

**PERCEPTION ANALYSIS OF ATTITUDE TOWARDS
RESIDENTIAL RELOCATION IN DELHI NCR(REGION) WITH
REFERENCE TO METRO CONNECTIVITY, INFRASTRUCTURAL
AVAILABILITY**

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Abstract: Growing urban agglomeration in almost all the metropolitan cities of the world has been a cause of many socio-economic and developmental problems surfacing in the respective metropolitan cities. Some of these problems have been in the nature of countryside-metropolitan labor migration, traffic congestion, tremendous pressure on resources leading to rapid price rise in essential services (water, domestic gas, electricity and transport), realty sector and other commodities, accentuating divide between the haves and have-nots, imbalanced regional growth and the like. This paper aims to study how effective planning of a transportation infrastructure can create favorable situation to solve all the above problems. The scenario was observed to be similar in different parts of the globe whether it was New York City, USA ; Taiwan, Hong Kong, China; Manchester, UK; New Delhi, India; Tokyo, Japan. In many of these metropolitan cities, the development of an efficient Mass Rapid Transport System (MRTS) has been one of the ways by which the municipal corporation or the city's governing body has tried to address the problems mentioned above and has been successful to quite an extent.

This paper concludes that if in Phase I and II expansion of Delhi Metro Rail network from NCT to NCR region would have been taken then significant reduction in congestion, growing prices, urban agglomeration would have taken place and the development of region peripheral to the NCT would also be possible.

Keywords: Mass Rapid Transportation System (MRTS), NCT, NCR

Intrduction

New Delhi, being national capital of India acquires a special importance in the wake of Indian economy experiencing growth rates of 7-8 percent p.a. in the last one decade. Owing to this economic boom, a lot of employment opportunities are being generated and due to this in-migration to Delhi has been on the rise at a rapid rate.

A lot of plans have been made in the past like MASTER PLAN, DELHI to check in-migration and population of Delhi but due to unavailability of basic facilities like transportation and equal employment opportunities in other parts of the country these plans got failed. In this paper, the author has tried to study that if a high-tech Mass Rapid Transportation System(MRTS)is introduced along with other infrastructural facilities, will people shift from Delhi to these NCR region and what will be the economic impact on Delhi and in the NCR region.

Brief History of development of Delhi

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The era of urban planning in Delhi commenced in 1824, when a Town Duties Committee was constituted for the development of the Cantonment, Khyber Pass, the Ridge area and the Civil Lines area by the British colonialists. For planned development of the city, the Delhi Improvement Trust (DIT) was constituted in March, 1937.

Role of Delhi Development Authority (DDA)

Delhi Development Authority (DDA) was set up on 30th December, 1957 under the Delhi Development Act, 1957, DDA has reviewed the provisions of the Master Plan 2001 and the actual development of urban area in Delhi to date, with a view to revise the Master Plan with reference to the target period for 2021.

Concept of National Capital Region

The Master Plan for Delhi (1961-81) recommended development of the region surrounding Delhi to check the in-migration in to the city. Since then efforts have been made to initiate planned development of the region surrounding Delhi, within a given policy and institutional framework. The National Capital Region(NCR) covers an area of 30242 sq. kms including Delhi(NCT) which is 1483 sq. kms

Setting up of the NCR Planning Board

This Board was set up to make Delhi a manageable city. For that following towns and districts were taken in NCR from neighboring states.

