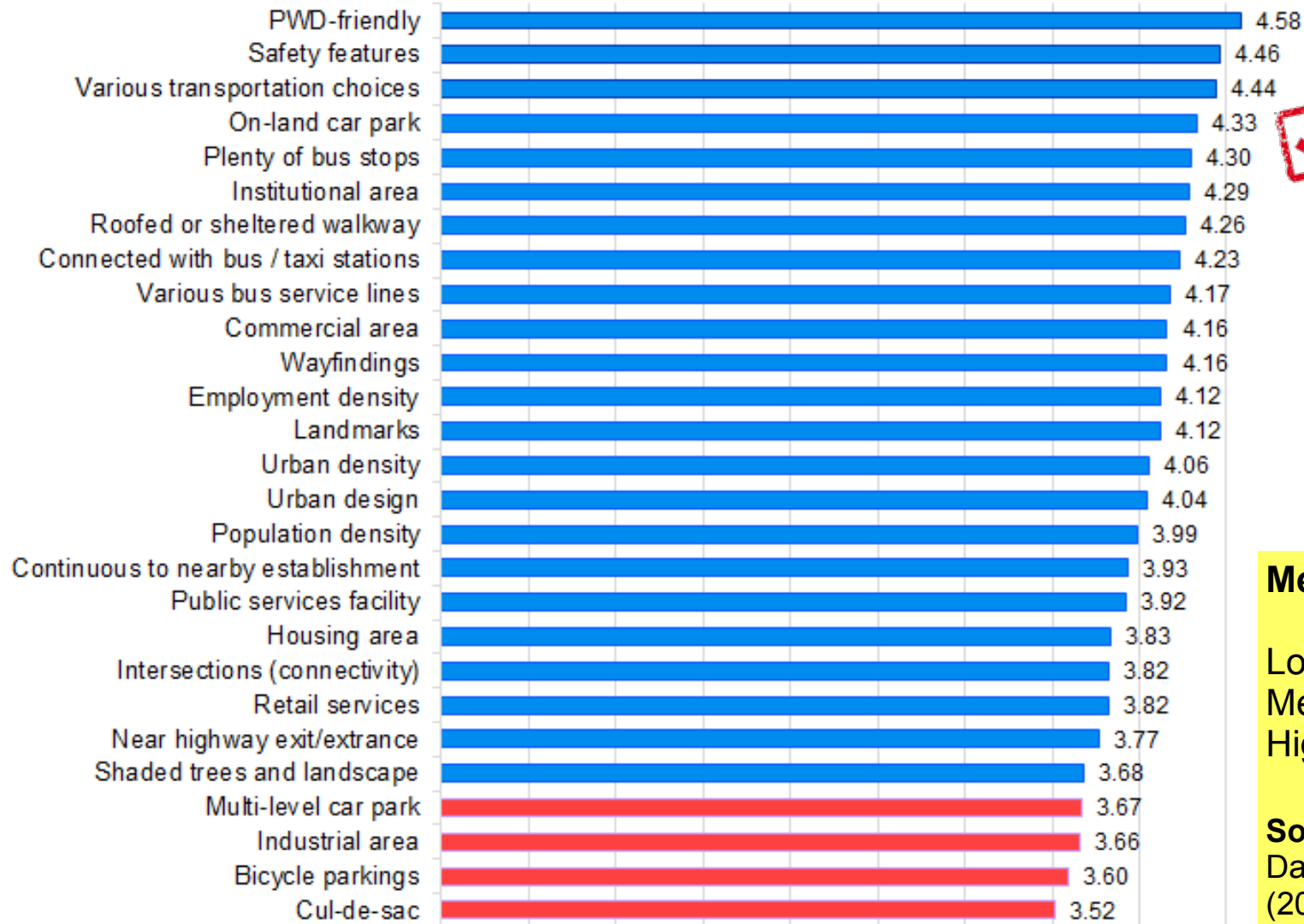




Findings for Research Objective 1



TOD Indicators' Mean Scores (Residents)



