Initiative 3: Impact of Cab Aggregators on Vayu Vajra Services

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Abbreviations and Acronyms

Abbreviations	Full Form
BMTC	Bengaluru Metropolitan Transport Corporation
CSTEP	Center for Study of Science, Technology and Policy
GoK	Government of Karnataka
IPT	Intermediate Public Transport
KEA	Karnataka Evaluation Authority
KIA	Kempegowda International Airport
KSRTC	Karnataka State Road Transport Authority
KSTDC	Karnataka State Tourism Development Corporation
SRS	Simple Random Sampling

Executive Summary

Bengaluru is one of the fastest growing metropolitan cities in India. With rapid urbanisation and population growth, the city experiences a significant demand for infrastructure in different sectors, including transportation.

Bengaluru's new international airport commenced operations in 2008. This airport is well connected to the city by taxi services, app-based cab aggregators and BMTC airport bus services.

BMTC started the airport bus service (Vayu Vajra)[1] in 2008. This is a dedicated AC bus service which connects the city to the airport. However, the introduction of app-based taxi services, at the airport, has impacted BMTC Vayu Vajra bus ridership. In this context, Government of Karnataka has engaged Center for Study of Science, Technology and Policy (CSTEP) as a technical research institution, to assess the impact of cab aggregators on BMTC's Vayu Vajra service.

This study aims to identify the primary reason for this shift from Vayu Vajra to cab services and to identify the impacted Vayu Vajra routes. For this assessment, an airport passenger opinion survey was conducted at Bengaluru International Airport (KIA), collecting responses from 800 commuters of which 70% were BMTC airport bus users. Major reasons for shift from Vayu Vajra bus services to cab aggregators were lack of luggage space, expensiveness compared to cabs and poor first and last mile connectivity. The study also identified the impacted routes based on the responses. Routes which were affected include KIAS 10, KIAS 5, KIAS 8, KIAS 12 and KIAS 7.

To improve Vayu Vajra bus ridership, BMTC needs to provide dedicated luggage space, promote a group discount scheme as opposed to an individual discount scheme in the range of 10-15% and address issues of first and last mile connectivity. Additionally, the survey also revealed respondents opinion about their suggestions for Vayu Vajra service. BMTC needs to provide real time passenger information systems at major exit points of the airport and signage leading to the bus bays. Within the city limits, there is a need for dedicated Vayu Vajra bus stop signs.

[1] The Terms 'Vayu Vajra'and 'BMTC airport buses' have been used interchangeably in this report.

Table of Contents

List of Tables

List of Figures

1. Introduction

BMTC started a premium AC bus service (Vayu Vajra), in 2008, which connects different parts of the city with Bengaluru International Airport (KIA) (Bangalore Mirror 2008). BMTC operates 11-Vayu Vajra bus routes with more than 250 trips per day catering ~10,000 commuters.

However, the introduction of app-based cab aggregators at the airport has impacted BMTC Vayu Vajra bus ridership. This study assess the impact of cab aggregators on Vayu Vajra services, specifically reasons for shift, socio-economic profile and travel characteristics of commuters who shifted from Vayu Vajra services to cabs.

2. Log Frame/Theory of Change/Program Theory

This study aims to assess the impact of cab aggregators on Vayu Vajra bus services. This involves a survey at the airport to understand the socio-economic and trip characteristics of airport commuters. The responses were collected from cab users of which 70% were previous BMTC bus users and 30% used other modes of transport. The reasons for shift from BMTC bus to cab were analysed in this study. Also the impacted BMTC airport bus routes were identified.

