

IMPACT OF EXTENDED TRANSPORTATION SYSTEM ON CITY DECENTRALIZATION: A STUDY ON KHULNA CITY

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ABSTRACT

The transportation system plays a vital role in the origin and growth of cities. Khulna, the third largest city in Bangladesh also known as the “Industrial City” has developed based on its transportation system. Since being granted municipal council status in 1884, Khulna has witnessed multiple shifts in its city center, a process that continues today. Recently, the Khulna City Corporation (KCC) has proposed the acquisition of additional land, showing around 10-12% expansion of the city area, which will be added to the KCC boundary soon. This research aims to investigate the impact of the new addition to the city transportation system, the peripheral city bypass road, on Khulna city decentralization. The research adopts a mixed-method approach. Firstly, examine Khulna City’s historical expansion and decentralization pattern. Secondly, an exploration of how the previous transportation system impacted the decentralization of Khulna. The research includes active field surveys and GIS mapping for spatial data collection. A semi-structured questionnaire was used to collect socio-economic growth data. These sets of data were further analyzed to assess the impact of the Khulna peripheral city bypass on the city’s decentralization. Simultaneously, an analysis was conducted to compare past and present decentralization patterns. In conclusion, the transportation system plays a crucial role in the decentralization of Khulna. Currently, the city center is shifting to the northeast, coinciding with the establishment of the Khulna peripheral city bypass road.

Keywords: *City decentralization, Transportation system, City expansion, Khulna City.*

1. INTRODUCTION

It is frequently agreed upon that the state of transportation infrastructure significantly influences the development of cities. We predict that, in particular, advancements in urban transportation infrastructure will impact the placement of incentives for people and companies, as well as affect the quantity of driving and mode selection contingent on the location of residential and commercial properties. In the long run, these infrastructure improvements might have an impact on how cities are physically laid up and how their activities are organized (BAUM-SNOW & TURNER, 2012). Urbanization is one of the most apparent impacts on the environment resulting from humans worldwide. Developing countries have seen a decrease in the use of rural land and an increase in the use of urban land due to urbanization in recent decades (Afroz, 2023). Land use and land cover in developing countries are shifting swiftly due to expanding populations (CORNER ET AL., 2014). Consequently, developing nations invest enormous sums of money in transportation systems that will have an effect on their cities for a long time to come (BAUM-SNOW ET AL., 2017). Ensuring national competitiveness and promoting economic development are two of the fundamental purposes of the Highway system. Production specialization becomes feasible by transportation systems. Transportation routes enable the functioning and upkeep of system for the distribution of industrial goods and products. They can also lead to an expansion of marketplaces by providing access to specialist resources for the production process (Center, 1998). As a result, the World Bank provides larger amounts for transportation development (20%) than for social programs. In contemporary cities, the development of transit routes and street networks, land-use planning and policy and the spatial arrangement of utilities all depend heavily on the development of highways and rail systems. By lowering transportation and commuting expenses, transportation infrastructure directly improves well-being. It also modifies urban form, influences urban ecological impacts and reduces the amount of land obtainable for cultivation (BAUM-SNOW ET AL., 2017). For instance, china has been building urban rail transport systems to handle the country's increasing urban population. By 2020, there were 244 lines spread over 45 cities, whereas in 2000 there were only five lines in two cities (Zhang, 2020). Several studies have shown that these new transportation hubs improved local economic outcomes and expanded the growth of the city (Cervero & Duncan, 2002).

Khulna, the third largest city of Bangladesh, is also known as "industrial city" and is regarded as one of the major commercial and industrial hubs of the nation. At first, the city was a market town with a variety of administrative functions. Following independence, the government put forward a "five-year road plan", with 5,000 miles set aside as the goal route. By 1951, there were 2,000 miles of new roads added to the 600 that were already in place, indicating that the water system was prioritized. Located next to the Bhairab river, the central business district (CBD) of Khulna was established with the first master plan developed in 1961. Then it has been determined as "Dak-Bangla more/node". However, the enlargement of the core has moved linearly in conjunction with the spatial increase caused by growing highways. The transition from community to government, and from water to roads, has been clear (AHMED ET AL., 2014). Khulna has an expansion and infill pattern of urban growth (Parvin & Mostafa, 2010). Nonetheless, the urban core of the city has narrowed, and suburban areas have witnessed simultaneous urban expansion in recent years (Ahmed et al., 2014) (Sultana & Shehzad, 2021). The city is compact in nature, similar to other mid-sized cities (Arku & Marais, 2021) (Escudero Gómez et al., 2019), but it is expanding polycentrically due to feasible primary factors like the creation of economic zones and cross-border transportation (Khatun, 2020), intraregional transportation and economic corridors, and the revival of industries (Parvin & Mostafa, 2010).

The Khan Jahan Ali bridge, which indicated the construction of the bypass road, spanning approximately 640 meters, was constructed in 2005 to provide a traffic link between Khulna city and the capital Dhaka. The ferry was the means of crossing the Rupsha river stream at the beginning of the

2000s, but it eventually slowed down internal and external trade accessibility and became an obstacle to speedier communication systems. In this case, a fixed network like a bridge will facilitate efficient traffic flow by creating comprehensive contact between the capital city of Dhaka and the northwest and southwest regions via the Yamuna and Paisley bridge (RAHMAN & ISLAM, 2018). Following the Khan Jahan Ali bridge's completion, many companies, industries, workshops, and cottage industries built adjacent to the bridge. Many more industries were built in the Rupsha area because of the ease of transportation, including the salt, cement, wood, shrimp, cottage, fish and associated industries, among others. This has greatly increased employment opportunities for the residents living close to the bridge. Research showed that 84% of respondents said that the bridge has resulted in employment opportunities (FATTAH ET AL., 2021).

