Enterprise Survey for Cities Region Development Project: Conjoint Analysis

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Abstract

In this paper an attempt has been made to provide a lucid analysis of the current scenarios of infrastructural facilities (Supply and demand) in urban areas of Bangladesh. Such an analysis has been made in the framework of simple statistical tools as well as sophisticated statistical tool namely, Conjoint Analysis. Data used are Enterprise level responses collected by Face-to Face interview. Several policy implications have emerged from study outcomes and these are useful for formulating guidelines for improved & expanded facilities and services for urban citizens & entrepreneurs. Such findings will supposedly help launch the Cities Region Development Project (CRDP) in a more beneficial way for the society. People's perceptions, requirements and aspirations have been well reflected in the study outcomes.

Key words: *Enterprise Survey, CRDP, Conjoint Analysis, Factor/ Attribute.*

1. Background

Urbanization means the concentration of population in the big cities of a country. These big cities causing serious problems even in the very advanced countries of the world. The big cities are full of congestion and environmental pollution. The modern cities are growing in a very unsystematic manner due to fast industrialization. In reality, the concentration of industries also causes the problems of urbanization. There are push factors as well pull factors. The population of big cities is always on the increase, because the villagers migrate in large numbers to the cities in search of employment. In the villages there are not many opportunities to get work due to lack of industries. The people of villages also come to the cities in search of higher standard of living and better living conditions. The cities are more glamorous, They provide many sided entertainment through the clubs, cinema houses, television, hotels etc, where as villages lack all such facilities.

Bangladesh has experienced increased Urbanization since independence in 1972. Rapid urbanization has created growing demand for urban infrastructure and services. The development of urban infrastructure has not kept pace with rapid urbanization, causing an acute shortage in every urban service. Rapid urbanization is largely attributed to immigration from rural areas; Immigrants compete for limited employment opportunities, and tend to be in low income group setting in urban slums without access to basic services.

Through the urbanization, large cities and surrounding secondary towns have been agglomerating with close economic and social linkages, forming city regions. Industrial clusters are emerging in agglomerated cities, which have been a driving force of the national economic growth. The contribution of urban areas to the national gross domestic product grew from 26% in 1973 to 48.6% in 2005. However, lack of long-term vision, strategic planning and coordination among various public entities has been preventing the city

regions from materializing their full economic growth potential. Capital investments have been often selected to meet supply-demand gaps, than to promote competitive industries based on strategic assessment of development potentials.

In this view, there was a flagship study namely, "Inclusive Growth and Good Governance for Clustered Cities Development: Innovative interventions in South Asia". Under the second package of RETA 6337: Development Partnership Program for South Asia (the RETA). Roundtable discussions were held in 2008 with key stakeholders, who positively reacted to the new approach to the urban development in Bangladesh. The proposed PPTA will be built upon the conceptual framework to be developed under the RETA, and make a concrete program for capital investments and institutional developments to be funded under the ensuing City Region Development Project (CRDP). A city region comprises a large metropolitan city (City corporation such as Dhaka, Cittagong and Khulan), Secondary towns (Pourashavas) clustered nearby and adjacent areas.

Thus, in order to gather clear picture of current scenarios a baseline survey at enterprise level was conducted in 2009. The principal aim of the survey was to collect primary information on service provisions, its expansions and needs. The Business survey has the objective to collect information on the type of businesses, operational status, employment positions, regulatory environment, quality of public services, expectations and willingness to pay for those services, access to services, and future demand for services.

2. Data Description and Sample Size

In two broad regions namely, Dhaka region and Khulna region the survey was conducted. Business survey was carried out within 750 industries in the upazila and municipalities of Dhaka, Gazipur, Narayanganj and Norshingdhi districts and 250 industries in khulna Region. Dhaka region is situated somewhere at the middle and Khunla is situated at the extreme south of Bangladesh.

One respondent (business head) per enterprise was interviewed.

Types of industries included are:

Type A: Factory and headquarter at the same location

Type B: Factory and headquarter at the different location

3. Methodological Issues

Two types of statistical tools namely, Descriptive statistics and Conjoint Analysis were adopted for the present study. Here we briefly present the basic idea behind Conjoint Analysis (CA) .

Function of CA

For each factor level or for each feature CA provides a value for each feature. Such a value is also termed **as utility**. Features/factor levels having highest such value is declared as the most important for respondents. CA secures utility scores (Called part-worth) of each level of a factor from ratings or rankings of combination of factor levels by consumers (respondents).