	Intervention Logic	Verifiable Indicators of Achievement	Sources and Means of Verification	Assumptions
Overall Objectives	*What are the overall broader objectives to which the activity will contribute?* • Assessing impact of cab aggregators on BMTC's Vayu Vajra service	*What are the key indicators related to the overall objectives?* • Impacted Vayu Vajra routes	*What are the sources of information for these indicators?* • Passenger Opinion Survey of cab users at KIA	
Specific Objectives	*What specific objectives is the activity intended to achieve to contribute to the overall objectives?* • To identify commuters' reasons to shift from Vayu Vajra to cab • To identify most impacted Vayu Vajra routes	*Which indicators clearly show that the objective of the activity has been achieved?* • Commuters' response on reason to shift to cab • Vayu Vajra routes (maximum number of respondents shifting)	*What are the sources of information that exist or can be collected? What are the methods required to get this information?* • Airport Passenger Opinion Survey of cab users at KIA	*Which factors and conditions outside the PI's responsibility are necessary to achieve that objective? (external conditions)* *Which risks should be taken into consideration?* • Willingness of competent authority to permit the survey
Expected results	*The results are the outputs envisaged to achieve the specific objective.* *What are the expected results? (enumerate them)* • Major reason for the shift from Vayu Vajra to cabs	*What are the indicators to measure whether and to what extent the activity achieves the expected results?*	*What are the sources of information for these indicators?*	*What external conditions must be met to obtain the expected results on schedule?*

	• Most impacted Vayu Vajra routes due to this shift.			
Activities	*What are the key activities to be carried out and in what sequence in order to produce the expected results?* *(group the activities by result)* 1. Primary Survey - Passenger Opinion Survey of cab users at KIA 2. Identifying the reasons for shift from Vayu Vajra to cab 3. Identifying impacted routes due to this shift	***Means:*** *What are the means required to implement these activities, e. g. personnel, training, studies, etc.* • Urban planning experts • Transport planning experts • Training for conducting passenger opinion survey	*What are the sources of information about action progress?*	*What pre-conditions are required before the action starts?* • Permission by competent authorities to conduct the survey

3. Problem Statement

To assess the impact of cab aggregators on BMTC's Vayu Vajra services

4. Objectives and Issues for Evaluation

Objectives:

- To identify the major reason for the shift from Vayu Vajra to cab aggregators
- To identify the impacted Vayu Vajra routes

Scope:

Target Population: The target population for this study is the passengers at KIA who use cabs for city-airport commute.

Geographical Coverage: Vayu Vajra service coverage area

5. Evaluation Design

5.1. Information Sources

Primary Survey: Airport Passenger Opinion Survey

Airport passenger opinion survey was conducted at KIA. The survey captured the socio-economic data, trip characteristics and the reasons for shift from BMTC airport bus to cabs through a questionnaire (Annexure I).

6. Evaluation Methodology

The details of the steps followed in the methodology have been discussed below:

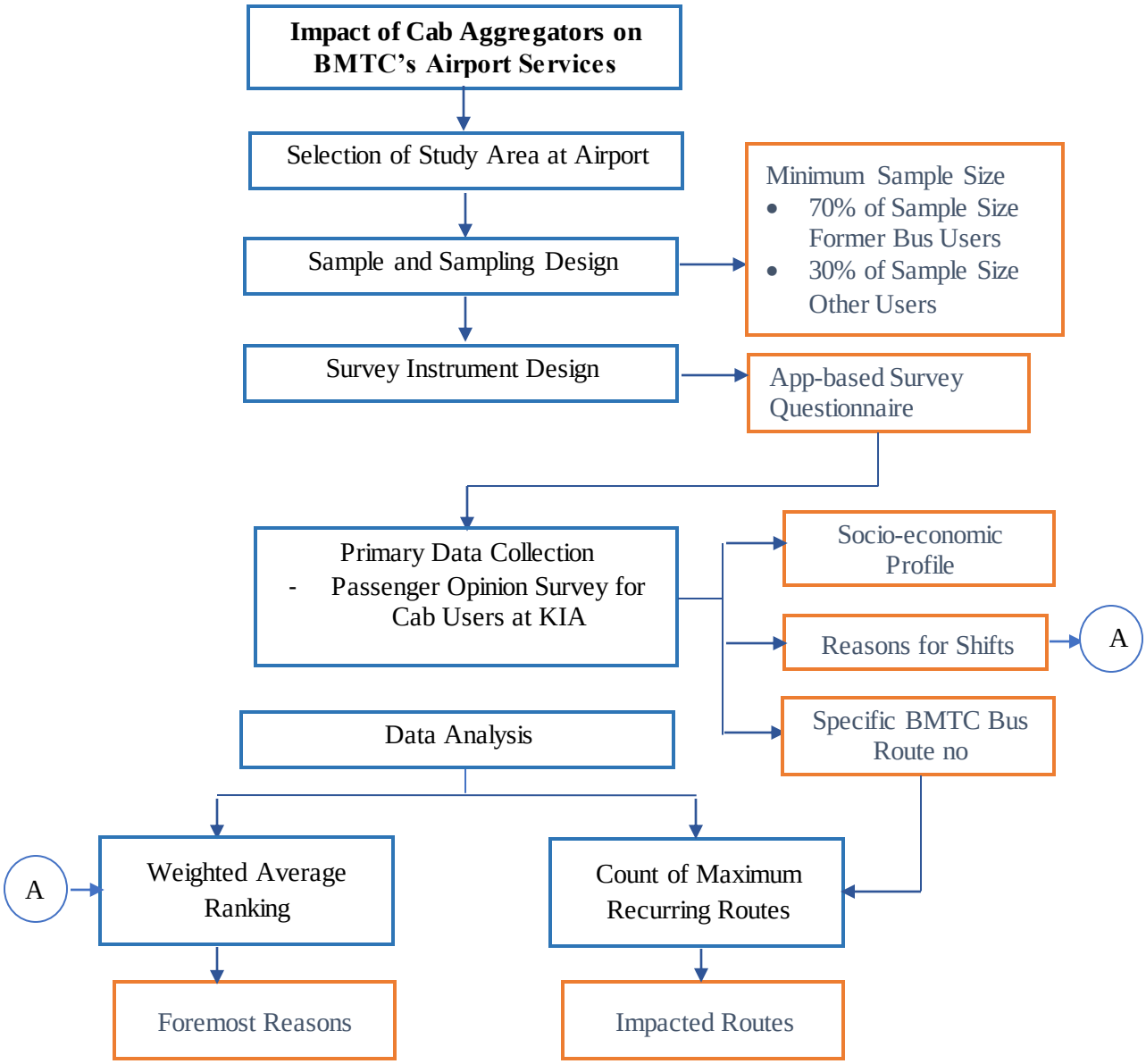

Figure 1: Process of assessing impact of cab aggregators on BMTC's Vayu Vajra service

6.1. Sample and Sampling Technique

Sample and Sampling (SRS) Design:

As mentioned in the scope of this study, the target population for this study included the cab users at KIA. As this forms a uniform set with no strata, a Simple Random Sampling (SRS) technique was used to arrive at the sample size. Formula for SRS:

$$n_1 = \frac{Z^2 \times p(1-p)}{e^2} \quad \text{Equation 1}$$

$$n_2 = \frac{N \times n_1}{N + n_1} \quad \text{Equation 1}$$

Where,

n_1 = Sample Size

n_2 = Finite Population Correction

N = Total Population

Z = Z – Score (Z – Table value at 5% of level of significance)

E – Margin of Error

P – Prior Judgment of the Correct Value (Probability)

The following Table 1 shows the simple random sampling details for the Passenger Opinion Survey of Cab Users at KIA.

Table 1: Simple random sampling

Passenger Opinion Survey of Cab Users at KIA						
Population (Daily Passenger Traffic at KIA)	Confidence Level	Z value	Margin of Error - (e)	Sample Size (n1)	Finite Population Correction (n2)	Sample Size chosen
60,000	95%	1.96	0.05	384.16	382	800

The above table shows that for target population of 60,000 and 95% confidence level, 382 is the minimum sample size required. In consultation with BMTC and to ensure higher precision, this study considered a sample size of 800.

6.2. Type of Data Collected from Various Sources

Primary Survey: Airport Passenger Opinion Survey

- Socio-economic profile of commuters
- Travel pattern of commuters (origin-destination, mode of travel, frequency)
- Reasons for shifting from BMTC airport bus to cabs

6.3. Instruments for Data Collection

For the primary data collection, a structured survey questionnaire was prepared to capture the required data. The survey questionnaire is presented in Annexure I.