The city bypass road which was constructed in 2008 as an alternative to the major highway in Khulna city has a linear shape. The road is working as an economic corridor connecting Khulna city to its peripheral areas (administrative sub-units of districts) and Mongla port (AHMED, 2011). Research showed that the land use changed by the corridor in the following year of 2000 to 2010 with the construction of bypass road. Also, the number of other classes to built-up was positive, indicating the development of this road (Nahar et al., 2023).

Therefore, this research aims to identify the factors that influenced the urban growth of Khulna city as well as the expansion of transportation. It is found that the transportation system plays a vital role in different aspects of building urban cores. So, the focus is to pinpoint the effect of comprehensive transportation system on city decentralization.

2. METHODOLOGY

This research is primarily focused on the current expanded transportation system especially the new city bypass from the Khan-Jahan-Ali bridge to the Fultola Afilgate bus stand in Khulna Metropolitan City. Existing city map analysis and a detailed field survey were conducted to offer the overall road networking system especially the heavy vehicle transportation system of Khulna city. From historical analysis of the last 30 years and key informant interviews with Khulna City Corporation (KCC) personnel, the decentralization pattern and the impactful indicators are investigated. The current study seeks to establish whether the transportation system is playing a vital role in Khulna's decentralization. The city center is currently migrating to the northeast, coinciding with the construction of the Khulna periphery city bypass route. Survey summary and impact maps were developed by using AutoCAD and GIS. On the other hand, through a semi-structured questionnaire survey, the socio-economic aspects and the citizen satisfaction ratio were calculated.

2.1 Conceptual Framework

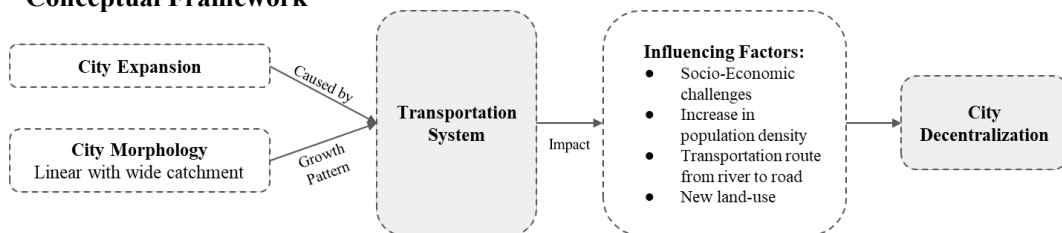


Figure 01: Conceptual Framework

Khulna City grew mostly because of its commercial expansion. With the construction of a new bypass road, the city found new commercial activities and a new land use pattern. People started constructing settlements on the surrounding areas of the new road and many found exclusive employment

facilities. With the help of these activities on the city outskirts, it is significant that the city is fast spreading towards the outskirts. Besides that, Khulna City Corporation has opted to expand its boundaries, which may lead to future urban expansion.

2.2 Study Area & Timeline

The study area of this research is the Khulna City Corporation administrative boundary and its major transportation system from 1985 to till date. This time frame is divided into four important phases according to a few impactful indicators that had massive influences on the economic and commercial expansion of Khulna city.

- I. **Phase 01 (1985-1995):** Declaration of Khulna City Corporation as the 3rd City Corporation of Bangladesh in 1990. Also, the foundation of Khulna University in 1987 was an important attachment to city expansion. (Britannica, 2023)
- II. **Phase 02 (1995-2005):** Jute industries started facing vulnerable times due to economic, regional, and political extremes after 1999 onwards (Hasan et al., 2000).
- III. **Phase 03 (2005-2015):** The inauguration of the Khan-Jahan-Ali bridge on the Rupsha River in 2005 had an enormous impact on the Khulna city transportation system. Which also expanded the horizons of possibilities for economic, commercial, and social development (Rahman & Islam, 2018).
- IV. **Phase 04 (2015-Present):** The government declaration of shutting down of jute industrial area in 2020 was a notable economic incident and had an inverse impact on the linear development of Khulna city. After the most awaited inauguration in 2022, Padma Bridge is just starting to heal the commercial and economic graph of Khulna city. It also links the Khulna zone with the national transportation route (Ali et al., 2022).

New extended boundary proposal of KCC respecting the New City bypass road in 2023. These four phases are identified as leading influences on city decentralization also. This study focuses on the existing commercial land use conditions and transportation system of Khulna.

The city's future growth and prosperity are also dependent on its effective transportation network. A great number of people come to the city from surrounding areas since the city serves as a transit hub between the Mongla Port, regional metropolitan centers, and the rich agricultural hinterland, and they make use of the transportation amenities, particularly the inner bypass route. People choose to live in the city's outskirts rather than in the city, thanks to the construction of the bypass road and improvements to transportation. As a result, the population of the surrounding upazilas, such as Batiaghata, is expanding while the city's population is falling. Despite a declining tendency in population growth, the city is at its peak development period (macro trends.net, 2020).