How Utilities Corresponds to Preferences

We calculate one utility for each feature (level) for each respondent using preference rankings or ratings. When utility of one attribute feature (level) is added to the utility of some other attribute's feature (level), sum for that combination will show correspondence with position of this combination in the original preference ranking of the respondent. CA calculates utilities for different combination of features of attributes. Such calculated utilizes correspond to preference ranking of combination of features of attributes. For example if a particular combination shows highest utility value, it corresponds for highest preference also.

→ It shows importance of each level of each factor (attribute).

→ It identifies which attribute is more important compared to others.

For each respondent utilities are derived from preference ranking or rating of combinations of features of attributes. Range of utilities of an attribute can show its importance. Comparing the sets of utilities one can identify groups / segments of respondents.

Approaches to CA

There are principally two approaches to CA viz. **two-factor evaluation** and **multi-factor evaluation**.

In two-factor approach large numbers of factors are involved and combination of levels of each pair of factors is taken at a time. Multi-factor approach is like complete factorial design. It defines different product profiles by taking all factors together. Each profile is written on a card and it is given to customer for his overall preference value/rating about the product. If product profiles are too many, one can select a limited number of them using orthogonal design in which effects of main factors are studied ignoring second and higher order interactions.

One can obtain respondent's preferences value either in interval scale or ordinal scale. In the former a respondent puts a value between say, 0 to 10 while in the later the respondent ranks product profile from highest 1 to the lowest rank as per number of combinations.

Utility (Part-Worth) by Level

Using technique of Multiple Regression with dummy variable utility of each level of each factor for a respondent can be obtained. Preference value is treated as dependent (criterion) variable and levels of factors are treated as regressors in regression model. Utilities are selected in such a way that errors between actual preference values and corresponding estimated preference values are minimized. This is the **OLS Procedure of Regression.** For any product profile preference value is obtained by adding the utility values of respective levels of factors of that profile. For example, if a profile has 3 levels having utilities .86,-.27,-10 respectively, then that combination has utility= (.86-.27-.10)=.49

Conjoint Analysis Operational Procedure

Several esoteric softwares are available for conjoint analysis. Computer starts with random starting values of utility estimates or part- worth functions and iteratively it modifies those utility estimates until prediction of consumer preferences are within some tolerable error margin.

Dummy variable regression can be used to estimate the components of a conjoint analysis. Consumer/ customer/ agent preferences are treated as dependent variable and dummy variables for attributes can be treated as predictors. Such regression may look like the following one.

Predicted preference

$$= \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$$

Here $X'S$ are dummies for attribute levels.

A value of $\beta = 0$ will indicate that the corresponding factor level does not matter.

A larger $\beta - value$ means more utility and a consumer is more inclined about that attribute.

4. Results and Analysis

We provide study results and analysis in two parts namely, Descriptive Statistical Analysis and Conjoint Analysis.

A. Descriptive Analysis

Here we present the scenarios of Dhaka and Khulna regions separately. We present the survey outcomes by heads of issues as follows.

Dhaka Region

General Information

About 60% of the industries are Type A (whereby they have their headquarters and factories at the same location); majority of the industries (83.6%) in Narsingdi district were Type A, and a significant number of

industries from Dhaka, Narayanganj and Gazipur were from this category. In Savar 86.4% and Gazipur 64.6% industries fall into Type B category (Headquarters are at different location)

Location

Much less than 50%, ie.37% of the surveyed industries are established in an Industrial Estate or Park. Over half of the industries in Tongi (52.3%) are built within the industrial zones, and 93.2% industries in Savar are not located in such an area. Majority industries in Dhaka, Narayanganj, Gazipur and Narsingdi districts were not established within an industrial zone. Ownership of Land is considered to be the most criterions in the selection of location. Next considerations are ease of transportation, availability of land, and presence of other firms producing similar products. Availability of public utilities like water, power, gas, waste management also considered as determinants of location. In Dhaka 19% and in Gazipur 31% respondents say so. Land for lease is a dominant factor in Tongi. Over 40% industries have more than one factory. Out of them 78% have 3 or more factories.

In general about 45% industries are situated within 300 meters from adjacent main road. In Dhaka 52% and in savar 59% industries are situated within 100 meters from main road.

Sales

During the period 2006-07 to 2008-09, percentage in sales rose significantly in all surveyed areas. However, Savar experienced the most significant growth (79.21%) by a large margin in comparison to other areas, followed by Gazipur (19.85%) and Dhaka (14.15%).

