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Importance-Performance Analysis (IPA) of Service Quality in Public Transport of Asansol-Durgapur Development Authority

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ABSTRACT
This paper is an attempt to analyse the perception on private minibus transport service quality provided in Asansol-Durgapur Development Authority (ADDA) area with an aim to search out the attributes explicitly act upon the service. These attributes effectively enhance the quality of service enjoyed by its users. The Importance-Performance Analysis (IPA) upgraded by confidence interval has been used in this investigation as a methodology. In a time span of March to April 2018, perception of 180 passengers who use minibus transport service has been analysed in the study. Importance-Performance of 30 service quality attributes has been measured with the structured questionnaire schedule and analysed with the application of the SPSS software. The methodology is universally accepted one and has been used for measuring the importance of the service sectors of various cities.
KEYWORDS: Public transport systems, Confidence Interval, Customer satisfaction, Importance-Performance Analysis, Public transport, Service sector, Service quality attributes

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I. INTRODUCTION

An important characteristic of modern society is its concern with encouraging more sustainable modes of transport (Fergusson and Skinner, 1999; Bräuninger *et al*. 2012) to solve the problems resulting from excessive use of the private cars in most urban areas (Pojani and Stead, 2015). One of such measures towards achieving sustainability would be to attract more people to the public transport system (Holmgren, 2007). This can be achieved by the use of the most important variables of public transport services. Future investment in transport policies can then be made to improve the variables like waiting time, reliability and journey time that will have a positive impact on the overall service quality (Dell'Olio *et al.* 2010).

Increasing travel demand and preferences in the use of private vehicle has caused rapid motorization (Hong *et al.* 2007) in many counties around the world (Kitamura and Mohamad, 2009; Newman, 1996). Most people are now highly dependent on private motorized travel system (Ellaway *et al.* 2003). This enhanced private motorization has resulted in an increased traffic congestion which in turn results in extended travel times for many people (Asri and Hidayat, 2005; Beirão and Cabral, 2007). In addition to congestion, private motorization also affects the safety of vulnerable road users (Kodukula, 2009), high consumption of the non-renewable fuel resource (Aßmann and Sieber, 2005) and causes the serious threat to the quality of human environment with immediate effects on air quality (Goodwin 1996; Greene and Wegener, 1997).

Public transport acts as an integral part of the socio-economic and political structure of the country as the developmental processes in the urban areas are controlled by the public transport system in present time (Mathew and Rao, 2007; Rodrigue, 2017). People living in urban areas generally depend on the transport, especially for their movements as well as of the goods (Stjernberg and Mattisson, 2016). People use it for day-to-day activities such as for attending the places of work, education and shopping and other leisure events (Schmöcker *et al.*2010). The majority of the passengers travel within a city boundary between their homes and places of employment, education, marketing or recreation (Dey, 2015; Saxena, 2012). Therefore, it is vital for a city for its better functioning as well as maintaining the good quality of life (Kumar *et al.* 2014; Miller *et al.* 2016).

Public transport needs to become the part of a solution for sustainable transport in the future. However, in order to accommodate and attract more passengers, public transport must have high service quality to satisfy and fulfil a more wide range of different customers' needs (Oliver, 1980; Anable, 2005). Improvement in the quality and efficiency of the public transport (Stelzer *et al*. 2015) is equally important to attract more people, especially to private vehicle holders (Blythe *et al.*2000; Maha *et al.* 2014).

The quality of a public transport system (Redman *et al.* 2013) is covered by many factors, such as comfort and safety within the vehicle, the time spared to cover the routes and the convenience and existence of any supporting infrastructure (Dell'Olio *et al.* 2010).

It is important to be aware about what drives customers' satisfaction and dissatisfaction in public transport arena to design an attractive and comfortable public transport system (Redman *et al.* 2013). Customers perceive each of the service quality elements (Ojo *et al*. 2014) in a different way. The same quality of service element can be judged differently by different customers in terms of the level of satisfaction and importance of the transport system. Analysing the levels of satisfaction and importance of service quality elements from the customers' point of view (Morton *et al.* 2016), service quality elements with a high level of importance and a low level of satisfaction can be identified. With the aim of improving the quality of the transport system from the customers' point of view, those elements may be effective upon sustainable transport system.

