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**DEVELOPMENT OF THE TRAVEL SATISFACTION SCALE (TSS)
FOR THE ASSESSMENT OF COMMUTERS' SATISFACTION IN
PUBLIC TRANSPORT: EVIDENCE FROM DELHI METRO (INDIA)**

Summary. The Travel Satisfaction Scale (TSS) was created to gauge public opinion on Delhi Metro travel. It has two affective dimensions and one cognitive dimension. This study leverages data from the Delhi Metro commuter trips to undertake new tests because there has been little research on its reliability and structure in the past. Differences in the TSS's reliability and structure – notably for the Delhi Metro and the demographics of the region – are also considered. Finally, the outcomes of this study imply that a single dimension of the affective dimension, rather than the two sub-dimensions, provides a better fit for the Delhi Metro, as well as other public transportation infrastructures in developing countries like India. Individual objects do not load on the two emotional dimensions as intended in a three-dimensional structure, which is more suited for public transportation. Two of the scale's elements – enthusiastic/bored and relaxed/hurried – were associated with the other items in a previous study differing from ours. Researchers should adapt the structure of the TSS in the future by adding or replacing some items with alternate options, which will make it easier to collect data and reduce

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the burden on the respondent, as well as increase the reliability of the data while maintaining the TSS's consistency and balance.

Keywords: Delhi metro, travel satisfaction scale, emotions dimension, affective dimensions, cognitive dimension, public transportation

1. INTRODUCTION

1.1. Background and need for the study

The Travel Satisfaction Scale (TSS) was developed by a group of researchers to assess people's satisfaction with mobility, and it has since become crucial and one of the most important aspects of social sustainability. Because of its potential contribution to subjective well-being [5], travel pleasure can be employed as a measure of the quality of life and urban liveability. Future TSS research may choose to employ the TSS framework by removing some items or substituting them with other options, reducing the burden on researchers and improving the TSS internal consistency. This will allow determining whether travel satisfaction is a valid measure of satisfaction in the field and a good indicator of city liveability and quality of life.

The purpose of the survey of local perceptions and related travel satisfaction is to draw attention to the subject of transportation research [2]. The quality of travel is an important issue to consider while promoting public transportation, as it leads to increased use of the mode and makes it more suited for daily commuters. Long-term contentment, mode of travel, attitude/preference, and residential location are all factors in determining travel satisfaction. The level of pleasure with the travels shifted because of these connections. We suggest a continuous procedure that can build travel habits by playing a continuous role.

Delhi is the capital of India as well as the hub of commercial activities in the country, due to which commute is a significant part of the lightning-fast life of the city. Considering the quality of life in the urban areas, travel satisfaction plays a major role in the entire life satisfaction or well-being of the residents of the city [12]. From the transportation planning perspective, it is important to provide a good and satisfactory public transport infrastructure so that it is preferred over the other transport modes, leading to reduced emissions and limiting the stress of traffic congestion. Public transportation is also an affordable mode of transportation over others; it is aimed to make life easy in urban areas from an economic standpoint.

The Delhi Metro played a key role in ushering in a new era in India's mass urban transportation system. For the first time in India, the sleek and modern Metro system brought pleasant, air-conditioned, and environmentally friendly services, radically revolutionizing the mass transit landscape in not only the National Capital Region but also the entire country. The DMRC today stands out as a shining example of how a mammoth technically complex infrastructure project can be completed before time and within budgeted cost by a government agency, having built a massive network of about 389 km with 285 stations.

1.2. Recent literature on travel satisfaction scale

Studies for the most part since 2010 show that movement fulfilment-incorporating fulfilments with explicit outings and generally fulfilments with trips are influenced by an assortment of components (counting mode choices, travel period, travel mentalities). Nonetheless, these investigations are frequently extremely divided and deficient, given that a large portion of them only spotlights a couple of angles that influence travel fulfilments and do

not think about numerous two-way connections. In the accompanying areas, we will clarify how travel fulfilments have a two-way relationship with long term satisfaction, the decision of commute pattern, travel-related perspectives, and location of home. Past research has identified several characteristics and methodological issues that are critical considerations in the development and application of an appropriate methodology to analyse travel satisfaction.