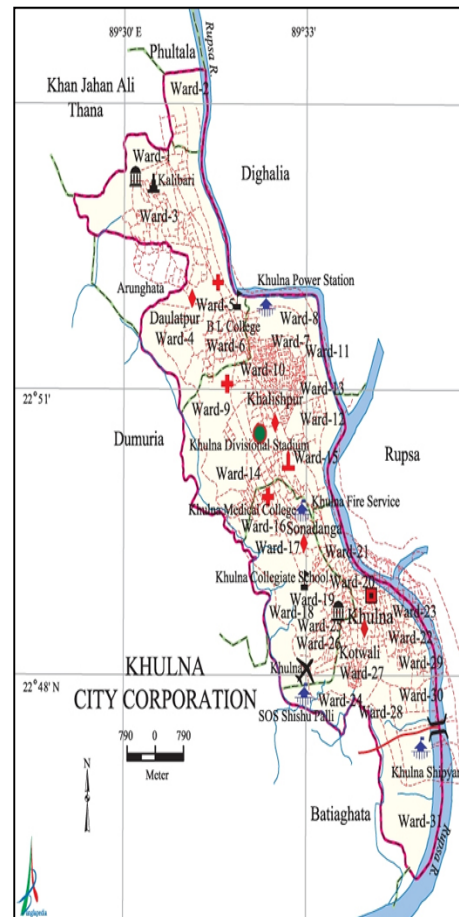


Figure 02: Proposed extended administrative area of KCC (Source: Banglapedia)

2.3 Data Collection

The secondary sources like, journals, books, and newspaper articles were the first step of data collection. Land use maps, road maps, ward map, structure map were collected from Khulna Development Authority (KDA) and Khulna City Corporation (KCC). A key person interview was done to collect data about city expansion and its influence from the aspect of new transportation system.

Oral historical narrative is the available primary data source for this research. A semi-structured questioner survey was done for quantitative analysis according to the root cause indicators of Khulna city decentralization based on extended transportation impacts. They question topics are:

1. Timeline of the commercial establishment of the area.
2. Comparison of the previous and present scenario from the profit-making point of view of a merchant.
3. Reason behind to establish their outlet in the current location.
4. Likert scale questioner for impact assessment of the indicators.

Indicators	Importance Scale			
	Most Important (100%)	Important (75%)	Moderate (50%)	Less Important (25%)

Sample size was 120 from different time-frame and location of the Khulna city. We started from the aristocratic merchants of phase 01. Snow-ball sampling method is used for sample selection. Three primary samples are:

- a) Md. Selim, Razzak Brothers- Boro-Bazar commercial zone, since 1947
- b) Md. Abdullah, Chittagong Trading- Boro-Bazar commercial zone, since 1950
- c) Indra Mohan Sweets- Boro Bazar wet market, since 1890

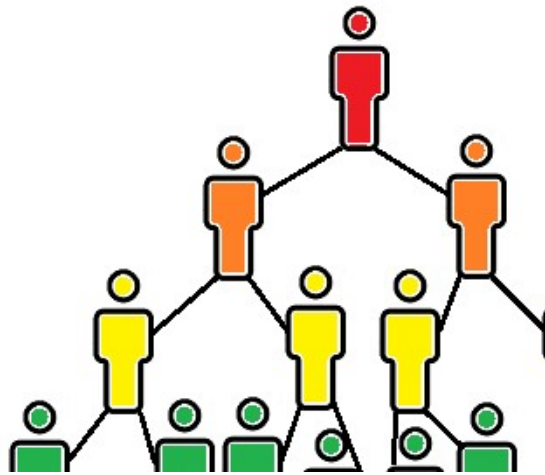


Figure 03: Snow-ball sampling applied for sample collection

2.4 Methodological framework of the study

The detailed methodological framework that was used to perform the study is depicted here, where everything from problem identification to final paper presentation can be readily understood.

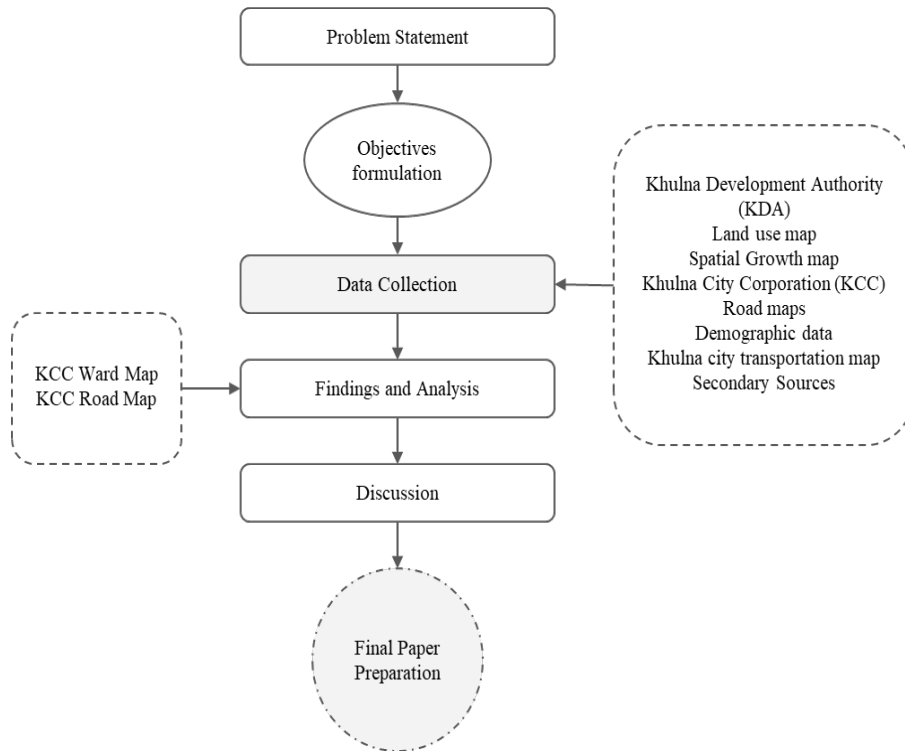


Figure 04: Methodological Framework

3. DATA SUMMARY

The Khulna city was developing alongside the river Rupsha. After the Khulna City Corporation was established in 1984, the city had two main developing zones, one was in Khalishpur and another was in Dakbangla. We have divided the study timeline, 1985 to present, into four phases considering the major commercial development.