II. LITERATURE REVIEW.

Importance-Performance Analysis (IPA) is a part of marketing research techniques that contains the study of customer approaches toward key product or service and has been used in numerous markets, e.g., automotive, healthcare, housing, tourism, education, food, hospitality industry etc. (Martilla and James, 1977; Sethna, 1982; Hawes and Rao, 1985; Cunningham and Gaeth, 1989; Dolinsky, 1991; Alexitch *et al.* 2004; Kitcharoen, 2004; Go and Zhang, 1997; Lee *et al.*, 2008; Silva and Fernandes, 2010 and 2011; Wong *et al.* 2011; Tzeng and Chang 2011; Grujičić *et al*. 2014; Somkeatkun and Wongsurawat, 2017).

Parasuraman *et al.* (1985) stressed that the quality and services of products were the prime concern in the 1980s, when service quality was greatly neglected by its users.

Gotlieb *et al.* (1994) applies a theoretical structure to help construct a model that attempts to describe the relationships among disconfirmation of expectations, perceived quality, satisfaction, perceived situational control and behavioural intentions.

Badami and Haider (2007) made an analysis of public bus transit performance in Indian cities.

Fellesson and Friman (2008) perceived satisfaction with public transport services in nine European cities.

Dell'Olio *et al.* (2011) highlighted that waiting time, cleanliness and comfort are the public transport variables that users most valued. Variables such as driver's kindness, bus occupancy and journey time are generally given less weightage.

Chen and Chao (2011) have used an integrated model combining the theory of planned behaviour (TPB), the technology acceptance model (TAM) and habit to examine the switching over intentions toward public transit by private vehicle users (both car and motorcycle users).

Kumar *et al.* (2014) have worked on public transport and urban mobility and perception of people on public transport services in Bathinda City, Punjab, using the *Likert* scale and other simple descriptive statistical method.

Dey (2015) in her thesis has conducted a survey on passengers' perception and made a behavioural analysis on mass transport services in Kolkata.

Singh (2016) has assessed passenger satisfaction with public bus transport services of Lucknow city, India, to determine the key factors affecting the level of satisfaction in public bus transport services using the method of Principal Component Analysis (PCA).

III. OBJECTIVES.

The principal objectives of the present study are:

- to assess the passengers satisfaction with public mini-bus transport services in Asansol-Durgapur Development Authority (ADDA);
- to probe into the ways of improving the quality of public transport service system in the area;
- to examine the relative importance of service quality attributes for assessment of the priority for service quality improvements needed to increase passenger satisfaction; and
- to recognise the most significant variables for the users of public transport in their evaluation of service quality.

Study Area.

The Asansol-Durgapur Development Authority (ADDA), formed in 1980 under the West Bengal Town and Country Planning Act 1979,is located on the western part of West Bengal, sharing the state boundary of Jharkhand in the west, Paschim Bardhhaman district boundary on the south, east and north. The geographical area measures to 1603 km². It comprises 2 Municipal Corporations, 3 Municipalities and 8 C. D. Blocks. Asansol Durgapur Planning Area is principally urban in character with the presence of coal mining and large industrial establishments. More than 77% of its total population (2.4 million) is urban.