RO1

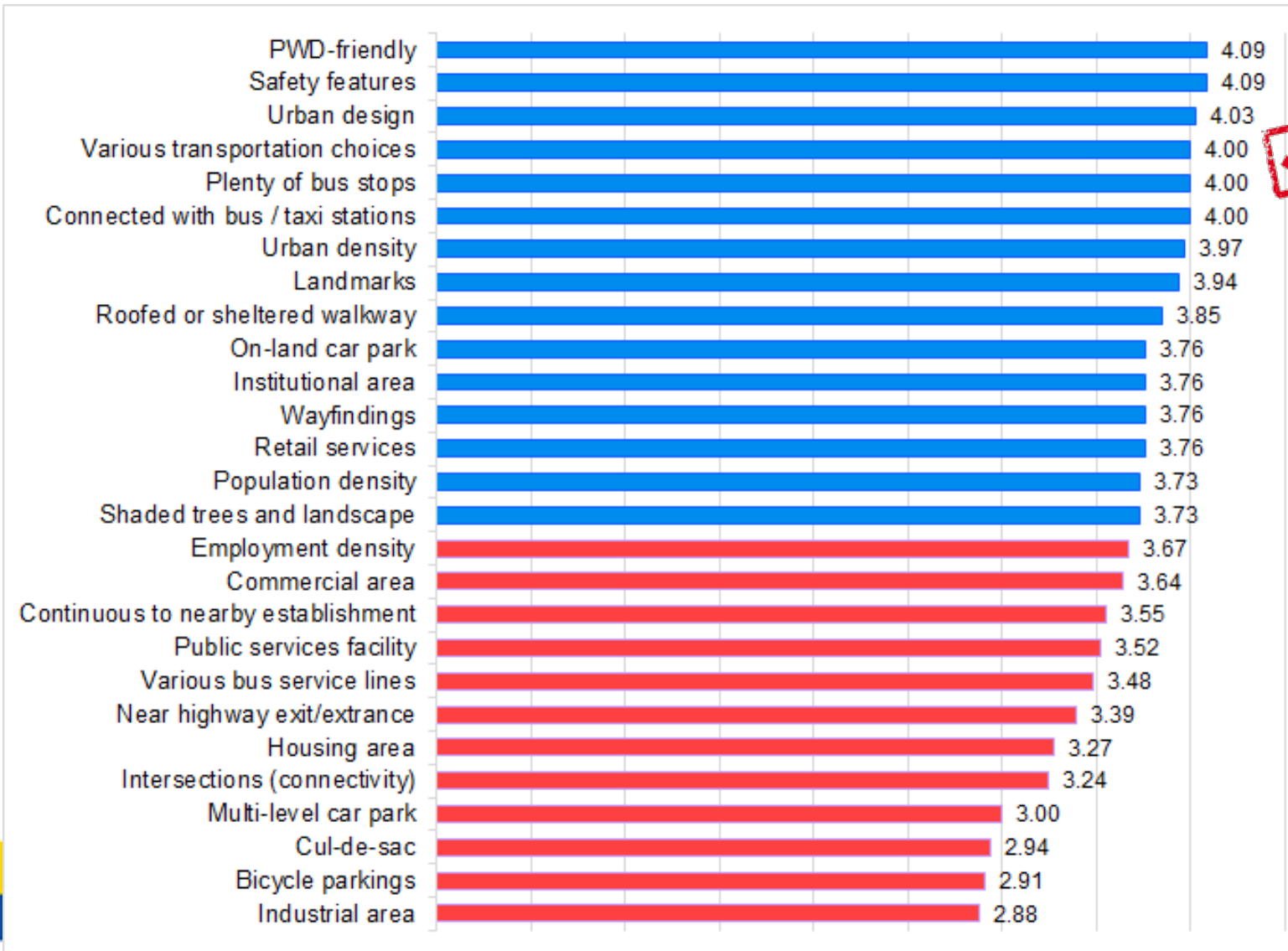


Mean Thresholds

Low: 1.00 to 2.33
 Medium: 2.34 to 3.67
 High: 3.68 to 5.00

Source:
 Darusalam and Hussin
 (2018)

TOD Indicators' Mean Scores (Retailers)



