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Review Article

Assessment of Child Marriage Propensity on the Basis of Influence Area: A Case Study on Jamalpur, Bogra and Sirajganj District of Bangladesh

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Abstract

Bangladesh has one of the highest global rates of child marriage. A substantial proportion of girls are married before the age of 18, often without their voluntary consent in Bangladesh. According to United Nations estimates, nearly 66% of Bangladeshi females enter into marriage during adolescence. This high prevalence is driven by a range of interrelated factors, including entrenched social norms, economic pressures, and cultural practices that perpetuate the cycle of child marriage. These factors may vary from region to region while two or more connected regions may have some common norms or customs that influence each other. The study aims to find out the influence area and unserved area of the upazilas of Jamalpur, Bogra and Sirajganj districts by Functional regionalization and to assess the reasons behind having most influence area on the basis of some factors. From Bangladesh Bureau of Statistics (BBS) 2011, the data have been collected and gravitational theory is used to find out influence area in this study. Crime data, socio-economic condition at these three districts are analyzed in this study. From the quantitative analysis the findings indicate that poverty, lack of education, patriarchal family structures, and social insecurity are some of the dominant factors driving early marriage in these regions. In many cases, families believe marrying their daughters at a young age provides social protection or economic relief. The analysis highlights how functional interdependency between neighboring upazilas strengthens cultural practices, leading to widespread child marriage. The study has successfully identified the functional interdependency and showed the influence between them which led early marriage frequently. Policymakers may find this information useful in focusing actions and providing resources to prevent child marriage in the areas most affected.

Keywords

Child Marriage, Functional Interdependency, Propensity, Bangladesh, Influence Area.

1. Introduction

Millions of girls worldwide are forced into early marriage, and Bangladesh is not an exception. It is still very common in most South Asian nations. Bangladesh ranks fourth globally in terms of child marriage rates, behind only the Central African Republic and Chad, according to UNICEF(Talukder et al., 2020). Child marriage is a significant social issue in

Bangladesh, where a substantial proportion of girls are married before reaching the legal age of 18. Approximately 90 percent of Bangladesh's population is Muslim, and early marriage is a common practice there, particularly in rural areas

where parents are under continual pressure to marry off their teenage daughters(Arnab & Siraj, 2020). Despite laws such as the Child Marriage Restraint Act (1929) and its amendment in 2017, which set legal frameworks to prevent child marriage, socio-cultural norms, poverty, and gender inequality continue to drive this practice. Bangladesh has one of the highest rates of child marriage globally, particularly in rural areas.

The consequences of child marriage are profound, affecting girls' education, health, and overall development, often leading to early pregnancies, domestic violence, and the perpetuation of the poverty cycle. In underdeveloped nations like Bangladesh, early marriages are often the result of poverty. In areas of extreme poverty, young girls are frequently seen as a burden. When this happens, the parents choose to marry off their daughters early because it means they will have fewer mouths to feed. Sometimes young females can express less interest in pursuing higher education, and poor households occasionally cannot afford to pay for their children's education. Families may be encouraged to marry their daughters at a young age in order to mitigate the chance that the girl won't be able to find a suitable spouse later in life or to avoid the growing expense of the dowry or the declining worth of bride riches that results as a girl ages(Streatfield et al., 2015). Although marriage at the age of eighteen is legal in 158 countries, laws prohibiting the marriage of underage couples are rarely implemented since social norms and customs encourage the practice. Bangladesh is a country where marriage is both common and nearly universal. In Bangladesh, getting married young and having children early on is normal. It is encouraged in Bangladeshi society to marry early and have children.