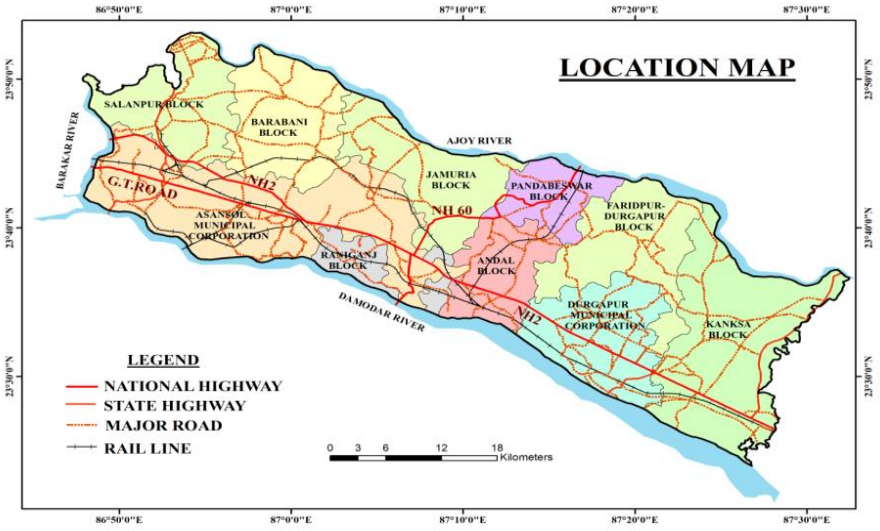

Figure 1.Study area map Source: ADDA, 2018

Data Base.

The study is based on primary data collected from 180 respondents of the study area during the month of March and April 2018. The questionnaire was framed after a pilot survey with minibus passengers. The passengers of bus transport services in Asansol-Durgapur Development Authority area were the target group as they each similarly use the bus transport services but differ in other characteristics such as income, age, gender, profession, etc. The passengers have expressed their views on the level of satisfaction and their personal importance to public bus transport services. The Survey on the service quality attributes in public transport system was conducted at ten bus stops of ADDA. It has incorporated the users of different routes in order to obtain a comprehensive assessment of the public transport system from the public transport users' point of view. At each bus stop, respondents were chosen randomly irrespective of their age but use of public bus transport. All respondents had been between ages of 15 and 65years (Table No. 1) and there were 52% male and 48% female respondents.

Table 1.Age profile of the respondents

Age Group (in Year)	No. of Respondents	Percentage of Respondents (%)
15-25	43	23.88
25-35	67	37.22
35-55	32	17.79
55-65	38	21.11

Source: Field Survey, 2018

The age groups were chosen for the survey as people in this age group are likely to have routine commuting travel behaviour. A self-rated questionnaire was used for the study; respondents were asked to rate their overall satisfaction and importance to the bus transport services. The first part of the questionnaire schedule was related to respondents' age, sex, employment etc. In the second part of the survey, respondents put separate scores for each of the defined variables (Table 4) in terms of importance and satisfaction

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Table 2.Employment status of the respondents

Employment Status	Number of Respondents	Percentage of Respondents (%)
Government Sector	29	16.11
Public Sector	23	12.77
Student	63	35
Self-Employed	25	13.88
Unemployed	12	6.68
Housewife	20	11.11
Pensioners	8	4.45

Source: Field Survey, 2018

IV. METHODOLOGY.

Service Quality Attributes.

Service quality attributes in public transport may be considered in terms of cleanliness, safety, comfort, travel time, travel cost, reliability, and transport availability at peak hours etc. In this case, 30 service quality attributes have been selected after conducting a pilot survey in the study area. Some of those service quality attributes are of seat availability in the vehicle, cleanliness, driver and conductor's friendliness, vehicle availability, travel time, driving safety etc. All the service quality attributes are specified in Table no. 4.

To assess these 30 service quality attributes, the bus users were provided with a questionnaire schedule to mark the level of satisfaction and importance. The authors have used *Likert* scale and bus users had to put a grade from 1 to 5 for each element. Users were asked to mark about the qualities as:

Table3. Level of satisfaction

Grade	Quality
1	Not satisfied/important
2	Slightly satisfied/important
3	Moderately satisfied/important
4	Very satisfied/important
5	Extremely satisfied/important

To assess the service quality attributes, 180 respondents were approached to grade the level of satisfaction and level of importance. The value next to the service quality attributes labels denote the number of respondents that ranked the given service quality attributes with the corresponding grade. The measures of importance and performance have been classified purposively as because the respondents were asked in one question about the importance of ticket price, but in the next question, about his satisfaction with the current ticket price. Thus his/her answer to the first may influence his/her answer to the second (Martilla & James, 1977).