6.4. Protocols for Data Collection and Ethics Followed

For the primary survey, permission letters from BMTC, KIA and the Commissioner of Police, Bengaluru City were taken for conducting survey at Kempegowda International Airport. Care was taken by the survey team that traffic flow and general activities, duties of any traffic police and workers at KIA were not disrupted. The willingness of the respondents to participate in the survey was obtained before administering the survey questionnaire.

7. Data Collection and Analysis

The survey was conducted at KIA arrival area (within the airport premises), on two regular working days, covering around 800 samples. Only the cab users travelling from the airport to their respective destinations were interviewed. The survey questions were designed to identify the cab users and previous bus users, so as to capture 70% previous bus users and 30% other mode users. The survey was carried out using Open Data Kit (ODK) suite, an android based mobile app that replaces paper-based forms. Trained enumerators under the close guidance of supervisory staff were appointed for this purpose. All the data collected, was compiled and subjected to a thorough verification and analysis. The details of the samples collected are given in Table 2 below.

Table 2: Details of collected survey samples

Heading	Required	Collected
Survey Sample Size	800	841
Women Respondents	400	397
Men Respondents	400	444
Bus Users	560 (70%)	583
Women Bus Users	-	298
Men Bus Users	-	285

The data collected from the primary survey was processed in Microsoft Excel Software to remove the erroneous entries and obtain samples with the most relevant response.

7.1. Data Analysis

Detailed analysis of the data collected from the primary survey was carried out to understand the travel patterns of commuters, reasons for shifting to app-based cabs, impacted routes and their operational details and willingness of passengers to shift to the AC bus service.

7.1.1. Profile of Former Bus using Respondents

Socio-economic Profile:

The data fetched from the primary survey was filtered on the basis of gender, age, income, employment type and purpose of travel. 57% of the former bus using respondents (almost equal number of men and women) were from the age group 31–50 years. 83.5% of the respondents had monthly household incomes of INR 50,000 or above. This consisted of 55% having monthly household income between INR 50,000 and 1 lakh, and 28.5% having more than INR 1 lakh. 81% of the former bus users belonged to working class.