De Vos [15] developed a Scale for Travel Satisfaction (STS) to evaluate commuters' satisfaction with daily trips. His study consists of two affective dimensions and one cognitive dimension, tested using leisure travel data from Ghent (Belgium). The results show that assigning one latent dimension to sentiment instead of two provides a better fit than the Ghent data. For public transportation and strolling, a three-dimensional construction is more suitable, albeit a solitary component is not stacked in the two enthusiastic measurements true to form. Future examination using STS might wish to change the construction of the STS by discarding certain components or supplanting them with options, as this might decrease the weight on respondents and increment the inside consistency of STS.

Börjesson [1] focused on attributes that stand out from the rest in some way, which is primarily crowding. In the centre of Stockholm, overcrowding is the attribute with the lowest satisfaction and the only attribute where satisfaction has declined over time. For reliability and congestion attributes, data allows us to compare satisfaction and importance to performance. They found that satisfaction and importance are affected by the performance level of these two attributes.

Vickerman [15] found that Covid-19 has had a major impact on public transport systems in the United Kingdom. This article explores the challenges this poses to the current methods of public transport service delivery and believes that as public transport adjusts to the new normal of more family work and fear of crowded spaces, it is impossible to simply restore the status quo. Although the British government, like many other governments around the world, has taken steps to provide funding to allow services to continue functioning during the pandemic. This article believes that this situation requires a more fundamental approach to the entire long-term transportation policy and not just a model approach.

Lunke [10] demonstrated that effective vehicle courses with short holding up time and solid time use are a higher priority than the brief distance to stations and direct course. The examination depends on a far-reaching travel study in Oslo, Norway. This examination adds to the literature on drive satisfaction by investigating how the various qualities of public vehicle ventures influence individuals' satisfaction with their drives. The discoveries in this investigation are helpful for strategy producers arranging public vehicle administrations. Both to make the help more fulfilling for the current clients and to disclose transport as an alluring option in contrast to vehicle use.

Soulard [14] centres on fostering the Transformative Travel Experience Scale (TTES). It uncovers that a scale made out of four elements of neighbourhood occupants and culture, self-assurance, confusion and satisfaction are effectively used to gauge the interaction and consequences of ground-breaking travel. The scale is exceptionally helpful for associations that need to catch the positive changes achieved by taking an interest in extraordinary travel by applying for accreditations, compensates, and gives. Methodologically, the exploration results show that the distinction between the excursions of progress is that it centres on a blend of forceful feelings, for example, those caught by bliss and bewilderment.

Efthymiou [6] investigated the impact of crisis on public transport users' satisfaction and demand. The analysis uses data from two user satisfaction surveys conducted in Athens in 2008 and 2013, respectively. The results show that, overall, people used public transportation in 2013 more than in 2008. The significant increase in the market share of public transport is contrary

to supporting research, which does not consider the general reduction in travel activities due to increased unemployment.

De Vos [3] returned to the movement satisfaction, with attention on emotional prosperity, travel mode decision, travel-related perspectives and the private area. It shows the connection between movement satisfaction and long haul prosperity, the decision of movement style, travel-related perspectives, and the decision of where to take up residence. Further, it shows that movement satisfaction can assume a significant part in perspective change (away from vehicle use). At the point when satisfaction with driving is medium or high, individuals may not search for elective travel modes. Thus, it gives an outline of things that clarify travel satisfaction and potential travel results.

Mouratidis [11] has given experiences into the connections between drive satisfaction, neighbourhood satisfaction, lodging satisfaction and emotional prosperity. This is one of the principal studies on how satisfaction in driving, satisfaction with the area, satisfaction with lodging, and satisfaction with different everyday issues are identified with various parts of emotional prosperity. These discoveries demonstrate that satisfaction with driving, satisfaction with the area, and satisfaction with lodging are dependable markers of metropolitan liveability. The information was obtained through a study in the metropolitan space of Oslo, Norway, and broken down using underlying condition models.