Out of surveyed industries, 48% have 100% domestic sales of their products and 10% have partial domestic sales. Such domestic sales take place within 10 km from establishment of 37% industries. About 18% do domestic sales beyond 50 km.

Materials/Inputs

The1st domestically sourced input material comes from a radial distance of 10- 30km in 36% cases. However, there are notable spatial variations in this respect. In Tongi about 48% industries source their input materials within a radial distance of 1 to 10km. In Savar area, 36% of the 1st domestically sourced input materials come from a distance of 30-50km. While 46% of the total surveyed industries get delivery of materials from their main supplier 1 to 20 times a year, 33% of the industries receive supply 21 to 40 times in a year. Delivery frequency of main materials of majority of the industries varies between 1 to 40 times annually. The most dominant mode of transportation is truck and next is the waterways.

Employee

The garment industry employs 60% of the labor forces involved in all these sample industries. The textile industry involves about 28% of the overall labor force. All other sectors combined employ remaining 12% of the labor force. There was an increase of 6% employee in these industries over last one year (2008-09).

Perception on Services

Perceptions about quality of services were assessed in the survey. Almost 99% of the total surveyed industries use road networks provided by public authorities. Besides, public drainage and storm management systems are used by 73.8% industries. However, 34% of the industries use public water supply facilities, 44% use public sewerage facilities, 44% use public solid waste disposal systems, and 17% use publicly serviced land. About 42% of the total surveyed industries use facilities from private transportation service providers.

Over 77% of the industries that obtain water supply from public sources consider that, cost for the services are reasonable, but 54% expressed the service is inadequate. Over 60% respondents think that improvement in road network will

positively affect their business. Similar assertion was made by 49% respondents regarding water supply.

Willingness to pay

Respondents were asked about their willingness to make trade-off between better service & more bill payment. Such outcome by types of services is presented herein.

Water:

On the whole 76% of the total surveyed industries are willing to pay the higher water bill in lien of better service & supply. Since water is a very important ingredient in industries people want better service for more bill payment.

Sewerage:

Improved sewerage facilities at a higher cost are acceptable to 79% of the total surveyed industries.

Transportation:

Around 84% of the total surveyed industries are unwilling to have improved transportation services and it is because employees of the surveyed industries live within closest vicinity of their workplace.

Khulna Region

In Khunla region 76% industries are of type A.

Location

While 31% of the total surveyed industries within the Khulna Region are situated in an Industrial Estate or Park, 100% industries in Khalishpur are built within industrial zones, but 100% industries in Phultala are not located in such area. More than 55% of the industries in Khan Jahan Ali, Mongla and Abhaynagar are built within the industrial zones.

Among factors determining choice of location, ease of transportation is considered to be the most dominant factor (51%) followed by ownership of land (37%), close to material suppliers (24%), and availability of workers (51%).

Sales

During 2006-07 to 2008-09, the cumulative percentage in sales rose significantly in Phultala (1546.88%). Excepting Khalna Sadar and Abhaynagar, other surveyed area experienced sales growth but not as high as Phultala. Daulatpur experienced the 2nd most significant growth (69.29%) by a large margin in comparison to other areas, followed by Batiaghat (19.06%) and Khalishpur (11.66%).

Of all the total surveyed industries, 77% have 100% domestic sales of their production. While,7.60% has partial domestic sales of their total production. While 36% sell their products within 10 km 20% sell within 10-30km and 13% beyond 50 km. For domestic sales mostly trucks are used (52%) followed by river transport (29%).

Materials/Inputs

Majority 53.8% of the1st domestically sourced input material comes from a distance of more than 50km more than half of the industries in Abhaynagar (56.8%) and Phultala (60.0%) source their input materials within 1 to 10km. In Batiaghata, Khan Jahan Ali and Mongla; areas, almost 25% of the 1st domestically sourced input materials come from a radial distance of 10 - 30km. Primary mode of transport is trucks followed by river boats. In 23% cases railways are also used.

Employee

About 65% of the total labor force in the region are in jute industry and next is the fish industry, contributing to almost 15% of the overall labor force in the year 2008-2009. The remaining eight sectors combined contribute about 20% of the labor force. Overall increase in the total number of people employed across all industries has increased by about 19% from 2007-08 to 2008-09.