The *P* (performance i.e., satisfaction) and *I* (importance) value for each service quality attributes is calculated by the average grade from all public transport users. The *P* and *I* value for attributes *i* are computed as:

$$P/I = \Sigma fx/N$$

Where, f= Number of respondents who specified the grade, x= Grade,
N= Number of public transport users (N= 180).

Table 4. Level of satisfaction (i.e., performance) and importance of service quality attributes

Sl. No.	Level of Satisfaction/Performance	Grade					*P*
		1	2	3	4	5	
1.	Cleanliness in the vehicle	30	36	57	33	24	2.916667
2.	Ventilation in the vehicle	36	50	51	31	12	2.627778
3.	Enough space in the vehicle	33	51	60	24	12	2.616667
4.	Vehicle age	45	48	54	18	15	2.5
5.	Vehicle suitability	36	30	81	18	15	2.7
6.	Getting a seat	30	57	66	18	9	2.55
7.	Driver and conductor's friendliness	36	12	48	54	30	3.166667
8.	Information provision	15	9	51	60	45	3.616667
9.	Vehicle availability at peak hours	30	60	60	27	3	2.516667
10.	Availability of vehicle after 7 p.m.	42	69	51	15	3	2.266667
11.	Ticket price	33	27	45	48	27	3.05
12.	Waiting time at the bus stop	44	39	54	24	19	2.638889
13.	Travel time	27	42	57	39	15	2.85
14.	Punctuality	18	48	72	27	15	2.85
15.	Vehicle frequency	15	45	72	30	18	2.95
16.	Driving safety and security	27	30	60	57	6	2.916667
17.	Appropriateness of speed	36	39	75	27	3	2.566667
18.	Ambiance/condition of the bus stop	36	54	45	33	12	2.616667
19.	Enough leg space	45	48	54	24	9	2.466667
20.	Passenger's safety	42	36	57	36	9	2.633333
21.	Absence of noise in the vehicle	42	66	51	12	9	2.333333
22.	Music in the vehicle	24	39	60	27	30	3
23.	Fellow travellers cleanliness	42	39	57	27	15	2.633333
24.	Passenger politeness	15	54	69	21	21	2.883333
25.	Protection from the exposure to the elements	39	36	48	21	36	2.883333
26.	Possibility of finding a parking place	15	60	51	33	21	2.916667
27.	Avoidance of traffic jam	51	39	57	27	6	2.433333

28.	Pavement quality	54	51	45	21	9	2.333333
29.	Distance of bus stop from the main road	30	27	45	42	36	3.15
30.	Condition of shelter at the bus stop	30	36	21	63	30	3.15

Sl. No.	**Level of Importance**	**Grade**					***I***
		1	**2**	**3**	**4**	**5**	
1.	Cleanliness in the vehicle	0	3	21	57	99	4.4
2.	Ventilation in the vehicle	3	3	6	65	103	4.4556
3.	Enough space in the vehicle	6	9	24	66	75	4.0833
4.	Vehicle age	9	6	18	54	93	4.2
5.	Vehicle suitability	3	3	21	69	84	4.2667
6.	Getting a seat	3	6	33	45	93	4.2167
7.	Driver and conductor's friendliness	0	3	3	48	126	4.65
8.	Information provision	0	0	15	48	117	4.5667
9.	Vehicle availability at peak hours	6	3	12	33	126	4.5
10.	Availability of vehicle after 7 p.m.	1	2	19	41	117	4.5056
11.	Ticket price	3	3	21	72	81	4.25
12.	Waiting time at the bus stop	0	3	18	51	108	4.4667
13.	Travel time	0	0	12	69	99	4.4833
14.	Punctuality	3	3	12	57	105	4.4333
15.	Vehicle frequency	3	6	24	57	90	4.25
16.	Driving safety and security	0	3	0	51	126	4.46667
17.	Appropriateness of speed	3	3	21	55	98	4.3444
18.	Ambience/condition of the bus stop	0	3	28	52	97	4.35
19.	Enough leg space	0	3	16	78	83	4.3389
20.	Passenger's safety	0	0	6	39	135	4.7167
21.	Absence of noise in the vehicle	6	9	18	78	69	4.0833
22.	Music in the vehicle	39	27	33	33	48	3.1333
23.	Fellow travellers cleanliness	3	6	24	69	78	4.1833
24.	Passenger politeness	9	3	24	60	84	4.15
25.	Protection from the exposure to the elements	0	3	9	57	111	4.5333
26.	Possibility of finding a parking place	0	0	18	72	90	4.4
27.	Avoidance of traffic jam	3	0	15	63	99	4.4167
28.	Pavement quality	0	0	27	57	96	4.3833
29.	Distance of bus stop from the main road	0	6	36	72	66	4.1
30.	Condition of shelter at the bus stop	0	6	27	57	90	4.2833