Humagain [9] identified heterogeneous satisfaction with hypothetical travel time profiles. This study made three contributions between 588 travellers in Portland, Oregon, exploring the answers on a personal level to the questions about the suspicion between the inviting. First, through cluster, identified eight different satisfactions in the travel time profile. Second, model Logit polynomial and order. Third, through visual comparisons, has supported the consistency of the corresponding integrity by supporting past and future research in response to all these questions about the essential utility of travel time.

The literature review finds that limited numbers of studies are available on the determination of commute satisfaction based on psychological factors. Most of the studies are based on the service quality and cost-benefit analysis of the trip. This study tries to fill the gap between the well-being concepts associated with commute satisfaction.

1.3. Motivation and objective of the study

The objective of this study is to understand the effect of the psychological factors, which are important in the well-being of commuters in urban areas. With the consideration of all three prominent aspects, which are social, economic and geographical for the public transportation travel, such kind of study is quite important in looking at today's scenario of urban liveability. These kinds of studies are much required for developing countries like India to understand the urban well-being of the people.

From a transportation planner's perspective, satisfactory public transportation infrastructure is important for the urban growth of the country, wherein issues like congestion, expensive mobility, etc., can be resolved. Emissions reduction is also a factor, which can contribute through the right usage of public transport services, leading to a decrease in the number of private vehicles on the road with fewer pollution issues, thus resulting in a healthy urban life.

2. STUDY METHODOLOGY

Overall satisfaction with the Delhi Metro is employed as an independent variable in this study. Specific service quality factors such as public transportation departure frequency, journey time, punctuality, price, information, cleanliness, staff behaviour, comfort, seat availability, metro platform security, safe from accident, on board security, platform condition, and information in the metro are dependent variables which all contributes to the nine items on the travel satisfaction scale. Data was gathered using a questionnaire, which is the most typical approach for evaluating similar goals.

The questionnaire is constructed of three parts:

1. Demographics, including age, sex, driving licence, access to private transportation, and recommendations to use public transportation according to the city in which they live.
2. Trip pattern behaviour, which includes routine commuting patterns, commute purpose, journey distance, travel time, number of commute days per week, majority daily mode of transportation, and public transport usage patterns.
3. Finally, responses were recorded on the travel satisfaction scale using the Likert scale, which contains the two dimensions, cognitive and affective, and further distributed in the nine sub-points.

Service quality items that are measured are derived from Friman's findings [8] for public transport, such as reliability, employee, and simplicity and design. Respondents were asked to record their satisfaction to the components of complete satisfaction and 13 items in the specific quality attribute for public transport. The Likert-type scale rate ranged from strongly disagree, disagree, neutral, and agree and strongly agree.

The respondents are asked to fill out the questionnaire at the offices or stops. The new system is supposed to deliver higher quality with concern to specific station conditions and security on board (because the door is closed). The data indicates satisfaction with the traditional public transport system, which is crucial information for the Public Transport Authority if it wants to expand the number of people who use public transport in the future.

Data were collected by handing out the questionnaire in different offices by instructed surveyors. This data collection method was used since it may be hard to find people that are willing to participate at the platform. People waiting at stations are often in a hurry, and thus, reluctant to fill out the questionnaire before the metro arrives. Data were collected at 8-10 in the morning and 3-5 in the afternoon. The filled out questionnaires were administrated and coded by one survey person on each station as much as possible. These surveyors were chosen due to their experience in handling similar surveys to make sure that all data were handled in the same way. Guidance for coding was provided to guarantee an equal administration.

The goal of this study is to determine total customer satisfaction and investigate the factors that influence it the most. The questionnaire is the most common tool to explore similar aims. The collected data will be analysed using a statistical method. To summarize and rearrange the data, several interrelated procedures are performed during the data analysis stage. The statistical tool, SPSS, was used for data input and analysis.