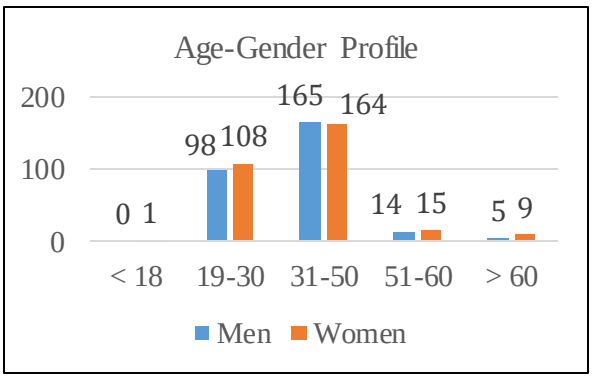

Figure 4: Age-gender profile of former bus users

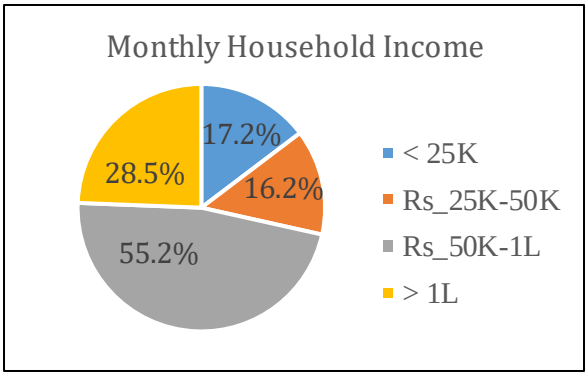

Figure 5: Monthly household income of former bus users

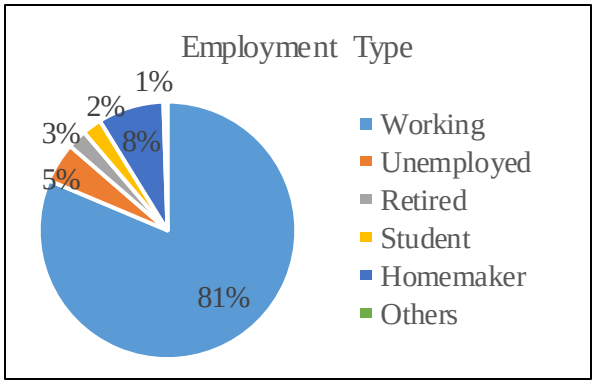

Figure 3: Employment type of former bus users

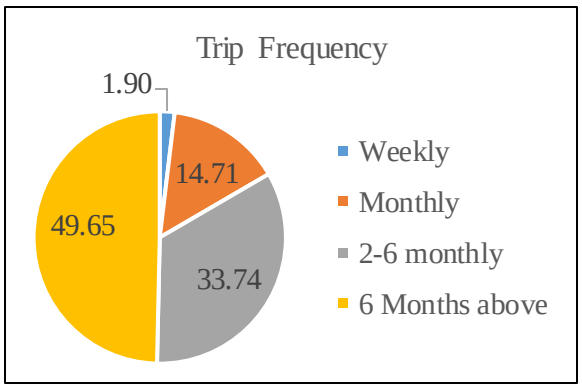

Figure 2: Frequency of travel of former bus users

Trip Character:

Almost 50% of the former bus users travelled at a frequency of only once in more than six months. All the respondents used the same route for their onward and return journey.

7.1.2. Profile of Non-BMTC Users

Socio-economic Profile:

From the non-BMTC user group, 78% belonged to the age-group 31-50 years and within this, 68% were men. 95% of these respondents were working and 76% travelled by air only once in six months. 55% of the total non-bus users had a monthly income of more than INR 1 lakh whereas 42% had within a range of INR 50,000 to 1 lakh.