A large-scale BRAC survey covering 27 districts found similar worrying trends: about 44.7% of girls in those districts married before 18; geographically, Pirojpur had one of the highest rates at 72.6%**,** while Netrakona recorded 24.1%. Among factors cited, poverty, low levels of education, lack of social security, and finding a perceived “suitable husband” were frequently mentioned by parents(Amin, 2023). UNFPA, UNICEF, and other bodies note that although Bangladesh has seen a gradual decline in child marriage since 2011 (at around 2.1% per year), this decline is uneven—progress is far slower in poorer, rural, and less educated communities. Moreover, the COVID-19 pandemic appeared to worsen vulnerabilities: more girls were pushed into early marriages due to school closures, loss of income, and increased economic and social pressures(UNFPA, 2023). While national estimates show that over half of Bangladeshi girls marry before age 18, and under-15 marriages are rising (8.2% in 2023) in the country, district-level data are sparse. In places like Jamalpur, Bogra, and Sirajganj, anecdotal reports and program interventions suggest the issue is serious, but there is a lack of robust statistical evidence about the prevalence, trends, and spatial variation in child marriage in these districts. This gap in localised prevalence data underscores the need for this study to map child marriage propensity and influence areas more precisely in these districts.

1.1. Objectives

1. To find out the influence area and unserved area of the Upazilas of Jamalpur, Bogra and Sirajganj districts by Functional regionalization.
2. To assess the reasons behind having most influence area on the basis of some factors.

2. Literature Review

Child marriage, defined by UNICEF as the formal or informal union of any individual below the age of 18, remains one of the most pervasive human rights violations globally. It affects an estimated 640 million women and girls worldwide, with South Asia alone accounting for about 45% of these cases (UNICEF, 2023). Bangladesh ranks among the countries with the highest prevalence of child marriage globally and the highest in South Asia, making it a focal point for global development and gender equality discussions. According to the Bangladesh Bureau of Statistics, approximately 51% of Bangladeshi women aged 20–24 were married before reaching the age of 18, while 8.2% were married before 15(BBS, 2022). Although this marks a decline from more than 90% in the 1970s, recent data reveal a worrying stagnation, indicating that progress has slowed over the past decade. The persistence of child marriage in Bangladesh is intricately linked to a web of socioeconomic, cultural, and gender-based factors. The average age of first marriage among women remains between 20 and 24 years, yet up to 70% of rural women are still married before 18(Kamal, 2010; UNICEF, 2023). Poverty, cultural traditions, and entrenched gender inequality perpetuate this phenomenon. In rural areas, parents often view marriage as an immediate solution to financial hardship and social insecurity (Tahmid et al., 2020; Talukder & Hasan, 2020). The

economic dimension is particularly significant for low-income families, early marriage reduces the perceived financial burden of raising daughters and lowers the expected dowry payment (Wodon et al., 2017).

Education plays a crucial protective role against early marriage. Multiple studies show that girls who complete secondary or higher education are three to six times less likely to marry before 18 compared to those with no formal education (BBS, 2022; Zahangir & Kamal, 2011). Education empowers girls with knowledge, self-confidence, and decision-making power, which challenge patriarchal norms that often restrict female autonomy. Conversely, early dropout due to poverty or gender bias exposes girls to higher risks of early marriage (Ainul et al., 2020; Mim, 2017). The lack of secondary schools, inadequate safety for commuting, and social restrictions on girls' mobility further reinforce the practice in many rural areas (UNFPA, 2023). Beyond educational barriers, child marriage is closely associated with domestic violence, health complications, and limited empowerment. The Violence Against Women Survey revealed that nearly 87% of married women in Bangladesh have faced physical, emotional, or sexual abuse (BBS, 2011). Women married at a young age are more vulnerable to intimate partner violence, early pregnancies, and economic dependency (Abdullah & Quayes, 2015). Empirical evidence indicates that economic empowerment through access to education, employment, and microfinance significantly reduces exposure to violence and increases women's agency within households (Moyazzem Hossain et al., 2022).