3. DESCRIPTIVE ANALYSES OF COLLECTED DATA SAMPLES

This section prominently focuses on the quantitative analysis of the samples collected for evaluation. Data analysis was carried out in two ways, the first one is to measure all data collected to investigate the socio-demographics of the respondents. In the second analysis, data was analysed according to the two dimensions of the scale for travel satisfaction, which were emotions (affective dimension) and cognitive evaluation based on the perception of real-life conditions.

A total of 300 questionnaires were filled out and accepted for further analysis. The respondent consisted of 222 men and 78 women. The age range of respondents consisted of 9.33% less than 18 years; 39.33% aged 18-25 years; 26% aged 26-40 years; 18.33% aged 41-60 years; 7.01% were older than 60 years. Education qualification of respondents consisted of 7.67% who were illiterate; 15.33% were 10th standard; 19% were 12th standard; 36% were graduate; 19.67% were postgraduate; 2.33% were PhD holders. Employment of the respondents consisted of 20.33% who were self-employed; 16.33% were government employees; 23% were private employees; 5.33% were homemakers; 5.67% were retired from jobs; 27.34% were unemployed.

Monthly income of the respondents consisted of 37.33% who were not earning; 18.33% were earning up to 15000 rupees; 27.67% were earning between 15000-50000 rupees; 10.33% were earning between 50000-90000 rupees; 4.67% were earning between 90000-150000 rupees; 1.67% were earning more than 150000 rupees. Many respondents were not having two-wheelers (57.67%). Single two-wheeler owners were 38.33%; double two-wheeler owners were 3.33%; 0.67% were owners of more than two two-wheelers. Most of the respondents did not own four-wheelers (78.67%). Single four-wheeler ownership was 15.33%; double four-wheeler ownership was 4.67%; 1.33% were owners of more than two four-wheelers.

Out of all, 47% of the respondents had no driving licence. While the rest of them, 16.33% of the respondents had only two-wheeler licence, 34.67% had both two-wheeler and four-wheeler licences. Most of the trips were work-related trips (40.33%). After that, 17.67% had a study-related purpose for the trip, and 17% of trips were shopping-related. Leisure-related trips were 18.33%. The rest of them were other trips whose purpose was not specified in the questionnaire. Many respondents commuted daily (41 %). Some of them commuted 3-4 times a week (17.33%); 41.67% of them rarely commuted (Table 1).

Tab. 1

Socio-demographic characteristics of respondents

| <i>Sample characteristics</i> | <i>Numbers</i> | <i>Percentage (%)</i> |
|---------------------------------------|----------------|-----------------------|
| <i>Gender</i> | | |
| Male | 222 | 74.00 |
| Female | 78 | 26.00 |
| <i>Age of respondents</i> | | |
| <18 | 28 | 9.33 |
| 18-25 | 118 | 39.33 |
| 26-40 | 78 | 26.00 |
| 41-60 | 55 | 18.33 |
| >60 | 21 | 7.01 |
| <i>Education qualification</i> | | |
| Illiterate | 23 | 7.67 |

| | | |
|---|-----|-------|
| 10th standard | 46 | 15.33 |
| 12th standard | 57 | 19.00 |
| Graduation | 108 | 36.00 |
| Post graduation | 66 | 22.00 |
| Employment type | | |
| Self-employee | 61 | 20.33 |
| Govt. employee | 49 | 16.33 |
| Private employee | 69 | 23.00 |
| Retired | 17 | 5.67 |
| Unemployed | 104 | 34.67 |
| Personal monthly income (in Rs.) | | |
| Zero | 104 | 34.67 |
| 0-15000 | 63 | 21.00 |
| 15000-50000 | 83 | 27.67 |
| 50000-90000 | 31 | 10.33 |
| 90000-150000 | 14 | 4.67 |
| >150000 | 5 | 1.67 |
| Number of two-wheelers | | |
| Zero | 173 | 57.67 |
| One | 115 | 38.33 |
| Two | 10 | 3.33 |
| More than two | 2 | 0.67 |
| Number of four-wheelers | | |
| Zero | 236 | 78.67 |
| One | 46 | 15.33 |
| Two | 14 | 4.67 |
| >Two | 4 | 1.33 |
| Driving licence | | |
| No | 141 | 47.00 |
| Only two-wheeler driving licence | 49 | 16.33 |
| Only four-wheeler driving licence | 6 | 2.00 |
| Both | 104 | 34.67 |
| Purpose of trip/journey | | |
| Work | 121 | 40.33 |
| Study | 53 | 17.67 |
| Shopping | 51 | 17.00 |
| Leisure | 55 | 18.33 |
| Other | 20 | 6.67 |
| Frequency of trips | | |
| Daily | 123 | 41.00 |
| 3-4 times a week | 52 | 17.33 |
| 1-2 times a week | 60 | 20.00 |
| Rarely | 65 | 21.67 |