RO1

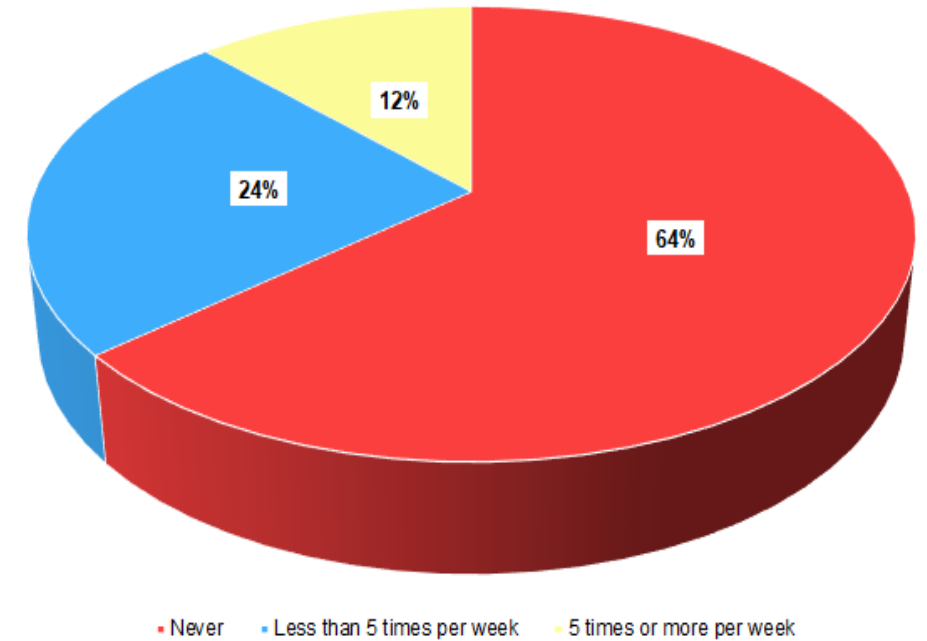
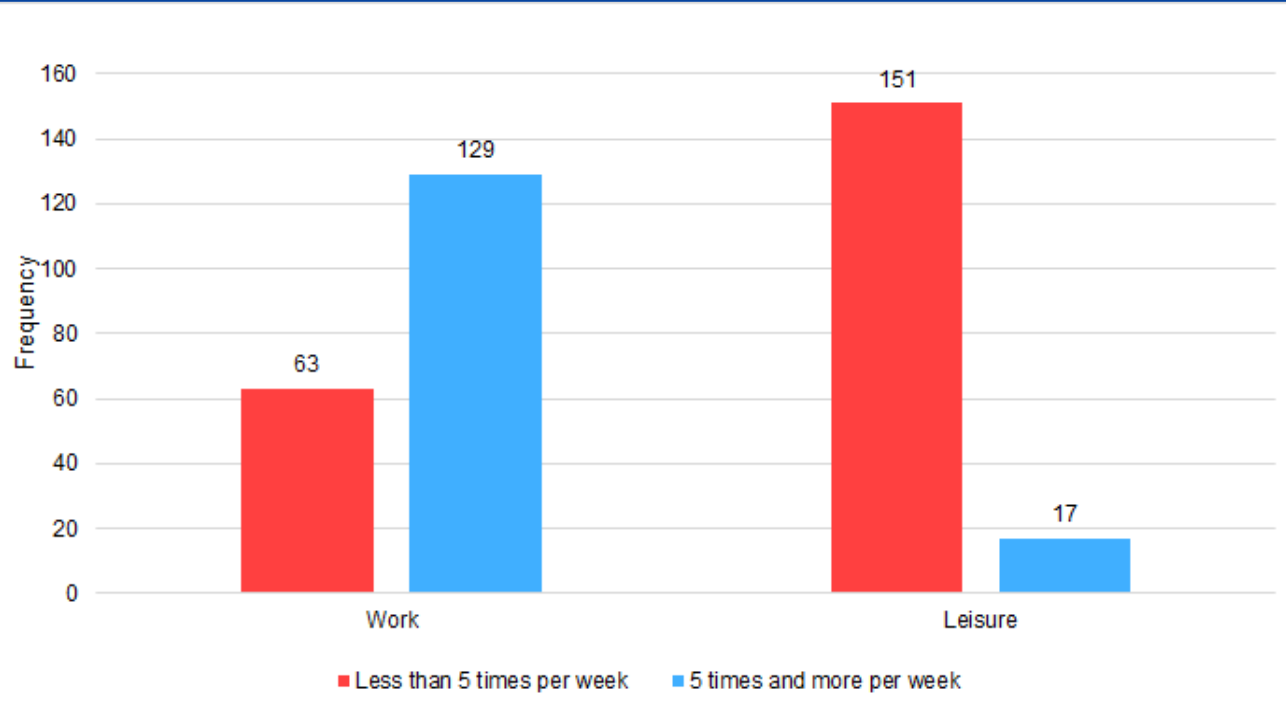