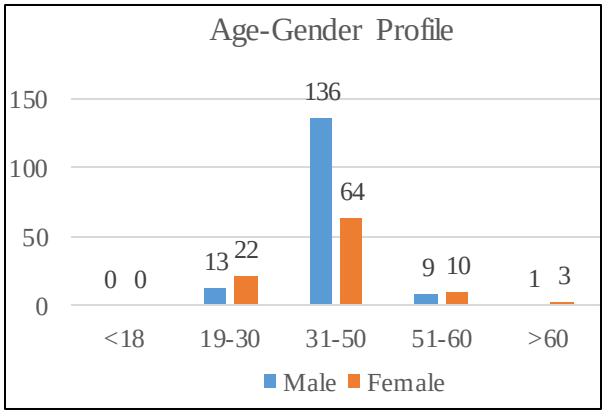

Figure 6: Age-gender profile of non-bus users

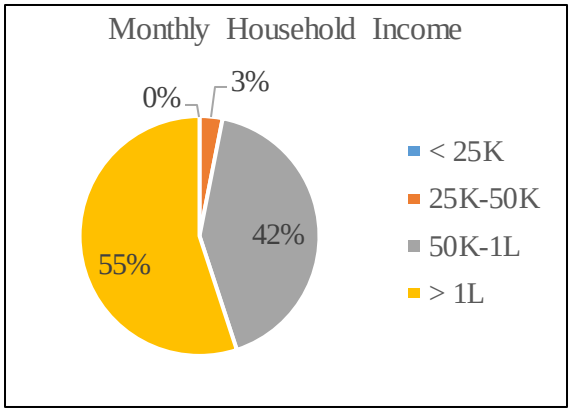

Figure 7: Monthly household income of non-bus users

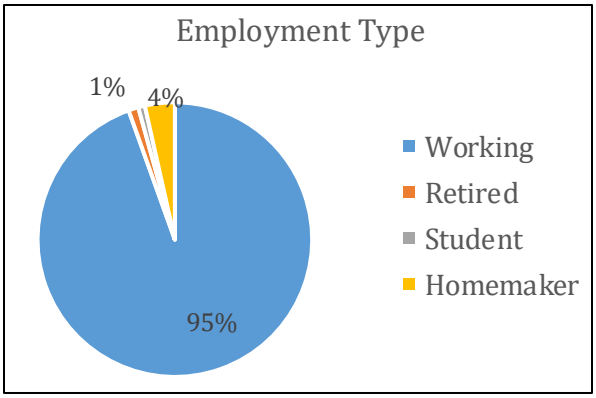

Figure 8: Employment type of non-bus users

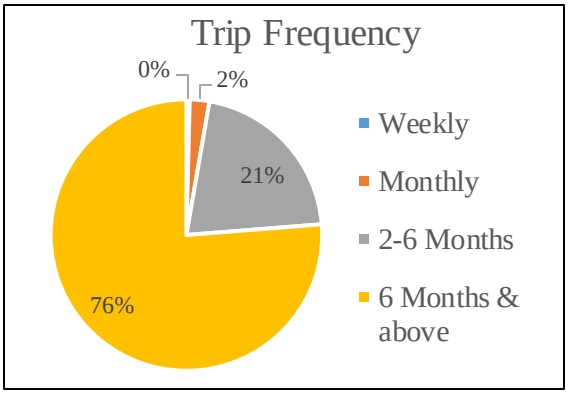

Figure 9: Frequency of travel of non-bus users

8. Findings and Discussion

The two major outputs of this survey were: 1) Reasons to shift from Vayu Vajra bus service to cab and 2) Impacted Vayu Vajra routes due to this shift.

8.1. Reasons to Shift from Vayu Vajra Bus to Cab

The respondents had to choose the reasons for shift listed in the questionnaire and rate each reason, on a scale of five. A weighted mean of all the reasons was thus calculated to understand the top priority reason for the shift from BMTC airport bus to cabs. From the analysis, it was observed that the luggage space and convenience was rated as the major reason for shift. This was followed by, Vayu Vajra bus services being more expensive compared to their current mode. Poor first and last mile connectivity also figured as a reason for shift. Table 5 below summarises the estimated weighted mean for each reason.

Table 3: Reasons for shift from Vayu Vajra to cab

Reasons for Mode shift	Weighted Mean
Luggage space and convenience	**4.307**
Expensive compared to current mode	**4.170**
Poor first / last mile connectivity	3.883
Low bus frequency / High waiting time for BMTC	3.864
Absence of direct AC bus connectivity	3.834
Travel time is more with BMTC buses	3.559
Overcrowding of BMTC Bus	3.553

This survey also captured response of commuters to shift back to Vayu Vajra bus services in the wake of proposed financial incentives- fare reduction (10-15%) and group discount (15%).Almost 96% of the total respondents (including other previous mode users) said that they might shift to Vayu Vajra service if the fare is reduced by 10-15%. Hardly any preference was given to the group discount of 15%.

8.2. Impacted Vayu Vajra Routes

From the response of the former bus users, it was found that 13% of them were travelling on KIAS 10 route. This route seems to be the most impacted among the routes from this survey. Out of the total respondents commuting on KIAS 10, 17% were travelling on the complete route.

Table 4: List of impacted routes

Route No.	Count	Percentage
KIAS 10	75	13%
KIAS 5	66	11%
KIAS 8	61	10%
KIAS 12	53	9%
KIAS 7	39	7%
KIAS 4	38	7%
KIAS 7A	36	7%
KIAS 8C	32	5%
KIAS 9	32	5%
KIAS 6	30	5%
Others	121	21%
Total	583	100%

9. Conclusions and Recommendations

Conclusions

The study relied on the Airport Passenger Opinion Survey for the required data. This survey identified the reasons for shift from Vayu Vajra bus to cabs and the impacted Vayu Vajra routes due to this shift.

'Lack of luggage space and convenience' was the major reason that prompted people to shift from Vayu Vajra to cab services. As there is no dedicated space for the luggage, it becomes uncomfortable for commuters to carry their own luggage during their journey between airport and their city origin/destination. Also, the fare for more than one passenger is cheaper for cabs than the Vayu Vajra fare. The study also identified the impacted routes based on the responses. Routes which were affected include KIAS 10, KIAS 5, KIAS 8, KIAS 12 and KIAS 7.