In phase 1 (1985-1995) we analysed the main commercial circulating road connecting the two main thriving commercial zones, Dakbangla and Rupsha Terminal. Heavy loaded trucks, pickups were circulating along Rupsha Terminal and K.D.A. Ghos road. This road was the main commercial connection between Mongla and Jashore. Old Freight rail way was also connected with this

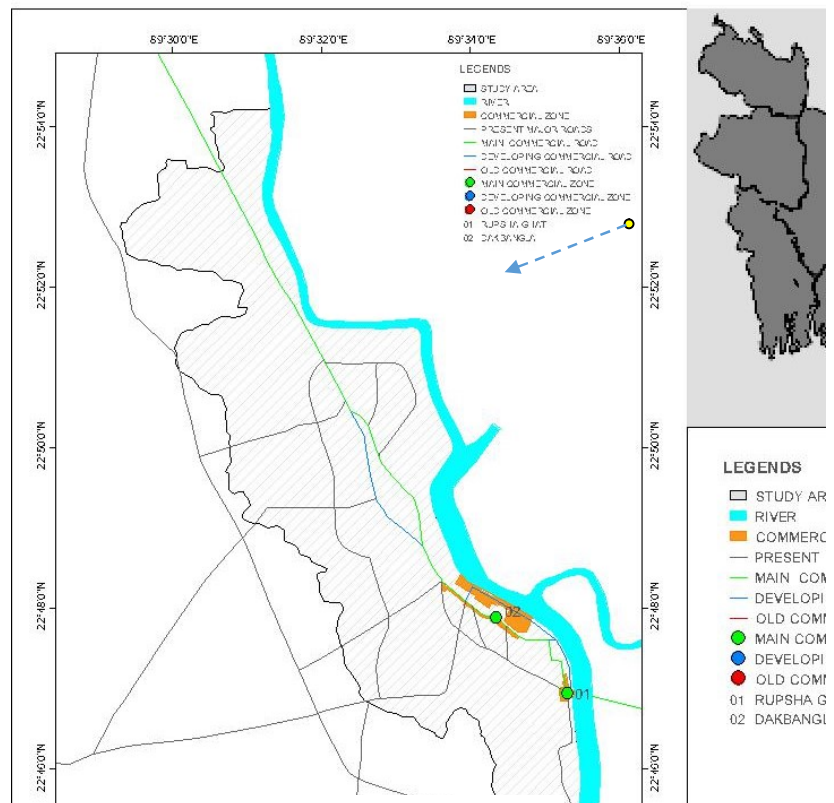


Figure 05: Phase 01(1985-1995)

road. As these two commercial zones were expanding with time, so were public access roads and vehicles. At the time the main public transports were Rickshaw, Baby-taxi, and Inter-city Bus. The Inter-District bus terminal was situated at Ferry terminal. Khulna-Dhaka-Jessore highway was newly developed and becoming a potential main commercial circulating road.

During phase 2 (1995-2005), the urbanisation process in Khulna city was already an on-going process due to the growth of commerce and manufacturing sectors. At the beginning of this phase Khulna city had a positive net migration. Therefore, the residential area of the city was expanding. People were migrating from surrounding area of the city. So, Khulna was residentially expanding westward. Consequently, Dakbangla as a core commercial hub for public was not sufficient anymore. Rupsha ferry was consistently the main commercial connection between Mongla and Khulna. Royal node was becoming popular destination for commercial activity among public. So, the Rupsha to Shibbari route was taking off quickly. Some major commercial brand shops were established alongside this route. This route became High-class commercial zone for household items.

As the residential area started sprawling thought the city, Nirala-Gollamari Road became another major commercial road in the city. While, Nirala and Moylapota became a potential commercial point. Commercial activities started to spread alongside the road.

Meanwhile, Dakbangla Rupsha connection still remained thriving wholesale commercial zone. People still needed to circulate this route and many amenities like parks, cinema hall, recreational areas were already developed at that time. Moreover, the old railway station was around Borobazar area as a major transportation hub. So, the need of Dakbangla as a major commercial zone was not over yet.