Source: Computed by authors

Importance-Performance Analysis.

Martilla and James (1977) first proposed the Importance-Performance Analysis as a tool to measure customers' satisfaction with a product or service. The IPA approach identifies satisfaction as the function of two components:

(1) The importance of a product or service to a customer; and

(2) The performance of that service or product.

The IPA examines not only the performance or satisfaction of a service but also the importance of that service (Silva and Fernandes, 2010). All the customers' ratings for those two components then provide an overall view of satisfaction with clear instructions for supervision and where to emphasise.

The IPA identifies strengths and weaknesses by comparing the two criteria that consumers' use in making a choice. The first criteria are the relative importance of attributes (a reflection of the relative value of the various quality attributes to consumers) and the second is satisfaction (consumers' evaluation of the offering in terms of those attributes) (Slack, 1994).

This technique has been recognized to be a normally relevant tool which is comparatively easy to administer and interpret resulting in its extensive use among researchers and managers of various fields. It has provided a new measure to promote the development of effective marketing programs as it simplifies the application of data and increases usefulness in making planned decisions (Slack, 1994; Matzler *et al*., 2003; Kitcharoen, 2004; Silva and Fernandes, 2010).

The IPA consists of a pair of the coordinate axes where the 'importance' (X-axis) and the 'performance' (Y-axis) of the different attributes involved in the service are compared (Fig. No. 3).

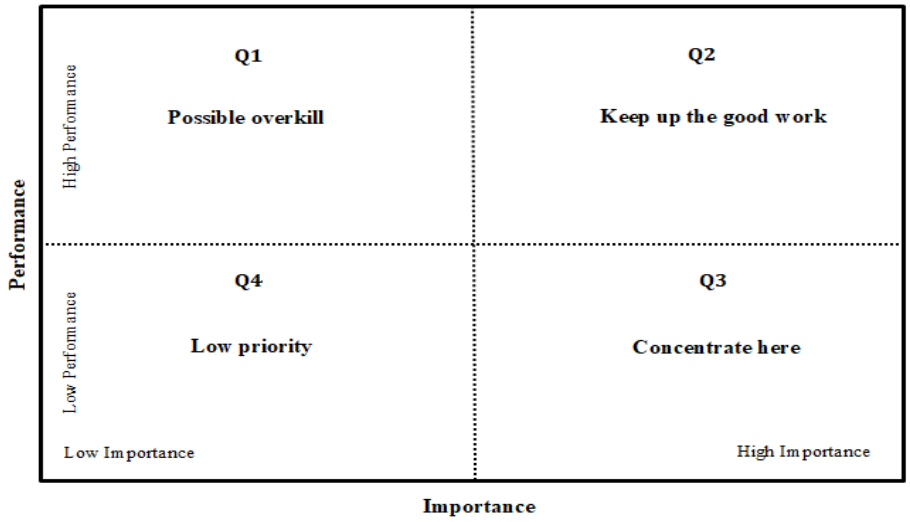

Figure3.Quadrants of IPA

The cells of the matrix are customarily defined by the calculated average values of all attributes related to importance as well as the evaluated values of the quality attributes (performance). Then two lines are clearly defined that run parallel to the two axes (the importance- axis and the performance-axis), through the points of the average values of the evaluation of importance and evaluation of performance of all the attributes. The boundaries between quadrants are defined by the mean value of all items of importance and performance. The quadrants are referred to as: Q1 *Possible overkill*, Q2 *Keep up the good work*, Q3 *Concentrate here* and Q4 *Low priority* (Martilla & James, 1977; Matzler et al., 2003; Go and Zhang, 1997; Silva and Fernandes, 2010).