Table 1. Details of regions falling under NCT and NCR

SN District/Tehsils.	Area in Sq. Kms
NCT-Delhi	
(i) Whole of the NCT-Delhi (No change in the existing area)	1483.00
Haryana	
(i) The whole of District of Gurgaon comprising the tehsils of Gurgaon, Nuh, Ferozepur-Jhirka, Pataudi, Punhana and Sohna	2760.00
(ii) The whole of District Faridabad comprising the tehsils of Ballabgarh, Faridabad, Palwal, Hathin and Hodel	2105.00
(iii) The whole of District of Rohtak comprising the tehsils of Rohtak and Meham	1667.77
(iv) The whole of District of Sonipat comprising the tehsils of Sonipat, Gohana, Gannaur and Kharkhoda	2260.53
(v) The whole of District of Panipat comprising tehsils of Panipat, Samalkha and Israna.	1249.88
(vi) The whole of District Jhajjar comprising tehsils of Jhajjar, Bahadurgarh and Beri	1867.70
(vii) The whole of District of Rewari comprising the tehsils of Rewari, Bawal and Kosli. 1559.00	

Sub-total	13469.88
Uttar Pradesh	
(i) The whole of District of Bulandshahr comprising the tehsils of Anupshahr, Bulandshahr and Khurja	3515.00
(ii) The whole of District of Meerut comprising the tehsils of Meerut, Mawana and Sardhana	2566.00
(iii) The whole of District of Ghaziabad comprising the tehsils of Ghaziabad, Hapur and Garhmukteshwar	1971.00
(iv) The whole of District of Gautam Budh Nagar comprising the tehsils of Gautam Budh Nagar, Dadri and Jewar	1456.00
(v) The whole of District of Bhagpat comprising the tehsils of Bhagpat, Baraut and Khekra	1345.00
Sub-total	10853.00
Rajasthan	
(i) The tehsils of Alwar, Behror, Ramgarh, Mandawar, Kishangarh Bas, Tijara and Kot Kasim of district Alwar.	4493.00
Sub-total	4493.00
Total area of NCR	30299.00

Source: National Capital Region Planning Board

The Problems

Population growth and population density

In India, population census is done once every 10 years. As per the last census in 2001, population of Delhi is increasing at the speed of 9%p.a. According to census 2001, population of Delhi in 2001 was 137.83 and according to forecasting it may be 210.82 in 2016. So there will be a huge burden on the government and resources of Delhi.

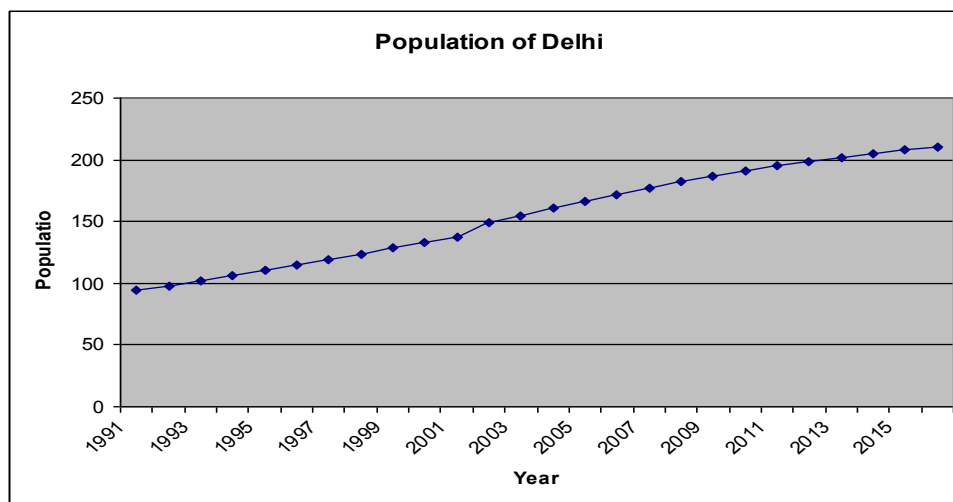


Figure 1. Growth of Population in Delhi

Source: Department of Census Operations, Delhi

But the problem of growth in population magnifies when we look at the population growth rates disparity between urban and rural Delhi. The following table will highlight this point.