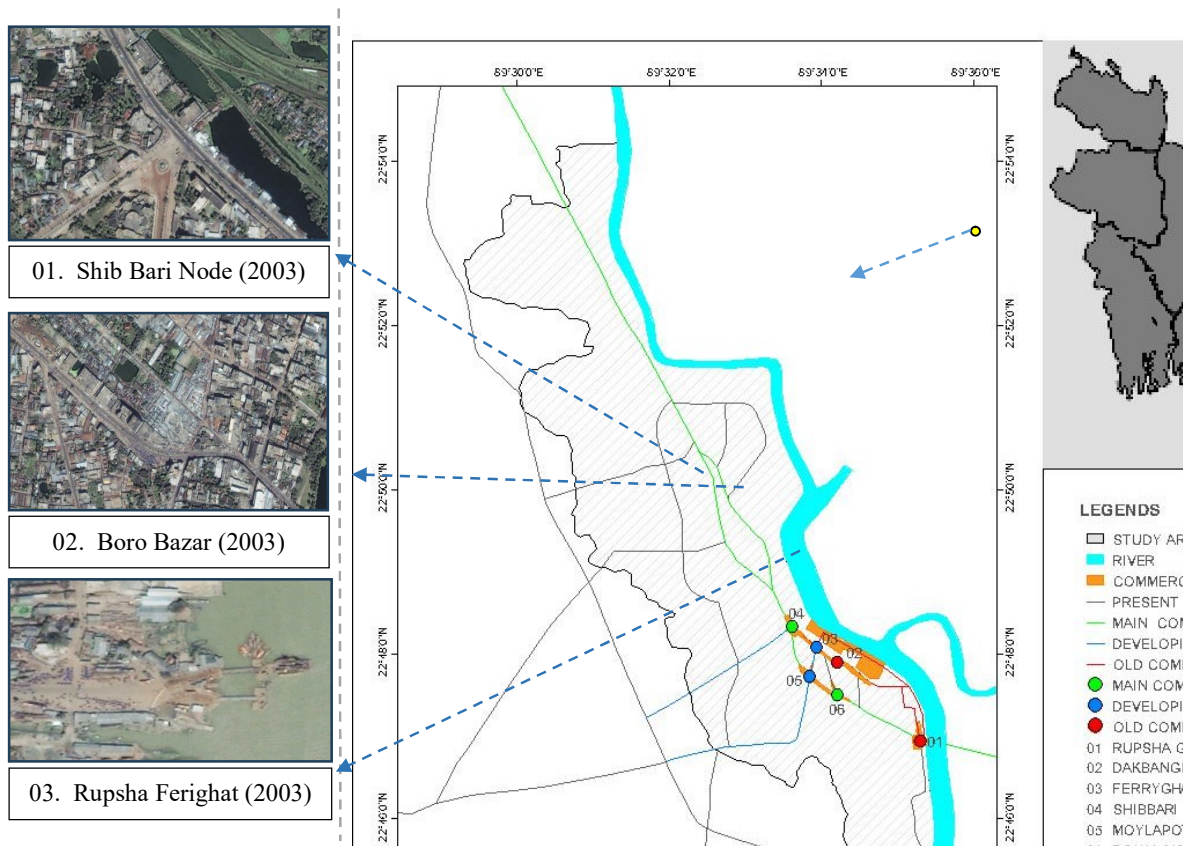


Figure 06: Phase 02 (1995-2005)

Phase 03 (2005-2015) was a pivotal time for Khulna city. The Khan Jahan Ali Bridge was open for public transportation in 2005. Rupsha Terminal-Mongla highway was segregated at Kudir bot-tola

Square, and Rupsha-Dakbangla commercial zone was connected with a new Shipyard Road. This road became crucial for commercial connection overnight. At the midpoint of this phase, Rupsha Ferry Terminal came to a shut down. So, the commercial heavy vehicles were using the peripheral roads of the city. The Shipyard to Dakbangla road became prominent and the Rupsha to Shibbari route showed a decreased traffic of commercial vehicles. At this time, inter-city bus was also shut off.

The westward part of the city was connected with the bridge also. This connection was made possible with another commercial road, which was connected through Zero point and Gollamari to Moylapota. As these routes began developing more and more commercial zones were spreading rapidly alongside the roads. Another route, Sachibuna-Gollamari was also becoming prominent for commercial usage. Gollamari-Sonadanga route was also becoming demanding for commercial circulation to avoid traffic congestion in the main traffic spine, Rupsha-Shibbari route. The administrative zone of the city was planning to shift towards Boyra zone. Therefore, residential area was sprawling slowly in that area. Public demand created small commercial zones in Boyra and Notun Rasta node.