Mean Thresholds

Low: 1.00 to 2.33
 Medium: 2.34 to 3.67
 High: 3.68 to 5.00

Source:
 Darusalam and Hussin
 (2018)

PATTERNS IN TRAVEL BEHAVIOUR



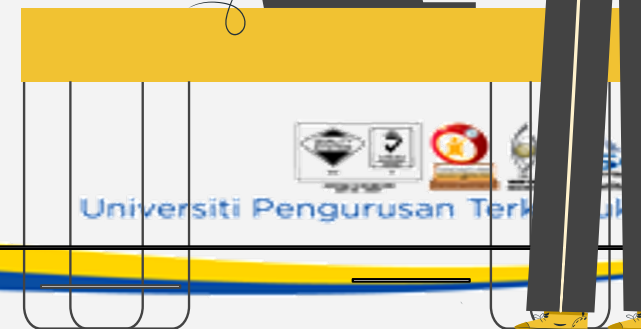
There was a **significant difference** in travel behaviour patterns between respondents who travel for **work** and travel for **leisure** at $p < 0.001$.

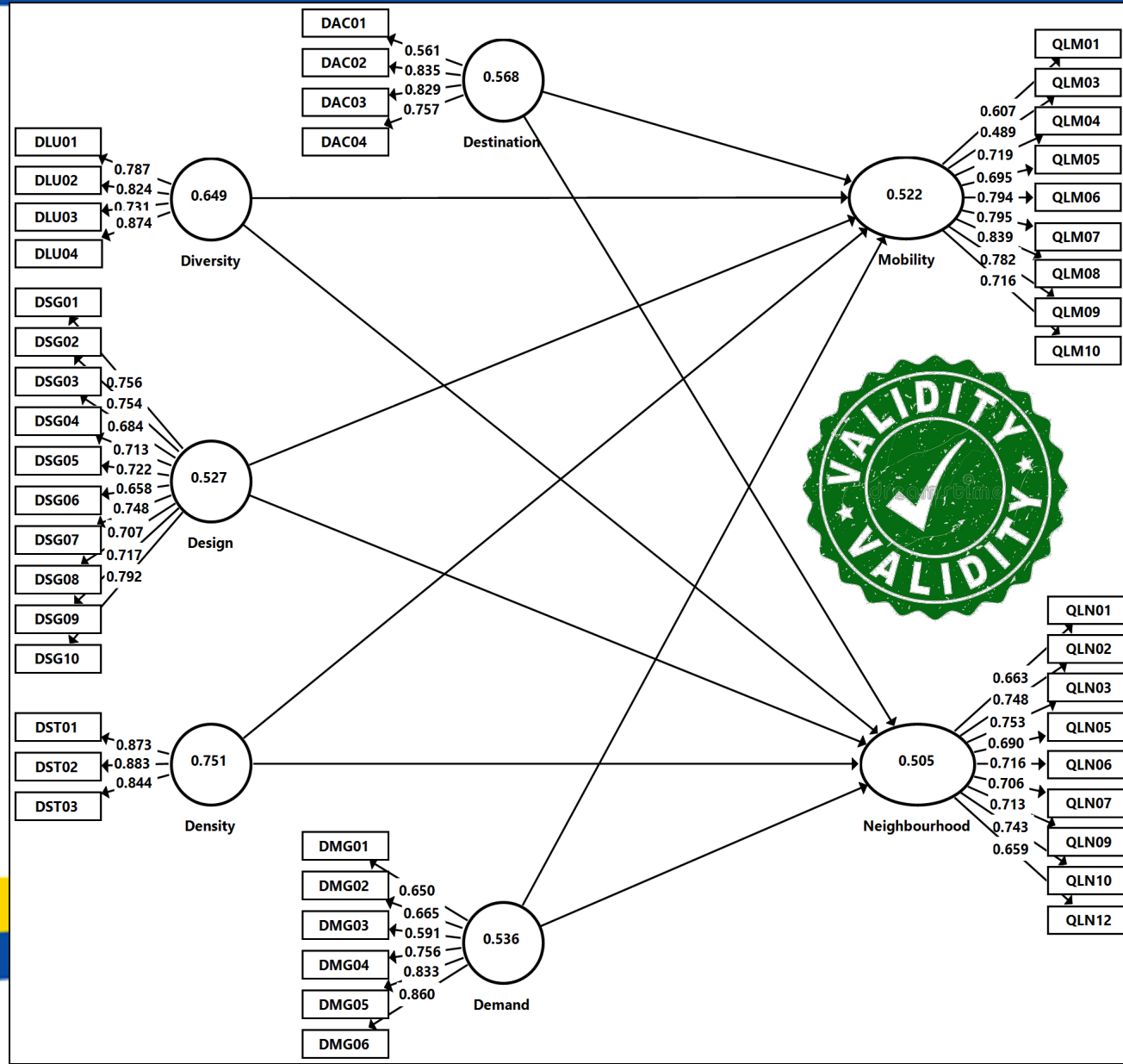
Majority of respondents from retail sector **NEVER** ride the train, despite working at the station or within 500m from the station.