Most commuters had a metro card (69.33%). The rest respondents used ticket tokens.

Tab. 2

Reason for using the Delhi Metro over other transportation modes

| <i>Reason for using the Metro(Multiple correct options)</i> | <i>Percentage (%)</i> |
|---|-----------------------|
| Affordable price | 73 |
| Travel comfort | 77.67 |
| Less travel time | 72.67 |
| Safety | 48.67 |
| Only travel mode option | 28 |
| Environmental concern | 39.67 |
| Easily accessible | 31.33 |
| Other | 1.33 |

The reason above (Travel comfort) promotes the use of the metro by the respondent over the other modes of transportation considering all possible factors like economical, time-based, safety-related and environmental concerns (Table 2).

| Two-Dimensions | Three dimensions | Negative | -3 | -2 | -1 | 0 | 1 | 2 | 3 | Positive |
|----------------------------|--|--|-----------|-----------|-----------|----------|----------|----------|----------|---------------------------------------|
| <i>Affective dimension</i> | <i>Positive activation – Negative deactivation</i> | <i>Bored</i> | ● | ● | ● | ● | ● | ● | ● | <i>Enthusiastic</i> |
| | | <i>Fed up</i> | ● | ● | ● | ● | ● | ● | ● | <i>Engaged</i> |
| | | <i>Tired</i> | ● | ● | ● | ● | ● | ● | ● | <i>Alert</i> |
| | <i>Positive deactivation – Negative activation</i> | <i>Stressed</i> | ● | ● | ● | ● | ● | ● | ● | <i>Calm</i> |
| | | <i>Worried</i> | ● | ● | ● | ● | ● | ● | ● | <i>Confident</i> |
| | | <i>Hurried</i> | ● | ● | ● | ● | ● | ● | ● | <i>Relaxed</i> |
| <i>Cognitive dimension</i> | <i>Cognitive evaluation</i> | <i>Travel was worst I can think of</i> | ● | ● | ● | ● | ● | ● | ● | <i>Travel was best I can think of</i> |
| | | <i>Travel was low standard</i> | ● | ● | ● | ● | ● | ● | ● | <i>Travel was high Standard</i> |
| | | <i>Travel did not worked out well</i> | ● | ● | ● | ● | ● | ● | ● | <i>Travel worked out well</i> |

Fig. 1. The travel satisfaction scale used in the questionnaire for measuring satisfaction

Based on the above format of scale, travel satisfaction was evaluated based on the two dimensions- affective dimension (emotion) and cognitive evaluation (perception oriented) (Figure 1). Those two dimensions are further divided into positive and negative attributes. The respondents' observations were collected using a Likert scale. More studies on the TSS's fundamental structure and dependability using varied data are still needed. We will see if separating the emotional domain of TSS into two subdomains (based on valence and activation) is the further option, instead of the collective merge of all affective components into a single domain (switching according to valence), are good as compared to previous one.

4. STATISTICAL ANALYSIS AND RESULTS

Commute satisfaction consists of both emotional dimension and cognitive evaluation and is greatest for private vehicles and lowest for public transport journeys according to mode-specific averages from prior studies.