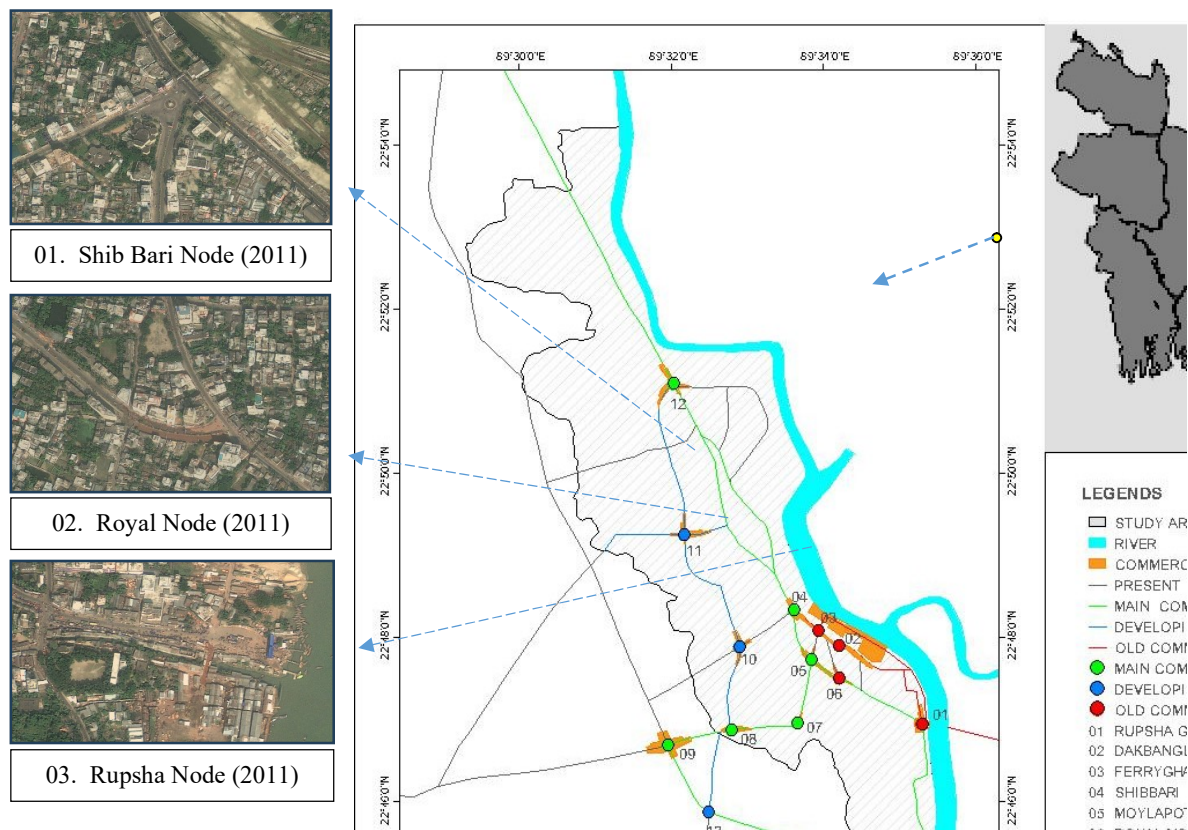


Figure 07: Phase 03 (2005-2015)

Phase 04 (2015-Present) shows us saturated commercial zones all over the city. Dakbangla became the fully converted wholesale market. As the Rupsha-Shibbari Road was no longer used as commercial routes, the main commercial connection with Dakbangla remained water ways with Voirob Stand – Rupsha Terminal Road. Rupsha Terminal, Royal node, Moylapota, Shibbari node all became commercially fully active as the public demand rose at this time.

Sachibunia – Gollamari route is gaining popularity as developing commercial route, where Sachibunia node is occupying small businesses. Gollamari - Sonadanga connecting road saw a rise in commercial usage. The road is now known as M.A Bari Street. As this route is situated at peripheral side of the city, it had a major role connecting surrounding areas with the city. The renowned truck terminal is

situated here and a Paikary Kacha Bazar started to form slowly. At present time, it is the biggest Kacha bazar in Khulna. This Bazar is connected with the city through Sonadanga Bypass Road, which is a developing commercial route in Khulna.

Khan Jahan Ali Bridge is still remained as the main outer circulation road of the city. Construction of the Padma Bridge opened new dimension for commercial access to the city. Khulna bypass road is the connection road between these points. Joy Bangla node saw a new development of commercial activity. Warehouses and small businesses are occupying the roadside along the bypass road. As land price is cheaper here than within the KCC boundary, people have started to move here recently and small residential zones are sprawling slowly. Mostofa'r node to Boyra node connecting road is developing commercially as the residential zones are expanding.

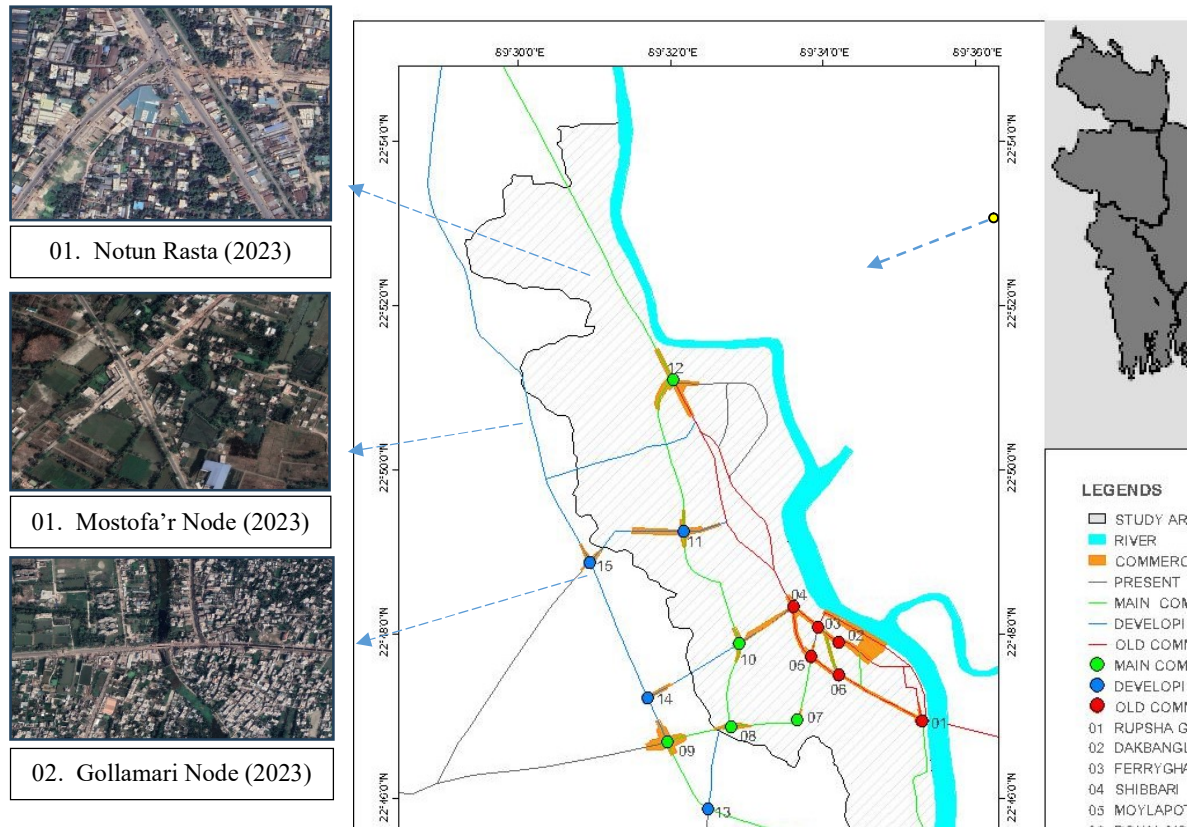


Figure 08: Phase 04 (2015-till date)

4. FINDINGS AND DISCUSSION

From the collected data and evidence, one thing is quite certain commercial expansion and decentralization along with previous to present transportation systems are interrelated. This is also a well-known theory for urban commercial development. Many newly developed commercial areas like Shenzhen in China also experience this type of growth and decentralization. According to research, the transportation system is the jack of the commercial hub development (Wang & Xu, 2002) and the pattern is quite similar to the commercial development of Khulna.