Table 2. Density of population in Delhi

Year	MCD	NDMC	Cantonment	Urban Delhi	Rural Delhi
1961	1791	6119	840	7225	258
1971	2649	7061	1334	8172	403
1981	4195	6388	1982	9745	507
1991	6459	7050	2197	12361	1190
2001	9607	7074	2907	13957	1692

Source: Department of Census Operations, Delhi

In the above table:

MCD : Municipal Corporation of Delhi

NDMC : New Delhi Municipal Corporation

Cantonment: Area whose maintenance is under Delhi Cantonment Board

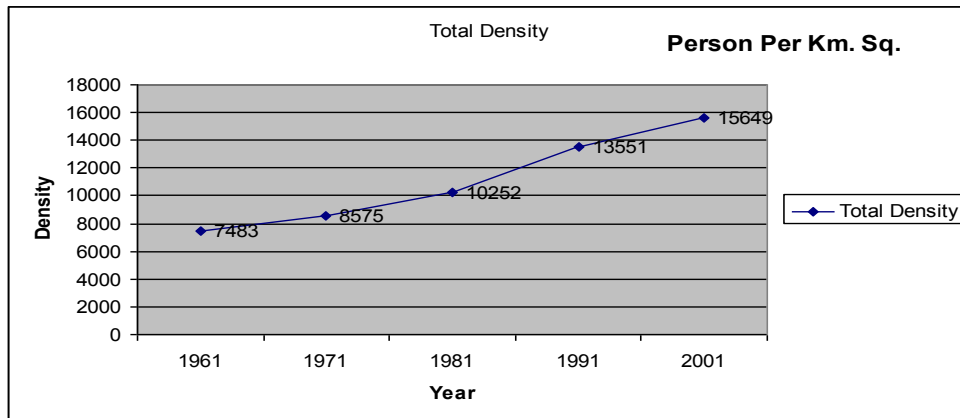


Figure 2. Population Density in Delhi

Source- Dept. of Census Operations, Delhi Data

In-migration to Delhi

Delhi as being a hub of employment and education, a large number of people and students come to Delhi from different part of India. So migration is also one factor in increase in population. The following figures tell us about the migration rate in Delhi.

Table 3. In-Migration status of Delhi

Year	Population as on 1st July	Increase in population over previous year	Total Birth	Total Death	Natural increase (col. 4 minus col. 5)	Increase Due to in-migration (col. 3 minus col. 6)	Ratio (Natural V/s in-migration)
1991	95.50	3.89	2.72	0.61	2.11	1.78	1 : 0.84
1992	99.37	3.87	2.74	0.62	2.12	1.75	1 : 1.02
1993	103.38	4.01	2.70	0.64	2.06	1.95	1 : 1.18
1996	107.50	4.12	2.62	0.68	1.94	2.18	1 : 1.42
1998	111.74	4.24	2.75	0.69	2.06	2.18	1 : 1.38
1999	116.10	4.36	2.83	0.76	2.07	2.29	1 : 1.50
2001	120.57	4.47	2.89	0.71	2.18	2.29	1 : 1.55
2003	125.14	4.57	2.84	0.80	2.04	2.52	1:1.79
2007	129.82	4.68	2.88	0.79	2.09	2.59	1:1.24

Source: Department of Census Operations, New Delhi

Electricity Consumption

Delhi, being a capital of India, is expected to have a status of 24 hour power supply. But in last few years due to increase in household consumption, increase in industries and due to technological evolvment, power consumption has increased very drastically. Following figures illustrate.