The nine items are all positively associated, but there are significant changes in the collective approach of the attributes (Table 3). Single component on the positive activation/negative deactivation subdomain that has no correlation greater than 0.537 with other components of the scale; however, this is not the case for other adjective pairings on the positive activation/negative deactivation dimensions, such as enthusiastic/bored and engaged/fed up. As observed in the excited and engaged pair computation, the highest correlation coefficients were obtained between components of the same domain (that is, positive activation/negative deactivation, positive deactivation/negative activation and cognitive evaluation). All emotional components (except relaxed with alert) exhibit correlation values greater than 0.4, showing that positive activation and deactivation variables are linked. The cognitive evaluation items are substantially connected ($r > 0.646$), and positive deactivation items appear to be more correlated than the positive activation items. Friman et al. [8] observed similar but greater correlation coefficients. They also discovered that alert/tired had the lowest correlation coefficients within the positive activation dimension.

Tab. 3
Correlations between nine scales, Means and Standardized Deviation

| <i>Positive adjective/statement</i> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Enthusiastic | 1 | | | | | | | | |
| Engaged | 0.780 | 1 | | | | | | | |
| Alert | 0.481 | 0.646 | 1 | | | | | | |
| Calm | 0.516 | 0.491 | 0.537 | 1 | | | | | |
| Confident | 0.422 | 0.458 | 0.490 | 0.664 | 1 | | | | |
| Relaxed | 0.425 | 0.446 | 0.358 | 0.536 | 0.708 | 1 | | | |
| Travel was the best I can think of | 0.371 | 0.422 | 0.356 | 0.409 | 0.534 | 0.517 | 1 | | |
| Travel was of high standard | 0.341 | 0.424 | 0.375 | 0.351 | 0.467 | 0.493 | 0.743 | 1 | |
| Travel worked out well | 0.398 | 0.436 | 0.361 | 0.482 | 0.452 | 0.463 | 0.646 | 0.740 | 1 |
| | | | | | | | | | |
| Mean | 5.34 | 5.29 | 5.18 | 5.25 | 5.33 | 5.33 | 5.55 | 5.54 | 5.60 |
| Standard Deviation | 1.037 | 1.028 | 1.084 | 1.123 | 1.194 | 1.260 | 1.028 | 1.143 | 1.127 |

All respondents' average TSS scores fell between five and six (Table 3). This suggests that respondents are pleased with their most recent travel experiences. The results of two-factor analyses on the nine questions are summarised in Table 4 (Principal axis factoring). The researchers employed an oblique rotation method (that is, promax rotation) to correlate the variables. Due to the oblique rotation, this approach has a high correlation between the older variables and the modified axis (that is, factor loadings). The components should highly relate with the nine TSS scale components to compute the bond among the stated domains of TSS for this study. We observed the stated component structure of TSS using exploratory rather than

confirmatory component analysis to avoid supporting a single hypothesis (for example, two emotional domains) with another (for example, one emotional dimension).

Tab. 4

Pattern matrix and correlation coefficients for the two-factor solution

| <i>Positive statement</i> | <i>Emotions(1.204)*</i> | <i>Cognitive Evaluation(4.936)*</i> |
|------------------------------------|-------------------------|-------------------------------------|
| Engaged | 0.870 | |
| Enthusiastic | 0.861 | |
| Alert | 0.843 | |
| Calm | 0.717 | |
| Confident | 0.503 | |
| Relaxed | 0.363 | |
| Travel was of high standard | | 0.967 |
| Travel was the best I can think of | | 0.906 |
| Travel worked out well | | 0.851 |
| PCC** | 0.583 | |

*factor Eigenvalue, **PCC (Pearson's correlation coefficient)

The two-factor solution accounts for 68.22% of the total variance, and a single-factor structure for affect and cognitive evaluation can be shown; the extracted components have a correlation of 0.583 (Table 4).

Although the affective domain related with positive deactivation (calm/stressed, confident/worried, relaxed/hurried) imposes a greater factor value than the other ones related with positive activation (enthusiastic/bored, engaged/fed up, alert/tired), all items on the factor exhibit positive loadings. The cognitive assessment component is almost identical to the category of the same name in the three-factor solution. The two-factor solution is more obvious than the three-factor solution because all factor loads are relatively high and no element has a higher factor load over other factors. Both factors have eigenvalues that are greater than one. The two-factor method is recommended for these reasons.