Table 5. Characteristics of quadrants

Quadrants	Characteristics
Q1(Possible overkill)	It contains the attributes that have high performance but low importance. It supposes that the respondents are satisfied with the performance.
Q2 (Keep up the good work)	Attributes are perceived to be very important to respondents and the level of performance is also very high. The services of these components suggest to be maintained at the existing level.
Q3 (Concentrate here)	This quadrant signifies great importance but has poor performance i.e., poor satisfaction. It is considered to be the greatest weakness and needs to be improved. It suggests to take the quicksteps to improve these attributes.
Q4 (Low priority)	Attributes are of low performance and low importance. Hence, it seemsunnecessary to take any additional effort to improve these attributes.

Wu and Shieh (2009) first introduced the philosophy of using the confidence interval to make the IPA more efficient. The IPA integrated with confidence interval enables the decision maker much easier to identify the strengths and weaknesses of service quality attributes. Here, the author of this study tries to upgrade the methodology i.e., IPA with confidence interval in order to make it more efficient. Importance and performance level of an item determines the location of that particular item in respect of coordinate system. If decision makers take the decision on the basis of point estimates for an item, they might be mistaken.In general, confidence intervals are stated at the 95% confidence level. Though the level of confidence is set by the researcher himself.

V. RESULT AND DISCUSSION.

There were statistically significant differences between importance and performance in all 30 bus service quality attributes (Table 4). It signifies that there are scopes for improvements on all items. This study on the Importance-Performance Analysis (IPA) suggests setting long-term and short-term operational upgrading policies by identifying priorities subjected to the needs of the customers and presenting them in a grid (Figure 4).

Now, the service quality attributes are plotted in the coordinate system (Figure No. 4), where, the X-axis represents the importance and Y-axis represents the performances of the service quality attributes. The coordinates of each service quality attributes represent the average value of importance (X-axis) and the average value of performance (Y-axis). Each service quality attributes are plotted on the basis of two values. The service

quality attributes are denoted by number 1 to 30. The number of each service quality attributes is extracted from table no. 4.

It has already been stated that the respondents provided ratings from 1 to 5, though due to the range of the obtained results, and for better clarity, the coordinate axes are shown using different ranges (Fig. No. 4). Table no. 6 shows four quadrants and service quality attributes under it. From this list, we can find more important and less important as well as more satisfied and less satisfied attributes of bus services according to customers' point of view. Quadrant 3 is the most important and less satisfied category and improvement of the service quality attributes under this quadrant is necessary. Whereas, service quality attributes under quadrant 2 is the most satisfactory and most important for bus users.