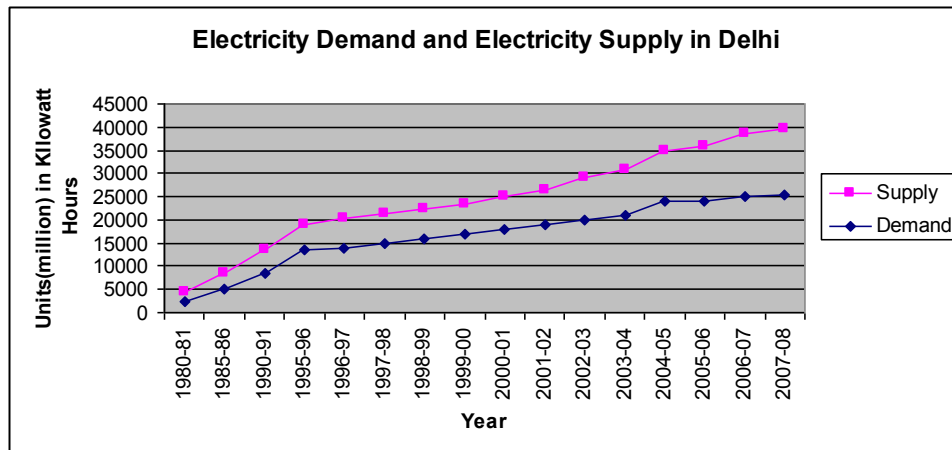


Figure 3. Gap between demand and consumption of electricity in Delhi
Source :Delhi vidhyut Board, Inderprastha, Delhi

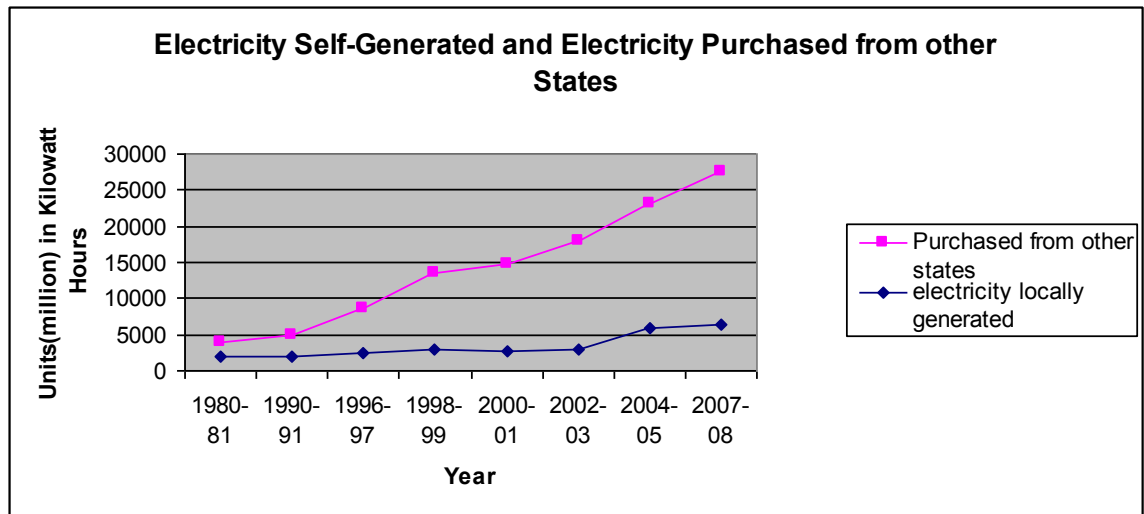


Figure IV: Graph showing electricity generated and purchased in Delhi
Source :Delhi vidhyut Board, Inderprastha, Delhi

Hence, the city is not self-sufficient in terms of electricity generation also.

Literature Review

According to Singh, Prasad, Chauhan(2005), India has witnessed an explosive growth of population accompanied by uncontrolled urbanization over the last five decades. Rapid industrialization and population growth especially in the last decade have adversely affected urban climate, air quality and caused imbalances in the regional climate at large.

Delhi which contains 1.4 percent population of India, accounts for 7 percent of all motor vehicles in India. Emission of air pollutants from various vehicles is one of the major causes for degrading air quality in Delhi.. Rising anthropogenic air pollution is a direct threat to our environment and is accelerated by growing population. With increasing dependency on coal and petroleum products as energy sources, the impact of pollutants on climate such as carbon dioxide, sulfur dioxide, aerosols and black carbon is increasingly visible as changes in hydrology cycle, temperature, precipitation etc.