Tab. 5

Cronbach's alphas for emotions and cognitive evaluation

| | <i>Emotions</i> | <i>Cognitive evaluation</i> |
|--|-----------------|-----------------------------|
| Cronbach's alpha | 0.870 | 0.880 |
| Cronbach's alpha when excluding | | |
| Enthusiastic | 0.850 | |
| Engaged | 0.841 | |
| Alert | 0.853 | |
| Calm | 0.838 | |
| Confident | 0.836 | |
| Relaxed | 0.855 | |
| Travel was the best I can think of | | 0.851 |
| Travel was of high standard | | 0.785 |
| Travel worked out well | | 0.853 |

Based on the factor analyses discussed above, Cronbach's alphas were determined for TSS with two basic dimensions; an affective dimension and a cognitive dimension (Table 5). Cronbach's alpha is good for both dimensions, and removing negative adjectives does not lead to higher values or more internal consistency. In other words, the emotive component of TSS is more reliable when all negative adjectives are integrated into one dimension rather than two.

Given the association between derived components in two- and three-factor solutions, it is not surprising that a factor analysis extracts a single factor that combines the emotional and cognitive parts of satisfaction. Satisfaction during the trip also brought positive results. With an eigenvalue of 4.93, the single factor explaining 54.84 % of all the variations and the smallest factor load of 0.36 for relaxed/ hurried (as before, the calculation spindle math and promax rotation were used). When the single dimension is computed, the Cronbach's alpha is 0.87, and when relaxed/hurried is removed, it decreases to 0.85.

Although these results suggest that emotions associated with a trip and its cognitive evaluation are clearly linked, we wanted to keep the distinction between emotional and cognitive components consistent with the current concept and idea that judging words like "trip was the best/worst thing I can think of". Among them, high/low quality trips and active/inactive trips require a slower, more deliberate process (assessment is likely to rely more on instinctive and emotional systems).

5. DISCUSSION AND CONCLUSIONS

This study shows a relationship between the emotional dimension and the cognitive dimension, which concludes to find the travel satisfaction of the commuter with the mode choice he opted for. A pen-paper mode survey was conducted in different areas of Delhi, where people access the Delhi Metro services for transit. All possible types of commuters were approached for observing a variety of data and socio-demographics of the respondents. This study gives a clear vision of how travel satisfaction is associated with the psychological factors of the commuters. We found variations in both the number of dimensions and the factor loadings for individual items. A two-factor method – one for affective and the other for cognitive evaluation – is best for other trips, but a three-factor system is best for mass transit.

Rather than these variations observed, the TSS structure was observed throughout the study; this disparity shows the huge variation due to data disparities. According to our findings, the structure of the domains at the core of the TSS is necessarily an empirical question; the structure explained by Ettema [7] not able to be globally accepted. Although collectively all six components related to the affective domain merging into one dimension creates high levels of internal consistency for our data, replacing relaxed/hurried and confident/worried with alternative adjective pairs that have highly contributed to capturing the core affect approach's positive activation/negative deactivation and positive deactivation/negative activation domains may be more prominent to compute.

Alternatively, these items might be replaced with the ones that are more closely related to the valence dimension, allowing the TSS's emotional dimension to focus on negative versus positive emotions throughout the travel with just modest activation variations. It is also adaptable to completely exclude the TSS's negative adjectives relaxed/hurried and confident/worried, leaving only the strongly related components for positive deactivation/negative activation and enthusiastic/bored, engaged/fed up for positive activation/negative deactivation. The scale's number of items would be reduced from nine to seven with the added benefit of lowering responder fatigue.

Subsequently, TSS can be created in a variety of ways. Following that, future studies should focus on improving the internal consistency of the various domains of TSS; it can be with one or two emotional domains. We can do this by reconstructing the components for finding the emotional aspects of trip satisfaction and/or reducing the overall number of components, hence, reducing the burden of the people filling the questionnaire.