Therefore, the analysis for testing causal relationships between TOD critical success factors and TOD benefits need to be **performed separately according to different travel purposes**.



Findings for Research Objective 2





Threshold
 Convergent validity:
 $AVE > 0.5$
Source:
 Hair et.,al (2019)



	Demand	Density	Design	Destination	Diversity	Mobility	Neighbourhood
Demand							
Density	0.582						
Design	0.763	0.478					
Destination	0.831	0.582	0.707				
Diversity	0.651	0.633	0.469	0.522			
Mobility	0.172	0.114	0.185	0.123	0.159		
Neighbourhood	0.313	0.187	0.359	0.254	0.186	0.639	



Threshold

Discriminant validity:

HTMT < 0.85

Source:

Hair et.,al (2019)

Residents: Travel for Working



RO2

CONTINUE...

✓ ACCOMPLISHED

Significant impact:

- Design → Mobility
- Design → Neighbourhood

Threshold

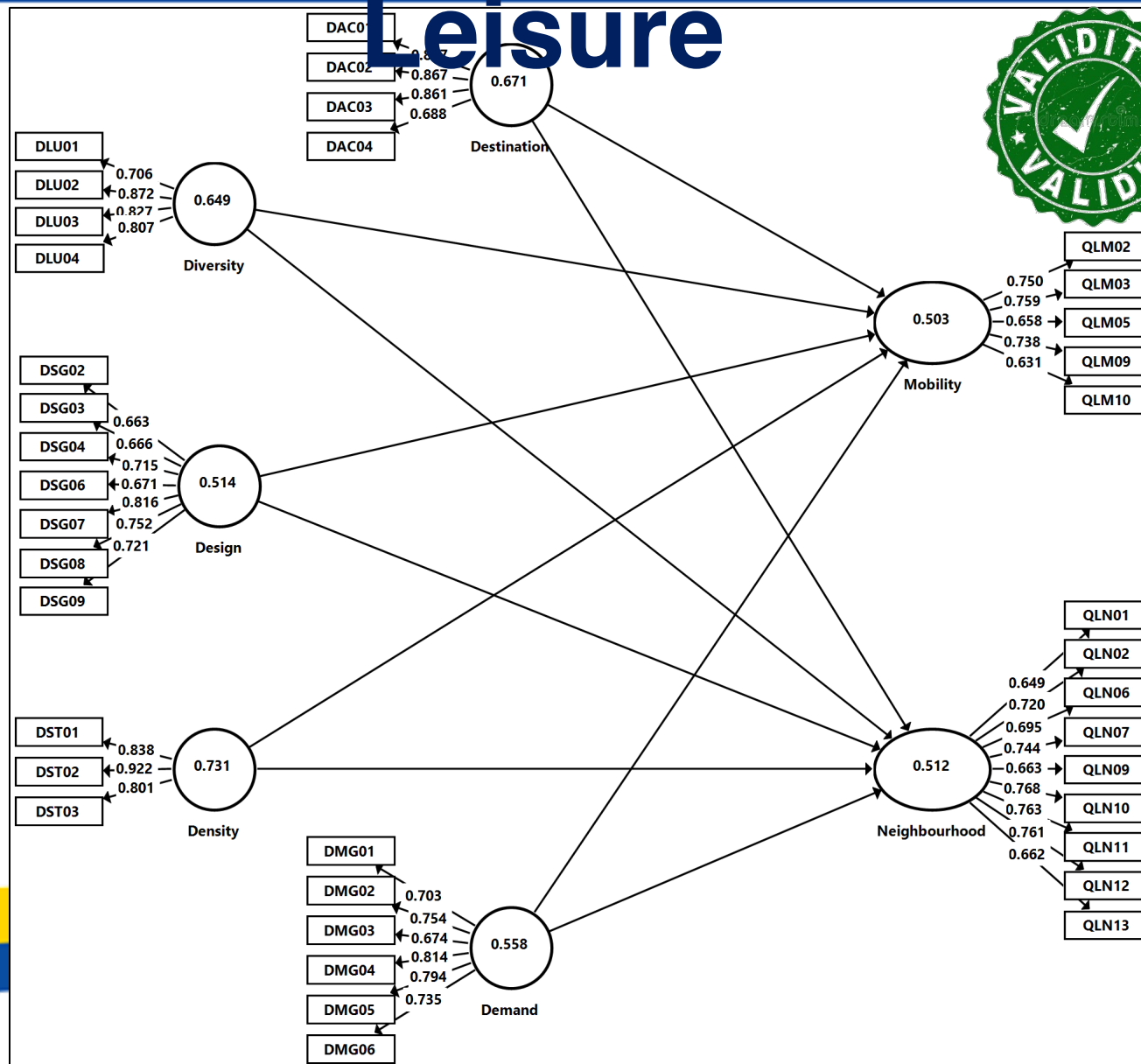
T statistics > 1.65

P values < 0.05

Source:

Hair et.,al (2019)

Relationships	Path Coefficients (β)	T Statistics	P Values
Demand → Mobility	0.183	1.398	0.081
Demand → Neighbourhood	0.147	1.134	0.128
Density → Mobility	-0.080	0.792	0.214
Density → Neighbourhood	0.006	0.062	0.475
Design → Mobility	0.198	1.667	0.048
Design → Neighbourhood	0.245	2.585	0.005
Destination → Mobility	-0.113	0.804	0.211
Destination → Neighbourhood	0.030	0.228	0.410
Diversity → Mobility	-0.156	1.117	0.132
Diversity → Neighbourhood	-0.033	0.287	0.387



Threshold
Convergent validity:
 $AVE > 0.5$
Source:
 Hair et.,al (2019)

Residents: Travel for Leisure

CONTINUE...



Constructs	Demand	Density	Design	Destination	Diversity	Mobility	Neighbourhood
Demand							
Density	0.562						
Design	0.742	0.677					
Destination	0.758	0.605	0.759				
Diversity	0.519	0.579	0.547	0.581			
Mobility	0.245	0.220	0.410	0.351	0.196		
Neighbourhood	0.377	0.340	0.461	0.365	0.403	0.727	



Threshold

Discriminant validity:

HTMT < 0.85

Source:

Hair et.,al (2019)



R02

Leisure

CONTINUE...