Recommendations

To improve Vayu Vajra bus ridership, BMTC needs to provide dedicated luggage space, reduce fares in the range of 10-15% and address issues of first and last mile connectivity.

Additionally, BMTC needs to provide real time passenger information systems at major exit points of the airport and signage leading to the bus bays.

Within the city limits, there is a need for dedicated Vayu Vajra bus stop signages.

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Annexure I

Impact of Cab Aggregators on BMTC Vayu Vajra Services

(At Kempegowda International Airport)

Purpose: To assess the impact of Cab Aggregators on BMTC Vayu Vajra services

Date & Time:

1. Are you a cab user

Yes	No

2. Were you using BMTC Airport bus service in last one year?

Yes Route no._____	No

3. Gender

Male	Female

4. Age group

Less than 18	19 - 30	31 - 50	51 – 60	Above 60

5. Employment Type:
   a) Working
   b) Unemployed
   c) Retired
   d) Student
   e) Homemaker
   f) Others

6. Monthly Household income

Less than Rs. 25,000	Rs. 25,000–50,000	Rs. 50,000–1,00,000	Above Rs. 1,00,000

Your trip from Airport:

Origin: **Airport**

7. Destination (Landmark, Nearest Bus Stop & Pin code):_____

8. Which cab service do you use? (Multiple choice)

Ola	Uber	Meru	KSTDC	Mega Cabs	Others _____

9. How often do you make this trip?

Weekly	Monthly	Once in two-six months	Six months and above

10. What was your previous mode of travel? (If Q.2 is 'No', then Q. 10)

Private car	Bike/ Scooter	Same as current (Cab)	Others _____

11. Is your trip '**To Airport'** same as this in terms of origin and mode of travel? (If yes, directly go to 17 Question)

Yes	No

Your trip to Airport:
Destination: **Airport**

12. Origin (Landmark, Nearest Bus Stop & Pin code):_____

13. What is/will be your current mode for the trip **to Airport**? (Multiple choice)

Private car	Bike/ Scooter	Taxi/cab	BMTC Bus Route no. _____

14. If cab, which cab service do you use? (Multiple choice)

Ola	Uber	Meru	KSTDC	Mega Cabs	Others _____

15. How often do you make this trip?

Weekly	Monthly	Once in two to six months	Six months and above

16. What was your previous mode of travel? (Multiple choice)

Private car	Bike/ Scooter	Taxi /cab	BMTC Bus Route no.	Same as current	Others _____ ___

17. If BMTC, what prompted you to shift to current mode from BMTC?

Lowest Priority **Highest Priority**

Sl. No.	Reasons	1	2	3	4	5
1	Absence of direct AC bus connectivity					
2	Low bus frequency / High waiting time for BMTC					
3	Expensive compared to current mode					
4	Poor first / last mile connectivity					
5	Overcrowding of BMTC Bus					
6	Travel time is more with BMTC buses					
7	Luggage space and convenience					
8	Other please specify					

18. What will promote you to shift to Vayu Vajra service for this trip?	15% group discount	10-15% fare reduction	Other (Specify)

Name _____ Phone Number_____

Annexure II

Cost Comparison between Vayu Vajra and Cab Service

According to this study, KIAL 10 is the most impacted route due to cab aggregators. This route runs from KIAL to Mysore Road Satellite Bus Station.

Distance between KIAL to Mysore Road Satellite Bus Station - 39 km

Scenario	Travel Cost (INR) per person
Person hiring a cab	750
One person commuting by Vayu Vajra bus	230
Four persons travelling together in a cab	187
Three persons travelling together in a cab	250
Two persons travelling together in a cab	375
Person commuting by Vayu Vajra bus (if group discount of 10% applied to single person's commute)	207

Vayu Vajra bus service works out to be costlier only when the cab has full occupancy (4 person in a car). This service is cheaper only when the cab has less occupancy. However the preference towards a cab was high due to adequate luggage space and last mile connectivity.