Perception on Services

About 78% of the surveyed industries use public road and storm management systems (28%). For operating their businesses, the

majority of the industries rely on self-owned service facilities rather than on services provided by public and private authorities. However, about 20% of the industries use public water supplies facilities and 10% to use publicly serviced land. The only service that industries acquire from private sources is solid waste disposal; about 5.60% of the total surveyed industries use the facility. Of those who use public networks 27% think that service is inadequate. About 77% believe that improvements in transport will have significant impact on business.

Willingness to pay

Water:

On the whole 61% of the total surveyed industries indicate that they are not willing to pay the increased water bill cost.

Sewerage:

For improved sewerage facilities 64% of the surveyed industries are not willing to pay higher bills.

Transportation

Over 90% of the total surveyed industries do not need improved transportation services for employees as because more than 95% employees of the surveyed industries live near by.

B. Conjoint Analysis Results

Conjoint analysis has been performed for service provisions like electricity, gas and water. In this case, all the industries were considered together and not by region. Thus, Conjoint Analysis has been done for 1000 industrial establishments' altogether.

Here we show the levels of attributes for electricity supply to be used for the respondents to assess their preferences.

Attribute Price : 10% more than existing rate,
: 20% more than existing rate
: 30% more than existing rate

Attribute Hours of Supply: 10 hours per day
15 hours per day
24 hours per day

One typical Example for ranking is shown below

		Price		
		10% more	20% more	30% more
Service: Hours	10	2	6	1
	15	4	3	7
	24	9	8	5

We have created dummy variables for each attribute as follows.

X_1=1 if supply time = 15 hrs otherwise X1 =0

X_2=1 if supply time = 24 hrs otherwise X_2 =0

Z_1=1 if price is 20% more otherwise Z_1 =0

Z_2 =1 if price is 30% more otherwise Z_2 =0

Predicted preference= $\beta_1 X_1 + \beta_2 X_2 + \beta_3 Z_1 + \beta_4 Z_2$

$=.53X_1 + .86X_2 - .15Z_1 - .36Z_2$

Here we assume Price 10% and 10 hours supply as bench mark.

There are 9 combinations of attribute levels and they were shown to each respondent and were asked to put part-worth between 0-10 as per his/ her own perception. Then regression was run. The typical example shows that the most desired choice of a person will be the least pay (10% more) and the most service (24 hours). And naturally, highest pay and least hour's service will be the lowest preference. We want to answer question, what are the utilities for price and service hours in determining preferences.

Table 4.1 **Conjoint Analysis Results: Utility values for electricity**

		Price		
		10% more	20% more	30% more
Hours of Service	10	00	-.15	.36
	15	.53	.38	.17
	24	.86	.71	.50

Examining the levels of attribute from the highest to the lowest rated levels we can identify the relative importance of each of the attributes. If different levels of an attribute produce different utilizes, then that attribute is important. Analyzing the trade-offs we can assess the desire of the people. For example, in the above table, the combination 10% more price and 24 hours service and also the combination 20% more price and 24 hours are the most desire of the people. As it appears, people are more concerned about service than price. So, medium price level but highest hours of service are the most desired combination. Even after increasing the price by a certain amount people want to remain connected as long as regularity in supply is there. So, it is clear that people are quality conscious having intention to make trade-off between quality & price. A common practice of judging goodness of fit of prediction is to find correlation between original assessment of respondents and predicated utilities. We have obtained such correlation coefficient to be r=0.789 which indicates quite good capture of consumer preferences. We naturally expect a linear behavioral movement in price of electricity and hours of its supply.

Conjoint Analysis Results: Utility values for water

Water is one of the most important consumption items for industrial activities. Considering the fact that supply of water is inadequate, access to water is quite problematic and it is quite expensive as well, respondents' desire was assessed in the frame work of Conjoint Analysis. Following Levels of attributes are for the respondents to assess their choices and preferences in the framework of Conjoint Analysis.

Attribute Price: 10% more
: 20% more
: 30% more

Attribute Supply: W1: Continuous 12 hours supply with normal pressure
W2: Continuous 15 hours supply with normal pressure
W3: Continuous 24 hours supply with more pressure

A typical example of ranking is given below

Price

		10% more	20% more	30% more
Supply:	W_1(12hrs)	5	2	1
	W_2(15hrs)	8	4	3
	W_3(24hrs)	9	7	6

We have created dummy variables for each attribute as follows.
X_1=1 if supply time = 15 hrs otherwise X_1 =0
X_2=1 if supply time = 24 hrs with more pressure otherwise X_2 =0
Z_1=1 if price is 20% more otherwise Z_1 =0
Z_2 =1 if price is 30% more otherwise Z_2 =0

Predicted preference= $\beta_1 X_1 + \beta_2 X_2 + \beta_3 Z_1 + \beta_4 Z_2$

$=.58X_1 +.49X_2-.27Z_1-.18Z_2$

We show the estimated utilities below.