✓ ACCOMPLISHED

Threshold

T statistics >
1.65

P values <
0.05

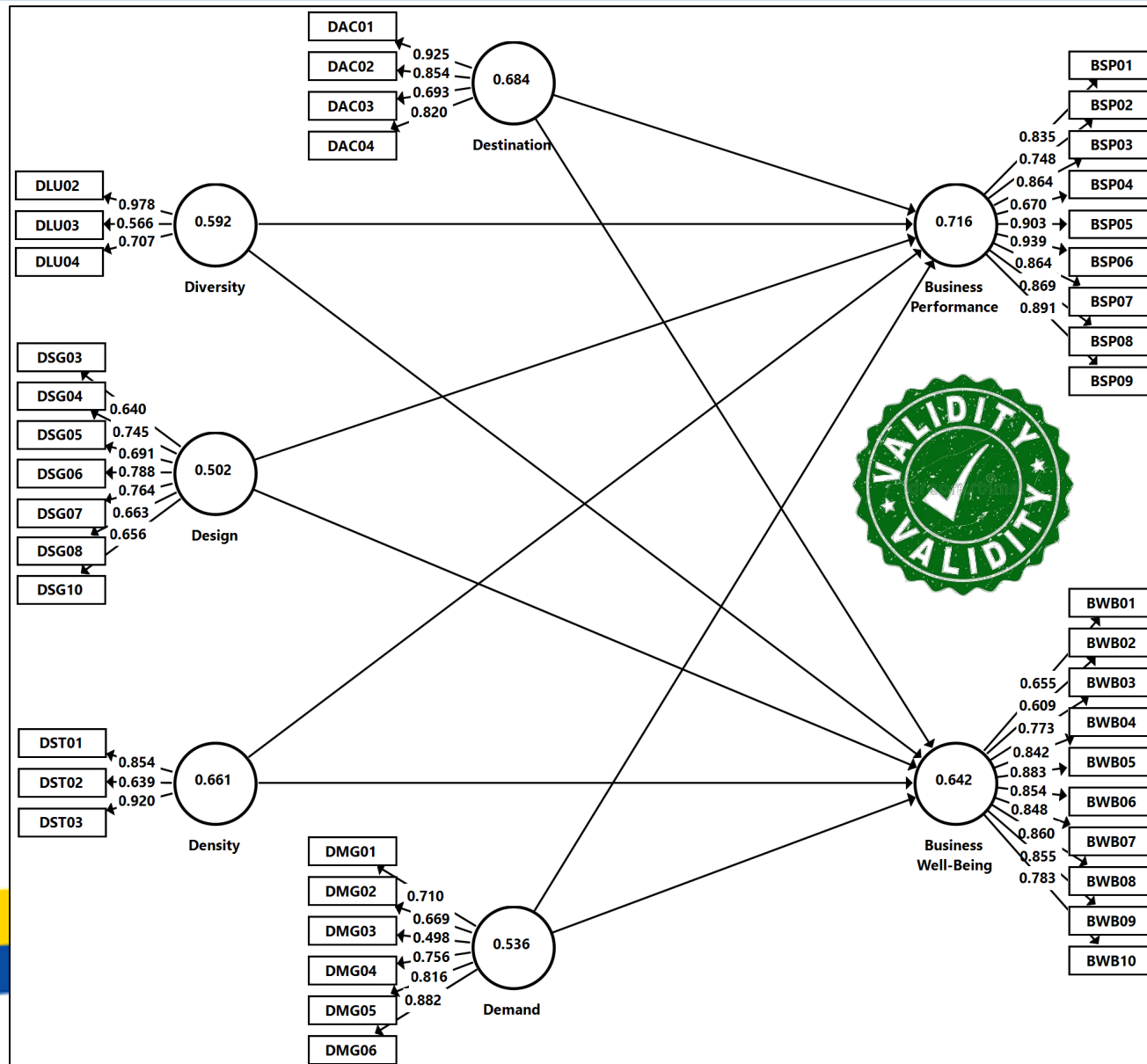
Source:

Hair et.,al
(2019)

Relationships	Path Coefficients (β)	T Statistics	P Values
Demand → Mobility	-0.075	0.615	0.269
Demand → Neighbourhood	0.078	0.790	0.215
Density → Mobility	-0.050	0.413	0.340
Density → Neighbourhood	-0.005	0.057	0.477
Design → Mobility	0.334	3.024	0.001
Design → Neighbourhood	0.246	2.416	0.008
Destination → Mobility	0.159	1.189	0.117
Destination → Neighbourhood	0.006	0.065	0.474
Diversity → Mobility	-0.007	0.067	0.473
Diversity → Neighbourhood	0.245	3.018	0.001

Significant impact:

- Design → Mobility
- Design → Neighbourhood
- Diversity → Neighbourhood



Threshold
Convergent validity:
 $AVE > 0.5$
Source:
 Hair et.,al (2019)



Constructs	Business Performance	Business Well-Being	Demand	Density	Design	Destination	Diversity
Business Performance							
Business Well-Being	0.833						
Demand	0.298	0.417					
Density	0.523	0.484	0.432				
Design	0.253	0.305	0.607	0.648			
Destination	0.288	0.378	0.547	0.432	0.553		
Diversity	0.192	0.181	0.530	0.424	0.625	0.399	

Threshold

Discriminant validity:

HTMT < 0.85

Source:

Hair et.,al (2019)





RO2



Threshold

T statistics >
1.65

P values <
0.05

Source:

Hair et.,al
(2019)

Relationships	Path Coefficients (β)	T Statistics	P Values
Density → Business Performance	0.431	2.144	0.016
Density → Business Well-Being	0.324	1.674	0.047
Design → Business Performance	0.045	0.128	0.449
Design → Business Well-Being	0.275	0.797	0.213
Diversity → Business Performance	0.055	0.214	0.415
Diversity → Business Well-Being	-0.132	0.494	0.311
Demand → Business Performance	0.242	0.796	0.213
Demand → Business Well-Being	0.371	1.408	0.080
Destination → Business Performance	0.174	0.575	0.283
Destination → Business Well-Being	0.196	0.749	0.227