The health implications of child marriage are equally severe. Early pregnancy and childbearing among adolescent girls lead to maternal malnutrition, obstetric complications, and poor neonatal outcomes. The World Health Organization reports that adolescent mothers (aged 10–19 years) face higher risks of eclampsia, puerperal endometritis and systemic infections than women aged 20–24 years, and babies of adolescent mothers face higher risks of low birth weight, preterm birth and severe neonatal condition (WHO, 2024). Young mothers face elevated risks of miscarriage, stillbirth, and neonatal mortality due to their biological immaturity and inadequate access to maternal healthcare (Moyazzem Hossain et al., 2022; UNICEF, 2023). These consequences perpetuate a vicious cycle of poor health, poverty, and gender inequality, further limiting opportunities for social advancement. Socioeconomic and cultural determinants remain central to understanding the propensity of child marriage in Bangladesh. Poverty is a primary driver family in the lowest wealth quintile are about five times more likely to marry off their daughters early compared to those in the richest quintile (UNICEF, 2023; Wodon et al., 2017). Social and religious norms reinforce this tendency, especially in conservative rural areas where early marriage is perceived as safeguarding family honor or ensuring a daughter's marriageability (Biswas et al., 2019; BRAC, 2023). Furthermore, patriarchal social structures grant limited agency to young women, often excluding them from educational and economic decision-making processes. Access to mass media and awareness campaigns has emerged as a key mitigating factor. Exposure to information regarding women's rights, reproductive health, and gender equality has been shown to significantly reduce the likelihood of early marriage (Girls Not Brides, 2024; UNICEF, 2023).

Development programs and community-based interventions such as those implemented by BRAC, Plan International, and UNFPA have demonstrated measurable success in delaying marriage and increasing school retention among adolescent girls. Despite national-level progress, recent studies show that child marriage rates are spatially uneven across the country. The Rajshahi Division, where this study is situated, exhibits some of the highest child marriage rates in Bangladesh, exceeding 60% of women married before 18. District-level data indicate rates surpassing 65% in nearby Chapainawabganj, Naogaon, and Joypurhat (BRAC, 2023). These patterns suggest that spatial, cultural, and economic interdependencies among neighboring districts play a crucial role in perpetuating early marriage. In particular, the districts of Jamalpur, Bogra, and Sirajganj the focus of this study are characterized by limited industrial development, poor educational infrastructure, and low literacy rates, all of which exacerbate child marriage propensity. Although numerous studies have explored the demographic and socioeconomic correlates of child marriage, few have analyzed its spatial and functional dimensions. Understanding how interconnected districts influence each other through shared culture, economy, and migration is essential to designing regionally targeted interventions. Hence, this research applies functional regionalization and influence-area analysis to identify the spatial clusters most affected by child marriage, revealing unserved areas where policy attention is most urgently needed.

3. Methodology

The names of the Upazilas and figures for the population were provided by the Bangladesh Bureau of Statistics (BBS). Furthermore, the BBS shapefile has provided information about the Upazilas headquarters' location, boundaries, and geographic area. Using a Geographic Information System (GIS), a map of the present-day borders has been produced. Reliance on Reilly's Retail Gravitational Theory was substantial in the research.

$$\text{Miles from outer limit of catchment} = \frac{\text{Distance between A to B}}{1+\sqrt{\frac{\text{Population of A}}{\text{Population of B}}}}$$

GIS has been applied to determine the split point for each Upazila by calculating the distance between the headquarters of two Upazilas. By connecting near Upazilas's split point, the influence area for each upazila has been created. A map prepared using GIS illustrated the unserved area between the polygons and the limited effect region. Microsoft Excel serves to rank the percentage, population influence area, and geographic region using the BBS data. Excel is used to create a bar chart using data from the BBS in order to better represent the factors' data. The result of the analysis has been cross-checked using secondary sources.

We have been taken four main factors that are assessed thoroughly for determining the propensity and current situation of child marriage among the three districts. These are:

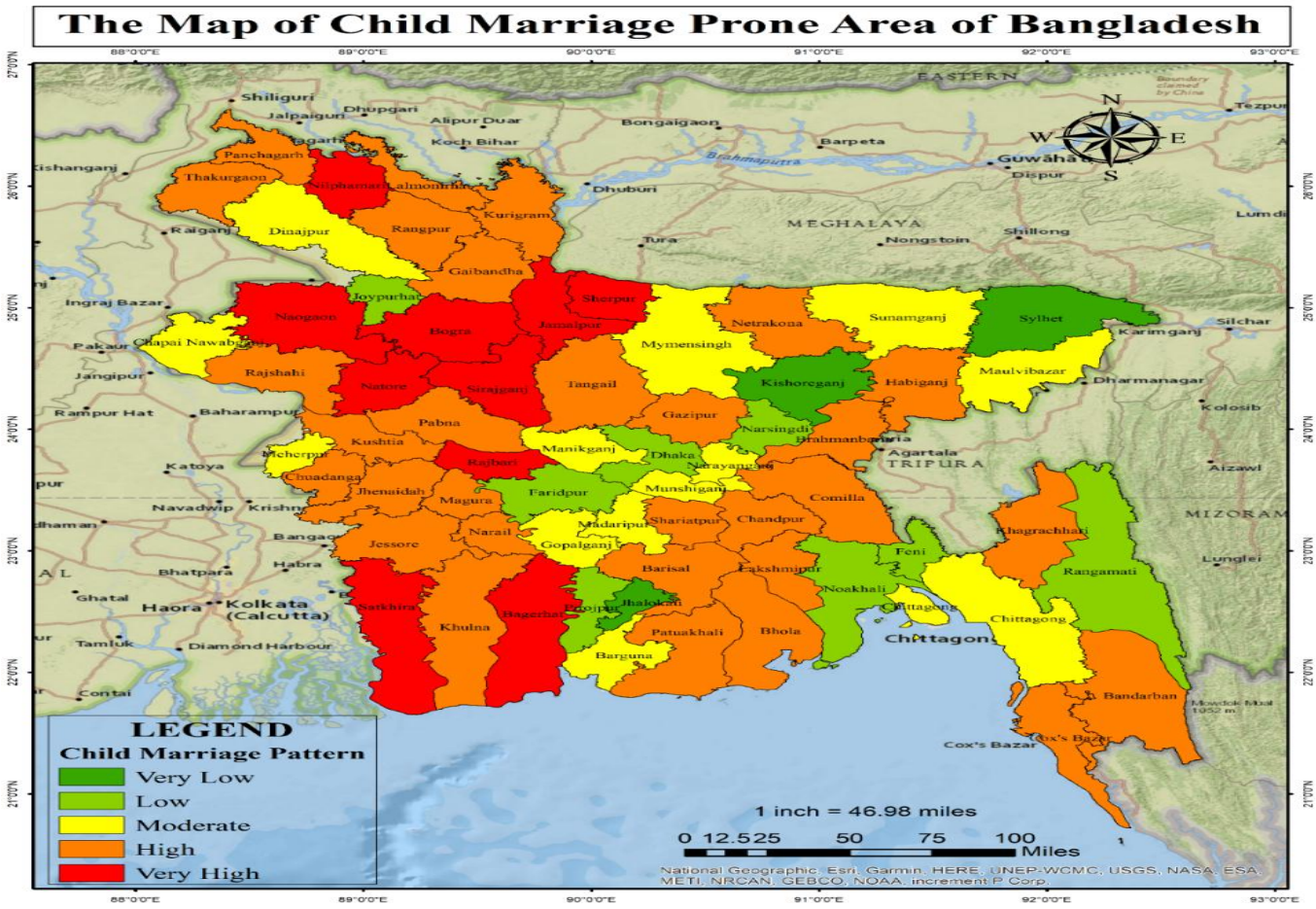
Crime Rate

Bangladesh's crime rate, which varies based on the type of crime and the area, has been cause of concerns. A safer atmosphere may be suggested by low crime rates, whereas high rates may be a sign of social instability. In addition to having inadequate law enforcement, restricted access to the judicial system, and a culture that supports harmful activities, high rates of child marriage can also contribute to higher crime rates.

Number of Government and Non-Government College

Girls who go to school/college are more likely to have greater knowledge, skills, and economic opportunities, which may delay marriage. Schools/ college can provide crucial instruction on human rights, gender equality, and the harmful effect of child marriage. By challenging cultural norms that may promote early marriage, this education empowers youth to make informed decisions about their lives.

Figure 1: The Child Marriage Prone Area Map of Bangladesh



Number of Industries

Industry sector of Bangladesh economy has been gradually and consistently expanding over the few years. Bangladesh Bureau of Statistics (BBS) estimates, the contribution of the broad industry sector to GDP stood at 36.01 percent in FY 2020- 21 which increased to 37.07 percent in FY 2021- 22. Industries are the medium of economic opportunities and employment is the subfactor. There are multiple industries included textile mill, garments factory, rice mill, steel and engineering, aluminum, jute mill, sugar and others.