To address the commercial expansion and decentralization pattern in Khulna City few influential indicators (Ristea et al., 2010) are being observed to investigate the root cause of decentralization. They are.

- i. Cost-effective Transportation.
- ii. Heavy vehicle accessibility
- iii. Public Exposure
- iv. Store position, size, and storage facilities
- v. Civic demand

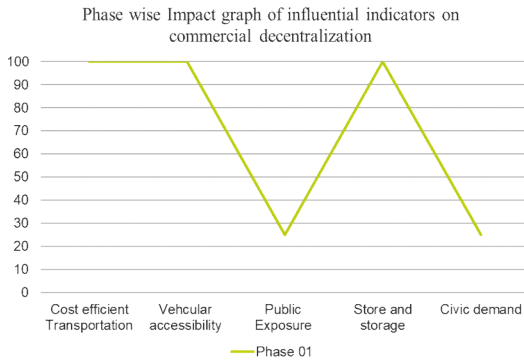


Figure 09: Impact graph of Phase 01

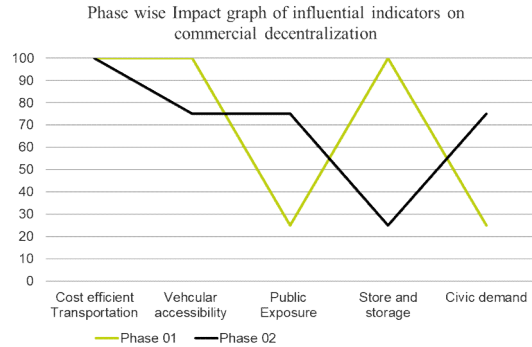


Figure 10: Impact graph of Phase 02

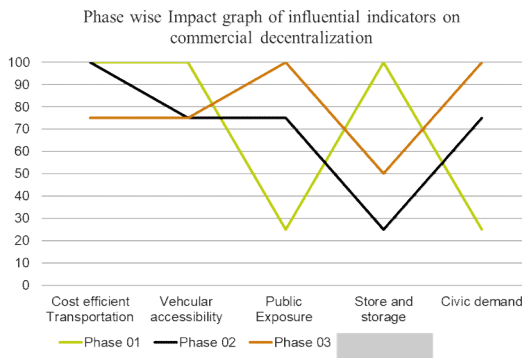


Figure 11: Impact graph of Phase 03

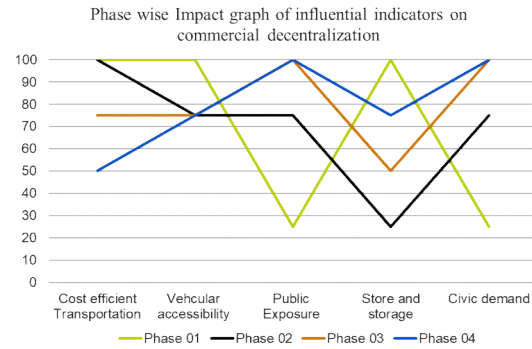


Figure 12: Impact graph of Phase 04

Phase 01 (Figure 05) clearly indicates that two major commercial points (Dak Bangla & Rupsha Ferryghat node) of Khulna were mostly water transportation based which was cost-effective, and heavy water vehicles were accessible through the Rupsha-Bhairab River. Road transportation and linkage were also commercial point-oriented and industry-based. Thus, all economic activities and exposure were bound to these areas in 1985. From the survey (Figure 09) it is found that most of the aristocratic business persons of the city started their activity within these two zones and the prominent reason behind this was cost-effective vehicular access through the river. The residential areas of the city at that time were also compact and clustered around Rupsha and Khalishpur areas. For daily necessities, mass people had to visit Boro Bazar and Dakbangla commercial zone. So, huge storage for wholesale shops was a must. However, The Brand store or luxurious shops were almost a daydream for the local people. This was a phase of township so civic expectations were more demand-supply based than luxurious exposures. The first and biggest Metropolitan park of Khulna city at that time which is now known as Shaheed Hadis Park was also located alongside KDA Ghosh

Road near the main commercial hub. This road also housed the first cinema hall in the city. As a result the city mostly crumbled up alongside its main commercial route.

During phase 02 (Figure 06), the major product transportation was still water route and Rail route oriented. Rupsha Ferry was the main commercial access to the city. As the residential areas were expanding the city needed more commercial hubs in city centers. To meet the city demand brand shop concept was introduced and many national brands like Bata, Nabisco, Berger Paints, etc. started their franchises. Due to civic demand and exposure, many commercial shops relocated to new commercial points from the Dak Bangla node & and Rupsha node to the newly developed Royal Node and Shibbari Node. These commercial zones were still on a small scale. Strategic marketing was beginning to take place at that time. More public spaces were accessible to the masses. Wonderland Amusement Park and Solar Park were gaining more popularity as people started to spread out of the city core. A few potential points were also introduced like the Moylapota node, Ferryghat node, etc. Which was a clear indicator of decentralization of the first commercial hub.