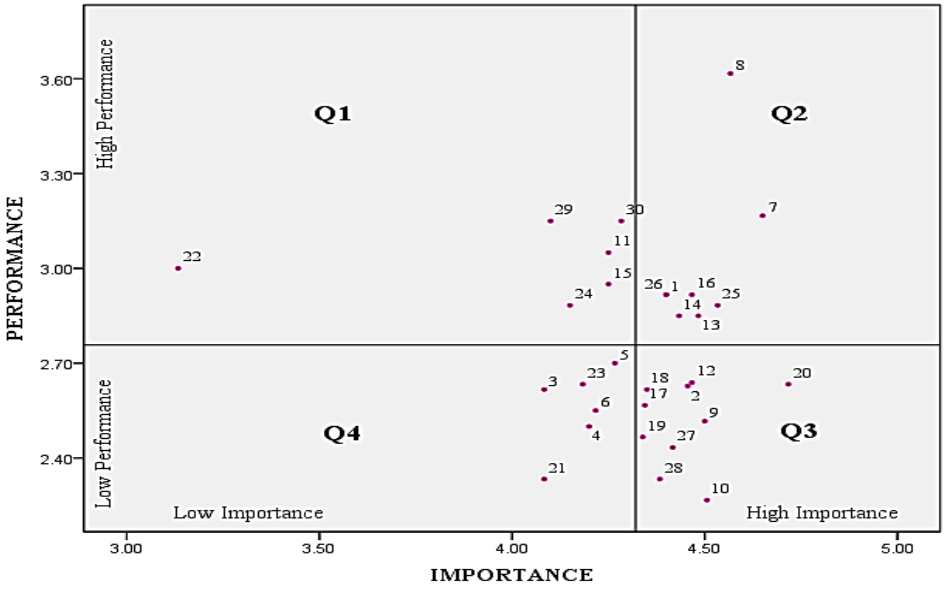

Figure4.Importance-performance analysis of service

Table6. Service quality attributes under each quadrant

Quadrant	Service quality attributes
Q1 (Possible overkill)	11. Ticket price
	15. Vehicle frequency
	22. Music in the vehicle
	24. Passengers' politeness
	29.Distance of bus stop from the main road
	30.Condition of shelter at the bus stop
Q2 (Keep up the good work)	1. Cleanliness in the vehicle
	7. Driver and conductor's friendliness
	8. Information provision
	13. Travel time
	14. Punctuality
	16. Driving safety and security
	25. Protection from the exposure to the elements
	26. Possibility of finding a parking place
Q3 (Concentrate here)	2. Ventilation in the vehicle
	9. Vehicle availability at the peak hours
	10. Availability of vehicle after 7 p.m.
	12. Waiting time at the bus stop
	17. Appropriateness of speed
	18. Ambience/condition of the bus stop
	19. Enough leg space
	20. Passenger's safety
	27. Avoidance of traffic jam
	28. Pavement quality
Q4 (Low priority)	3. Enough space in the vehicle
	4. Vehicle age
	5. Vehicle suitability
	6. Getting a seat
	21. Absence of noise in the vehicle
	23. Fellow travellers cleanliness

The Quadrant 1 is termed as 'Possible Overkill' as it has low importance and high performance. The bus service quality attributes in this category are (11) Ticket price, (15) Vehicle frequency, (22) Music in the vehicle, (24) Passengers' politeness, (29) Distance of bus stop from the road, and (30) Condition of shelter at the bus stop.
The Quadrant 2 is termed as 'Keep up the Good Work' as it has both high importance and performance. The bus service quality in this category are (1) Cleanliness in the vehicle, (7) Driver and conductor's friendliness, (8) Information provision, (13) Travel time, (14) Punctuality, (16) Driving safety and security, (25) Protection from the exposure to the elements, and (26) Possibility of finding a parking place. Service quality attributes in Quadrant 2 suggests maintaining their current level of performance and continuous improvement.
The Quadrant 3 is termed as 'Concentrate Here' on high importance but comparatively low performance, resulting in dissatisfied customers. Service quality attributes present here need to be prioritized. This quadrant includes (2) Ventilation in the vehicle, (9) Vehicle availability at the peak hours, (10) Availability of vehicle after 7p.m., (12) Waiting time at the bus stop, (17) Appropriateness of speed, (18) Ambience/condition of the bus stop, (19) Enough leg space, (20) Passengers' safety, (27) Avoidance of traffic jam, (28) Pavement quality. The quadrant suggests that these service quality attributes need to be improved.
Quadrant 4 is a zone of 'Low Priority' with low importance and low performance and it includes (3) Enough space in the vehicle, (4) Vehicle age, and (5) Vehicle suitability, (6) Getting a seat, (21) Absence of noise in the vehicle, and (23) Fellow travellers' cleanliness.
Thus the result obtained from the sample survey showed that acting on the listed attributes is the best way to improve the bus service quality of Asansol-Durgapur Development Authority. But, the question arises that whether the service quality attribute under these four quadrants are free of error caused by service quality attribute 5 (Vehicle suitability) closes to the quadrant 3, whereas 17 (Appropriateness of speed), 18 (Ambience/condition of the bus stop), 19 (Enough leg space) are close to the quadrant 4. If the number of are changed as per the purpose of survey, then these attributes may be relocated in other quadrants and hence it will obstruct the decision making process.
The authors have used confidence interval to avoid this type of errors in this context. 95% confidence interval is taken into the account and the result is shown in the figure number 4.