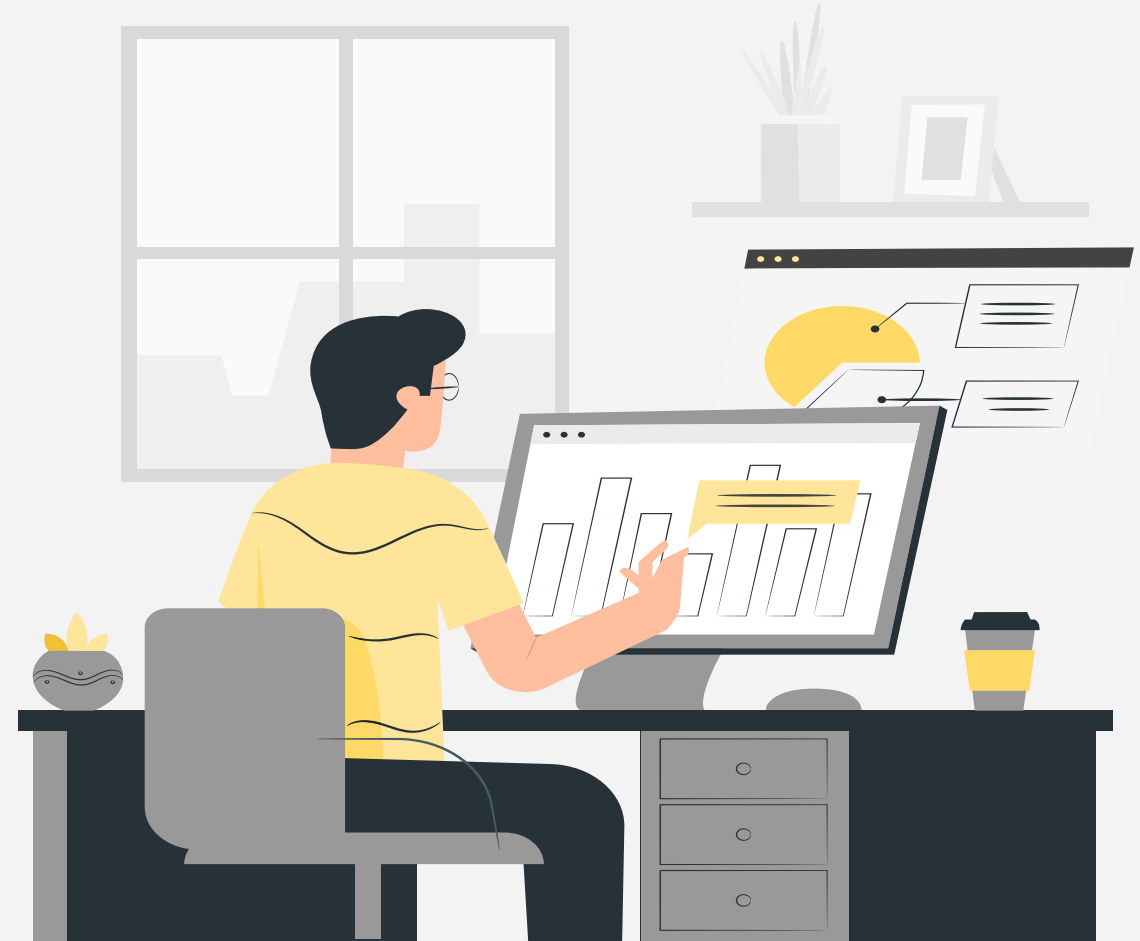
Significant impact:

- Density → Business Performance
- Density → Business Well-Being



CONCLUSION

1. Contributions
2. Concluding Remarks



Contributions

Conceptualising a variable from different perspective

Conceptualised critical success factors from 5 unique TOD principles; 1. Diversity, 2. Density, 3. Design, 4. Destination & 5. Demand

Conceptualised Quality of Life from two different perspectives; 1. residents and 2. retailers

Searching for new relationships in a phenomenon of interest

Established relationships between 5 TOD principles and 4 domains of Quality of Life (i.e., Neighbourhood, Mobility, Business Performance & Business Well-Being)

TRANSIT ORIENTED DEVELOPMENTS



— Quoquab and Mohammad (2018)

Practical Contributions



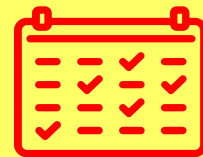
Assist Urban Planners & Policy-Makers

in making inclusive decisions regarding TOD strategic planning and policies.



Walkable Design

Highlight the importance of walkable design to realise quality of life from the perspective of residents



Identify Critical Factors

To develop potential train station areas into a full-fledged TOD city



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