Facts from the study of Pucher, Korattyswaroopam and Ittyerah (2004) say, India is a vast country with diverse mix of resources and economic activities. During the last two decades, rapid industrialization coupled with urbanization has resulted in

emergence of industrial centers without corresponding growth in civic amenities and pollution control mechanism.

Linking development, air quality and climate change

New Delhi, the national capital of India, has an area of 1483 square kilometre over 16.7 million people. Population growth has been extraordinary, increasing from 1.7 million in 1951 to over 13 million 2000 and is expected to reach 22 million in 2021. The rapidly increasing population, rising incomes and urbanization are largely responsible for the increase in the vehicular population in Delhi. Comparing the vehicular growth trends in Delhi with other metropolitan cities in India, we find Delhi is ahead of other cities. Even the ratio of persons to vehicles in Delhi is highest with three persons per vehicles as compared to 17, 20,7 and 10 persons per vehicle respectively for Mumbai, Kolkatta, Chennai and all India.

The characteristic feature of the transport system is the pre- dominance of private vehicle, which comprise about 90percent of the total vehicles in Delhi but cater to around 40percent of the total traffic load. On the other hand buses cater to around 50percent of the total traffic load.

Delhi has now become the fourth most polluted city in the world, with automobiles contributing more than two thirds of the total atmospheric pollution. For this, the decision of the Government of India to develop a mass transport system for Delhi providing alternative modes of transport to the passengers was most appropriate.

The first concrete step in the launching of an Integrated Multi Mode Mass Rapid Transport System (MRTS) for Delhi was taken when a feasibility study for developing a multi-modal MRTS system was commissioned by the Government of the National Capital Territory (NCT) of Delhi at the instance of the Government of India in 1989 and completed by Rail India Technical and Economic Services Limited (RITES), hereafter referred to as RITES, in 1995. The Delhi Metro (DM) planned in four phases is part of this MRTS. Phases III and IV of DM was expected to cover most of the remaining parts of Delhi and even extend its services to some areas such as Noida and Gurgaon belonging to the neighbouring states of Delhi.

DELHI METRO (DM) was developed with a vision of:

- Providing pollution-free environment to those living in the city and those coming to NCT for work.
- development of satellite towns into well-planned cities with all the amenities for the citizens of the nation
- Balanced regional development of other cities.

Identification of Economic and Social Benefits and Costs of Metro

Reduction in Number of Vehicles on Roads

The economic benefits from the reduced number of vehicles on Delhi roads due to the

Metro could be identified as the following:

- Savings in Foreign Exchange due to reduced Fuel Consumption
- Reduction in Pollution
- Savings in Time for all passengers using Metro and Roads
- Reduction in Road accidents
- Savings in Vehicle Operating Cost (VOC) due to decongestion for residual traffic
- Savings in Capital and operating cost of diverted vehicles
- Savings in the cost of Road Infrastructure

Table 4. Reduction in Vehicles Due to Metro (Phases I & II)

Year	Cars & Jeeps	Two wheelers	Buses	Total
2005-06	50586	284433	3398	338418
2010-11	80731	479286	4767	564784
2015-16	238737	1496497	12388	1747622
2020-21	381006	2521685	17374	2920065
2025-26	608055	4249185	24368	4881609
2030-31	970409	7160124	34178	8164711
2035-36	1548697	12065226	47936	13661859
2040-41	2471600	20330607	67233	22869440
2042-43	2979770	25049341	76975	28106087

*Source: Railway India Technical and Economic Services Limited, 1995a**

Savings in fuel consumption

There are savings in fuel consumption (inclusive of both CNG and petrol) due to the diversion of a part of the Delhi road traffic to Metro and reduced congestion to vehicles, still operating on the roads. There is an inter-fuel substitution of petrol and CNG to electricity that could result in savings of foreign exchange and a reduction of air pollution.