References

1. Börjesson, Maria, Isak Rubensson. 2019. „Satisfaction with crowding and other attributes in Public Transport”. *Transport Policy* 79: 213-222. DOI: 10.1016/j.tranpol.2019.05.010.
2. Clark Ben, Kiron Chatterjee, Adam Martin, Adrian Davis. 2019. „How Commuting Affects Subjective Wellbeing”. *Transportation* 47(6): 2777-2805. DOI: 10.1007/s11116-019-09983-9.
3. De Vos Jonas, Frank Witlox. 2017. „Travel Satisfaction Revisited. On The Pivotal Role Of Travel Satisfaction In Conceptualising A Travel Behaviour Process”. *Transportation Research Part A: Policy And Practice* 106: 364-373. DOI: 10.1016/j.tra.2017.10.009.
4. De Vos Jonas, Tim Schwanen, Veronique Van Acker, Frank Witlox. 2015. „How Satisfying is the scale for Travel Satisfaction?”. *Transportation Research Part F: Traffic Psychology And Behaviour* 29: 121-130. DOI: 10.1016/j.trf.2015.01.007.
5. Diener Ed. 1984. „Subjective Well-Being”. *Psychological Bulletin* 95(3): 542-575. DOI: 10.1037/0033-2909.95.3.542.
6. Efthymiou Dimitrios, Constantinos Antoniou. 2017. „Understanding the effects of Economic Crisis on Public Transport Users’ Satisfaction and Demand”. *Transport Policy* 53: 89-97. DOI: 10.1016/j.tranpol.2016.09.007.
7. Ettema Dick, Tommy Gärling, Lars E. Olsson, Margareta Friman, Sjef Moerdijk. 2013. „The Road to Happiness: Measuring Dutch Car Drivers’ Satisfaction with Travel”. *Transport Policy* 27: 171-178. DOI: 10.1016/j.tranpol.2012.12.006.
8. Friman Margareta, Satoshi Fujii, Dick Ettema, Tommy Gärling, Lars E. Olsson. 2013. „Psychometric analysis of the satisfaction with Travel Scale”. *Transportation Research Part A: Policy And Practice* 48: 132-145. DOI: 10.1016/j.tra.2012.10.012.
9. Humagain Prasanna, Patrick A. Singleton. 2021. „Exploring satisfaction with Travel Time profiles towards understanding intrinsic utilities of Travel Time”. *Travel Behaviour And Society* 24: 22-33. DOI: 10.1016/j.tbs.2021.02.001.
10. Lunke Erik Bjørnson. 2020. „Commuters’ Satisfaction with Public Transport”. *Journal of Transport & Health* 16: 100842. DOI: 10.1016/j.jth.2020.100842.
11. Mouratidis Kostas. 2020. „Commute Satisfaction, Neighborhood Satisfaction, and Housing Satisfaction as Predictors of Subjective Well-Being and Indicators of Urban Livability”. *Travel Behaviour And Society* 21: 265-278. DOI: 10.1016/j.tbs.2020.07.006.
12. Penedo Frank J., Jason R. Dahn. 2005. „Exercise And Well-Being: A Review of Mental and Physical Health Benefits Associated with Physical Activity”. *Current Opinion In Psychiatry* 18(2): 189-193. DOI: 10.1097/00001504-200503000-00013.
13. Russell James A. 1980. „A Circumplex Model of Affect”. *Journal Of Personality And Social Psychology* 39(6): 1161-1178. DOI: 10.1037/h0077714.

14. Soulard Joelle, Nancy McGehee, Whitney Knollenberg. 2020. „Developing and Testing the Transformative Travel Experience Scale (TTES)”. *Journal Of Travel Research*: 004728752091951. DOI: 10.1177/0047287520919511.
15. Vickerman Roger. 2021. „Will Covid-19 Put the Public Back in Public Transport? A UK Perspective”. *Transport Policy* 103: 95-102. DOI: 10.1016/j.tranpol.2021.01.005.

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