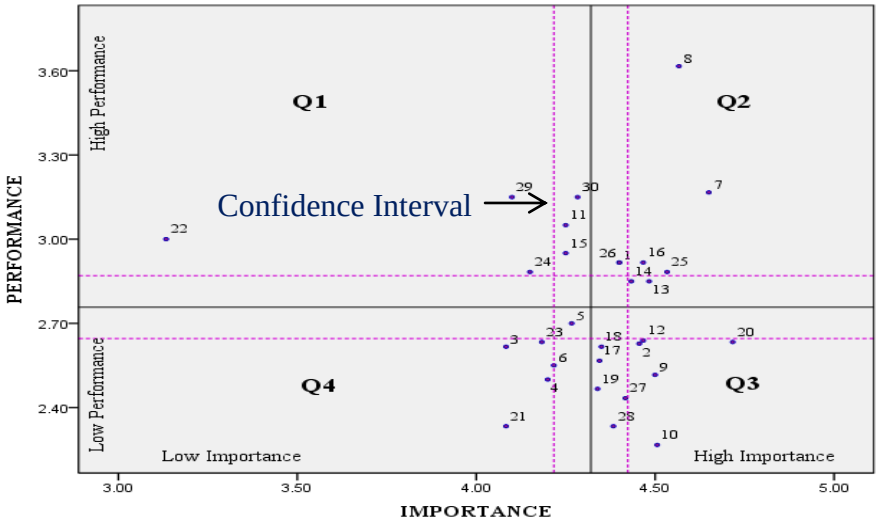

Figure 5.Importance-performance analysis with confidence interval

It has been observed that some service quality attributes are within confidence interval (Fig. 4). Service quality 5 (Vehicle suitability), 6 (Getting a seat), 13 (Travel time) and 14 (Punctuality) have a probability to fall under quadrant 3, 5 (Vehicle suitability) have a chance to fall under quadrant 1 whereas 17 (Appropriateness of speed), 18 (Ambience/ condition of the bus stop), 19 (Enough leg space) 27 (Avoidance of traffic jam) and 28 (Pavement quality) have a chance to fall under quadrant 4.
In spite of the use of 95% confidence level, the maximum numbers of services remain in the primary quadrant. Service quality of 2 (Ventilation in the vehicle), 9 (Vehicle availability at the peak hours), 10 (Availability of vehicle after 7 p.m.), 12 (Waiting time at the bus stop) and 20 (Passengers' safety) still then fall under quadrant 3.
Now, it becomes easy for the decision makers to take necessary steps to improve the minibus services in Asansol-Durgapur Development Authority.

VI. CONCLUSION.

It can be concluded on the basis of the analyses of the service quality attributes extended by the minibus transport service; the stakeholders are not fully satisfied to some of the aspects. The IPA analysis shows that the principle factors directly influence the service users up to satisfactory level mainly consider: availability of the buses at the peak hours, availability of the same after 7 p.m., short waiting time, less traffic jam and acceptable passengers' safety. In relation to those, the present study has been able to identify the attributes to be improved are increment of the number of buses even at the peak hours and at late evening, reduction of the interval between the buses, which can further reduce the waiting time that in turn can reduce the overload in the buses. This is also effective upon the cleanliness of the buses and comfortability of journey with available of seats. This improvement of the minibus transport services will be effective upon the reduction of number of the private vehicles like two wheelers and private cars that can reduce the road congestion and probability of road mishaps and ultimate will be effective upon the reduction of vehicular pollution.

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