Reduction in Air Pollution

Fewer vehicles and the decongestion for the residual traffic on Delhi roads due to Metro

could lead to reduced air pollution. Estimates of reduction in distance traveled every day due to the decongestion effect are obtained for cars, two-wheelers and buses as 9.18 kilometers, 7.65 kilometers and 69.72 kilometers, respectively. The monetary value of these pollution loads were estimated using the estimates of shadow prices of pollutants made in some recent studies in India Murty and Gulati, (2005); Murty, Surender Kumar and Dhavala, (2006)

Saving in Passenger Time

The savings of travel time of passengers traveling by the Metro instead of by road are calculated as the product of the number of passengers traveled daily and the time saved on the average passenger lead in Delhi. In the case of residual passenger traffic on road, RITES (1995a) has estimated the daily time saving by the passengers due to decongestion using the following formula:

where,

$$T = D/Sc - D/Sd \quad (1)$$

T: time saving on average daily run

D: daily run of vehicles (in km)

Sc: average speed in congested situation (without Metro).

Sd: average speed in decongested situation (with Metro)

Savings due to fewer accidents

The costs (at 2004 prices) under different heads are reported.

Savings in vehicular operating costs due to the decongestion effect

It is estimated as the product of the residual traffic, time saved on average lead per vehicle annually and the vehicle operating cost per hour according to RITES (2005b), the value of this component for the year 2011-12 is Rupees. 15040 million.

Savings in Capital and Operating Cost of Diverted vehicles

The net benefits for the government during the year 2011-12 are estimated as Rs. 31760 million at 2004 prices.

The Passengers gain to the extent of the difference between the fares paid to buses in the absence of the Metro and the fares charged by the Metro. For instance, during the year 2011-12, the fare box revenue to the displaced buses should have been Rs. 10460 million while that of the Metro is estimated at Rs. 35280 million. Therefore, passengers have incurred an additional cost of Rs. 24830 million due to these fare differences. The Unskilled labour employed on the construction and maintenance of Metro gain to the extent of the difference between the project wage rate and the wage rate in an alternative employment in India. Murty and Goldar (2006) provide an estimate of the marginal productivity of unskilled labour in agriculture as Rupees. 48 while on the average, the industrial wage for unskilled labour in India is Rupees. 120 per day at 2004-05 prices. The General public representing the Indian society receives the benefits of social premium on investment and foreign exchange and the environmental benefits of reduced pollution due to the Metro.

Linking MRTS with the problems being faced by the metropolitan city, Delhi

From the discussion so far, it can be said that the horizontal growth of the city was completed long ago and the vertical growth has been already underway since long. Also, the increasing trend of population has already become Delhi's problem and will compound the problem in future. But what needs to be ensured is that there are certain pre-requisite basic facilities which shall have to be provided before such a solution can be thought of. Then only the rampant in-migration and consequent congestion problems can be dealt with.

Implementation of the above would definitely require a multi-mode MRTS, because all NCR cities are almost 20 kilometers away from Delhi. This distance is not so high, but due to congestion on roads and due to lack of a proper, convenient, comfortable transportation system residents of the NCT would not be willing to relocate to NCR.

Research Methodology

Research Design: The research type used in this paper is analytical research or action research because we want to analyze the assumption taken for an action.

Population: The population is the respondents working in Delhi and also living in Delhi. For this various parts of Delhi like Badarpur Border (Delhi-Haryana Border), Rajiv Chowk (Gurgaon), Rajnigandha Chowk (Noida), Connaught Place (Delhi), Nehru Place (Delhi), IFFCO Chowk (Gurgaon). These places were selected because of their importance as significant business centre and institutional areas. The respondents are in the age group of 18-65 years.

Sample Design: Non probability judgment sampling

Non probability sampling is used as the respondents were selected and questions were asked from them as they were coming out of their offices work places and business centers. Therefore, there was not equal chance of every member of population to be selected for survey.