Table 4.2 Estimated utilities for water

Price

		10% more	20% more	30% more
Supply:	W_1(12hrs)	00	.58	.49
	W_2(15hrs)	-.27	.31	.22
	W_3(24hrs)	-.18	.40	.31

Results in above table clearly suggest that people are more concerned about quality of service compared to rise in price. Considering water is an highly essential item, people can make trade-off between high price and regularity in water supply. Correlation between original assessment of respondents and predicated utilities is 0.596.

Conjoint Analysis Results: Utility values for Gas

Gas is one of the most important consumption items. Considering the fact that supply of gas is inadequate, access to gas is quite problematic and it is quite expensive as well. Respondents' desire was assessed in the frame work of Conjoint Analysis. Following levels of attributes were posed to the respondents to assess their choices and preferences.
Attribute ``Price'': 10% more

: 20% more
: 30% more
Attribute 'Supply': G1: Continuous 12 hours supply with normal pressure
G2: Continuous 15 hours supply with normal pressure
G3: Continuous 24 hours supply with more pressure

A typical example of ranking is given below.

		Price		
		10% more	20% more	30% more
Supply:	G_1(12hrs)	5	2	1
	G_2(15hrs)	8	4	6
	G_3(24hrs)	9	3	7

We have created dummy variables for each attribute as follows.
X_1=1 if supply time = 15 hrs otherwise X_1 =0
X_2=1 if supply time = 24 hrs with more pressure otherwise X_2 =0
Z_1=1 if price is 20% more otherwise Z_1 =0
Z_2 =1 if price is 30% more otherwise Z_2 =0

Predicted preference= $\beta_1 X_1 + \beta_2 X_2 + \beta_3 Z_1 + \beta_4 Z_2$

$=.58X_1 + .49X_2 - .27Z_1 - .18Z_2$

We show the estimated utilities below.

Table 4.3 Estimated utilities for gas

		Price		
		10% more	20% more	30% more
Supply:	G_1(12hrs)	00	.58	.49
	G_2(15hrs)	-.27	.31	.22
	G_3(24hrs)	-.18	.40	.31

Results in above table clearly suggest that people are more concerned about quality of service compared to rise in price. Considering gas is a highly essential item, people appear to be ready to make trade-off between high price and regularity in gas supply. Correlation between original assessment of respondents and predicated utilities is 0.513. Several policy implications have emerged from the study outcomes and these are presented in the next section.

5. Conclusions and Recommendations

In this paper statistical analyses were performed on data collected in a baseline survey conducted in Dhaka City Corporation (DCC) & other 5 municipalities and Khulna region. The survey was conducted on enterprises in DCC, Municipalities and Khulna region. Survey outcomes appear to be very useful for planning and augmenting CRDP.

Baseline survey results based on Descriptive Analysis and Conjoint Analysis suggest several things that are useful for policy makers for effective launching of CRDP. These are delineated below.

1. Uninterrupted or almost so `power supply'
2. Uninterrupted or almost regular `gas supply'

3. Measures to reduce pollution are needed
4. Make easy access to power, gas and `water connection'
5. Modify traffic rules and operations to lessen the burden on people.
6. Making a trade -off between `raising price of electricity' and ensuring `regular power supply' can fulfill the desire of the majority citizens
7. Providing `regularity and quality of water supply' at a higher cost is acceptable to the citizens. Easy access is also a concern of the citizens.
8. Consumers appear to be happy to make a trade-off between `regularity in gas supply' and its increased price.
9. Poor and insufficient service system of DCC & municipalities regarding `drainage and waste management' need to be taken care of.
10. Increase in public transport facilities is of serious importance to be taken into account so that people can comfortably render services to the society. Here also people put more emphasis on `availability' and `quality of services' compared to `price' although majority of employees reside within the closest vicinity.

It is imperative that the above mentioned aspirations as expressed by entrepreneurs need to be under consideration of CRDP. Thus, CRDP goal can be achieved and thereby entrepreneurial initiatives in city regions will improve which will in turn improve social conditions and well-being.

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