Phase 03 (Figure 07) was the beginning of the new Khulna. The long-awaited Khan-Jahan-Ali bridge on the Rupsha River had accelerated the road transportation era for the economy of this city. It also was the initiative of new urbanism. Road transportation became more popular, cost-effective, and hazard-free. Only Riverbank-focused development got a new direction. As the vehicular route got more accessible, previous river-oriented main commercial zones were also over-saturated and needed further extensions. Due to city expansion and increased population, extended transportation routes like Khan-Jahan-Ali Road from Rupsha Ferry ghat to Shibbari node to Shonadanga Node got massive exposure for commercial development. The connecting outer bypass from the Gollamari Node to the Notun rasta Node generated potential commercial points, these areas played major roles for further decentralization. The vehicular transportation was not that much cost friendly but different types of heavy vehicles were accessible from the Khan-Jahan-Ali bridge through Zero Point in the city easily (Figure 10). Which got a notable public exposure for the local and territorial people of the district (Assessment of traffic congestion scenario at the CBD areas in a developing city: In the context of Khulna City, Bangladesh). Public amenities were becoming more accessible to the masses. Previously smaller commercial points were becoming more popular among the public. Hotels, restaurants, and street vendors started to occupy alongside newly developed commercial roads. Old prominent businesses started to branch out at this time. As the old outer bypass road got more commercially saturated, many important amenities like Khulna Medical College, Women's' sports club, etc. were established in this phase (Figure 11).

Phase 04 (Figure 08) is the current scenario of Khulna city. Where the previous commercial points and nodes are almost saturated, a few points are over-saturated like the Shib-Bari node, Moylapota node, etc. The very first points like Dak Bangla node and Rupsha ferry ghat node already lost their charm and attraction as retail commercial points. Heavy vehicular accessibility is very limited there. Water transport lost its previous popularity Due to the great Padma Bridge which recently added Khulna to the National transportation belt by road. Now Khulna is also a part of the Transit master plan of the county. The New City Bypass zone is going to be the new town for Khulna. All impactful indicators have high potential in this new Bypass area (Figure 12). A flow to "go to new town" tendency has already started. Government like- Central Jail, inter-district bus terminal, Khulna Agriculture University, and Non-governmental organizations like- NUBTK permanent campus, Cancer Hospital, etc. have secured their position in this area. Commercial and residential settlements are also rapidly shifting. Zero-point node, Joy Bangla Node, Mostofa Node, and Afil Gate node all have high potential for commercial expansion. Which will cause massive land use expansion and

commercial decentralization in Khulna City. This new City Bypass has already introduced the new Khulna and old Khulna concept among the civilians of Khulna City.

From all phase-wise discussions and data summaries, the root cause of Khulna City's decentralization, especially from the commercial point of view, is highly influenced by its extended transportation routes. New routes have introduced new commercial potentialities every time. This chain process can be summarized below:

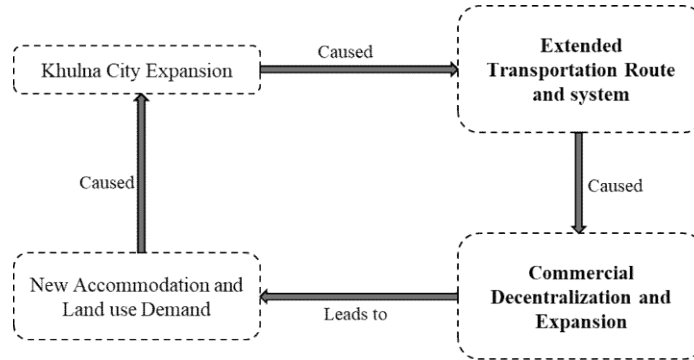


Figure 13: The chain of Expansion and Decentralization caused by the Transportation system of Khulna City

5. CONCLUSIONS

The expansion of a city's transportation network is mostly dependent on urban growth, and improved transportation infrastructure boosts the local economy and trade. When the economic growth happens, a city shifts its main core to main sub cores and develop other economic zones. Therefore, building new roads should come first in terms of economic expansion. Recently, Khulna Development Authority and Khulna City Corporation are concerned to develop roads and bridges in Khulna city. However, involving Roads and Highways Department alongside these priors may lead to a better solution to the city expansion patterns. Integrating transit-oriented development to explore newer activities like; public places, housing and commercial facilities can be beneficial for Khulna city implementing these expansions. Additionally, international transactions may be facilitated by the Mongla-Khulna-Benapole route or the Padma bridge-Khulna-Benapole route. Bringing these routes up to the international level will help the economy expand and could spur city growth.

There are many influential factors behind a city decentralization. In impoverished areas like Khulna city, transportation infrastructure most typically produces the biggest economic returns. Therefore, the main focus of these research was to find out which influential factors were behind the growth of commercial roads in Khulna city that lead to city decentralization. From Rupsha-Bhairab river way to the railway development and then shifting to the roads lead to many small economic zones for Khulna city. But developing the bypass road following by the Khan Jahan Ali Bridge development helped to growth those small zones to a larger scale. Recently, moylapota node and Shib-Bari node are playing one of the most prominent commercial area for Khulna city. In a nutshell, this research shows the positive impacts of extended transportation system to city decentralization. Furthermore, the study provides opportunities to explore prospective factors that might assist in the development of new transportation routes to access additional land and economic hubs inside Khulna city. Analysing the effective use of newly available lands for an improved planning of urban areas might be a potential subject likewise.

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