Sample Size: The sample size in this study is determined by using the comparison method. In this method the confidence level about the research in addition to the precision about the estimates concerning the population is specified.

$$\text{Sample size} = \frac{z^2 * p * q}{e^2} \quad (2)$$

z- Confidence level

p- % of people will migrate in NCR

q- % of people will not migrate in NCR

e- Sampling error

As there is no availability of prior literature on this topic, so to eliminate any biasness p and q are taken equal. We have taken an assumption that 50 percent people will relocate and 50 percent will not relocate to NCR region.

So the value of p is 0.5 and value of q is also 0.5. On this basis the sample size of respondents is determined based on the confidence level of the research and the responses of the people about their opinion.

Sampling error and Confidence Interval

In this sample size determination confidence level is taken to be 95 percent and its value is 1.96 and the sampling error is taken as 5 percent.

P is taken as 50 percent and Q is taken as 50 percent.

After using the formula with all the fields a sample size of 385 has been derived.

Data Collection: In this study primary data is collected and the method used for collection of data is the questionnaire method. A questionnaire was designed to find out

How respondents would rate the infrastructure facilities viz. water, electricity, roads etc in NCT region and the house rents they were paying in NCT region

A perception study was done to find out the preferences of people towards relocating in NCR region.

Statistical Software: SPSS 16.0 and Microsoft Office Excel

Statistical Tools: Likert Scale and Ratio Scale was designed for perception mapping

Chi-Square test to find, if the variables asked in the questionnaire have any association among themselves. Since the dependent variable in this study is categorical and the independent variables are multiple and metric in nature, hence Two-Way Discriminant Analysis has been used to test if there is a significant difference in the predictor (independent) variables.

Reliability Analysis has been conducted to determine if the model is statistically significant.

After the coefficients of Discriminant equation are determined, a sample of 30 respondents is put through Validity Analysis to test the accuracy of the model.

Hypothesis Formulation

1. The predictor variables used on the study are associated with each other or not. This shall be determined by running the **chi-square analysis** on the model.

Ho : The independent variables are not associated with each other

Hi : The independent variables are associated with each other.

2. The sample units would like to relocate in the NCR region

Ho: Less than 50 percent of the respondents surveyed would like to relocate to NCR

Hi : More than 50 percent of the respondents surveyed would like to relocate to NCR

Analysis and Findings

1. The reliability test was run on model and the model was found to be 75 percent significant. (Appendix)

2. RESPONDENTS' PROFILE indicating the composition of the sample respondents. (Appendix)

3. Findings of the chi-square analysis reflect the null hypothesis being rejected, leading to acceptance of alternative hypothesis, interpreting that there is a significant association between predictor (independent) variables.

4. The model which we got by applying the Discriminant Analysis is

$$Y = -8.401 + 2.148X_1 + 0.68X_2 + 0.3X_3 + 0.19X_4 + 0.122X_5$$

Where Y is the dependent variable, whether a respondent will like to relocate or not.

X1 is uninterrupted and relatively cheaper electricity provided to households in NCR region.

X2 is presence of hospitals, schools and recreational facilities in the NCR region.

X3 is daily office traveling distance of 20-30 kilometers from NCR to office

X4 is metro connectivity within 1-2 kilometers of residential location in NCR.

X5 is house rents within a range of Rs 5000 to Rs 10000 p.m. in NCR region

From the results of this analysis, it is inferred that more than 50% respondents would like to relocate to the NCR region if all the facilities were provided. Hence, the null hypothesis, H_0 is rejected and the alternative hypothesis, H_1 is accepted.

5. The validity test was conducted for the model for a sample size of 30 respondents and the model was found to be applicable on 21 cases.

Discussion

The study discusses, how development of a region effectively rests upon the availability of certain fundamental infrastructural facilities critical to development of a region and human life therein. By the virtue of the findings of the study, that bring out:

1. A high degree of association between the variables used in the study viz. house rent, travel distances, mode of transportation, electricity, recreational and other facilities and response of people towards relocating.
2. Better and relatively cheaper supply of electricity to be the most important variable affecting choices of respondent.
3. Availability of Metro Rail network within a vicinity of 1-2kms of residential areas.
4. Efficient and cost effective supply of services like electricity, hospitals, schools, recreational centers is available

Urban agglomeration and balanced regional development are certain issues that every urban center is trying to find an answer to. However, the strategy that any urban center applies to find an answer to differs. This paper finds the answer in creating and developing additional infrastructural facilities with efficient MRTS network.

Limitation of the study

Due diligence has been made to keep the study results as objective as possible, but the study is not able to capture the effects of familial ties (which in Indian context could be a strong influence) on decision of residents to relocate to a particular area. The sample results reflect the opinion of those, who were covered in the sample. The population study however, may bring out results which are not exactly similar to the ones projected.

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ANALIZA POSTRZEGANIA POSTAW WOBEC DZIELNICY MIESZKANIOWEJ W DELHI, W ODNIESIENIU DO METRA, ŁĄCZNOŚCI I DOSTĘPNOŚCI INFRASTRUKTURY

Streszczenie: Rosnąca aglomeracja miejsca w prawie wszystkich metropoliach na świecie, powoduje wiele problemów rozwojowych i socjo-ekonomicznych, w poszczególnych metropoliach. Niektóre z tych problemów występowały w zjawisku migracji za pracą ze wsi do miast, takie jak korki, wykorzystywanie zasobów, prowadzących do gwałtownego wzrostu cen niektórych zasobów (woda, gaz, elektryczność, transport), nieruchomości i innych dóbr, podkreślając przepaść między bogatymi i biednymi czy nierównowagę wzrostu regionalnego. Celem tego artykułu jest badanie jak efektywnie planowanie infrastruktury transportu może przyczynić się do powstania sytuacji w której można by rozwiązać wszystkie te problemy. Podobny scenariusz zaobserwowano w różnych częściach globu: w Nowym Jorku (USA), Tajwanie, Hong Kongu (Chiny), Manchesterze (UK), New Delhi (Indie), Tokio (Japonia). W wielu z tych metropolii, wdrożono efektywny system MRTS – Massive Rapid Transport System, który jest jednym ze sposobów, za pomocą których władze komunalne miasta lub organy zarządzające miastem, starają się rozwiązać problemy przedstawione powyżej. Niniejszy artykuł stwierdza że w przypadku, gdy w Delhi, rozbudowano by sieć kolejową od regionu NCT do KRS to zmniejszyłoby to stopień zatłoczenia, rosnące ceny a aglomeracja zyskałaby więcej miejsca wraz z możliwym rozwojem peryferiów.

Słowa kluczowe: Mass Rapid Transportation System, NCT, NCR

住宅搬遷在德里NCR（地區）與地鐵連接，基礎設施可用性的態度感知分析

摘要：在幾乎所有的世界大城市發展的城市群已經堆焊在各自的大城市的許多社會經濟和發展問題的一個原因。這些問題有些已經在大都市農村勞動力遷移，交通擁堵，資源的巨大壓力，導致基本服務（水，國內天然氣，電力和運輸）的價格快速上升，房地產行業和其他大宗商品的性質，強調鴻溝富人與窮人，區域增長不平衡和喜歡之間。本文旨在研究如何有效的交通運輸基礎設施的規劃創造了有利的局面，以解決上述所有問題。觀察到的情況是相似的在全球無論是紐約市，美國，台灣，香港，中國，曼徹斯特，英國，印度新德里，東京，日本的不同部分。在許多這些大都市的城市，發展一個高效的質量快速運輸系統（捷運）已被通過的市政企業或城市的執政身體已經嘗試解決上述問題，並一直頗為成功的方式之一程度的影響。本文的結論，如果I期和二期擴建德里地鐵網絡從NCT NCR地區會被顯著減少擁堵，價格不斷增長，城市群將採取地方和周邊地區的發展NC T會也是可能的。