Number of Growth Center

Growth center is taken as the first factor which has a great influence for the relocation of people. Growth center are rural markets or intermediate urban centers that have been identified by Planning Commission on the basis of socio-economic and administrative criteria for making development investment (LGED, 1995). This ensures higher agricultural and live-stock supply, which eventually helps to build economy.

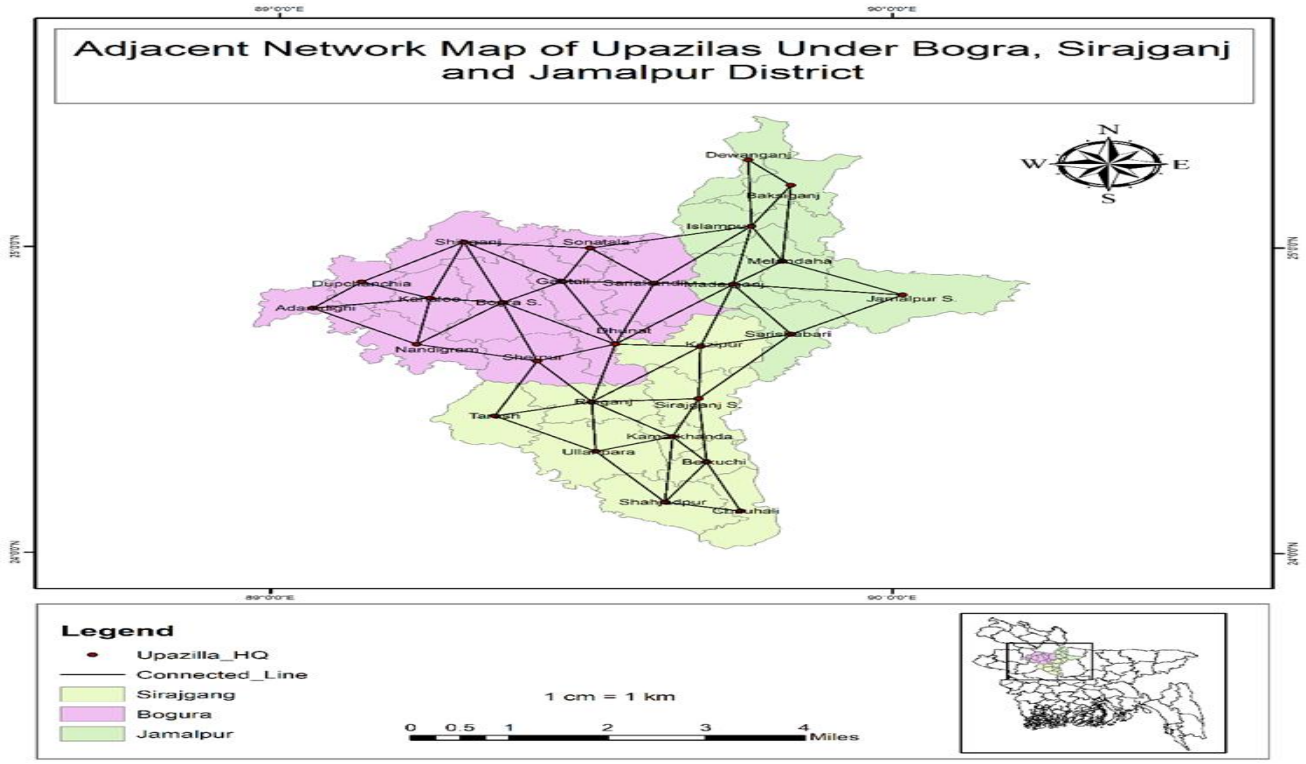
According to Figure 1. very high propensity of child marriage in formal regionalization, the study has been taken in these regions of Bogra, Jamalpur and Sirajganj. Then it will have been done the functional interdependency on these homogeneous regions for the propensity of child marriage on the basis of various factors like as Illiteracy Rate, Poverty Rate, Time to drop out of education (Upper secondary uncompletion Rate), Child marriage rate.

4. Data Analysis and Maping

4.1. Functional Regionalization

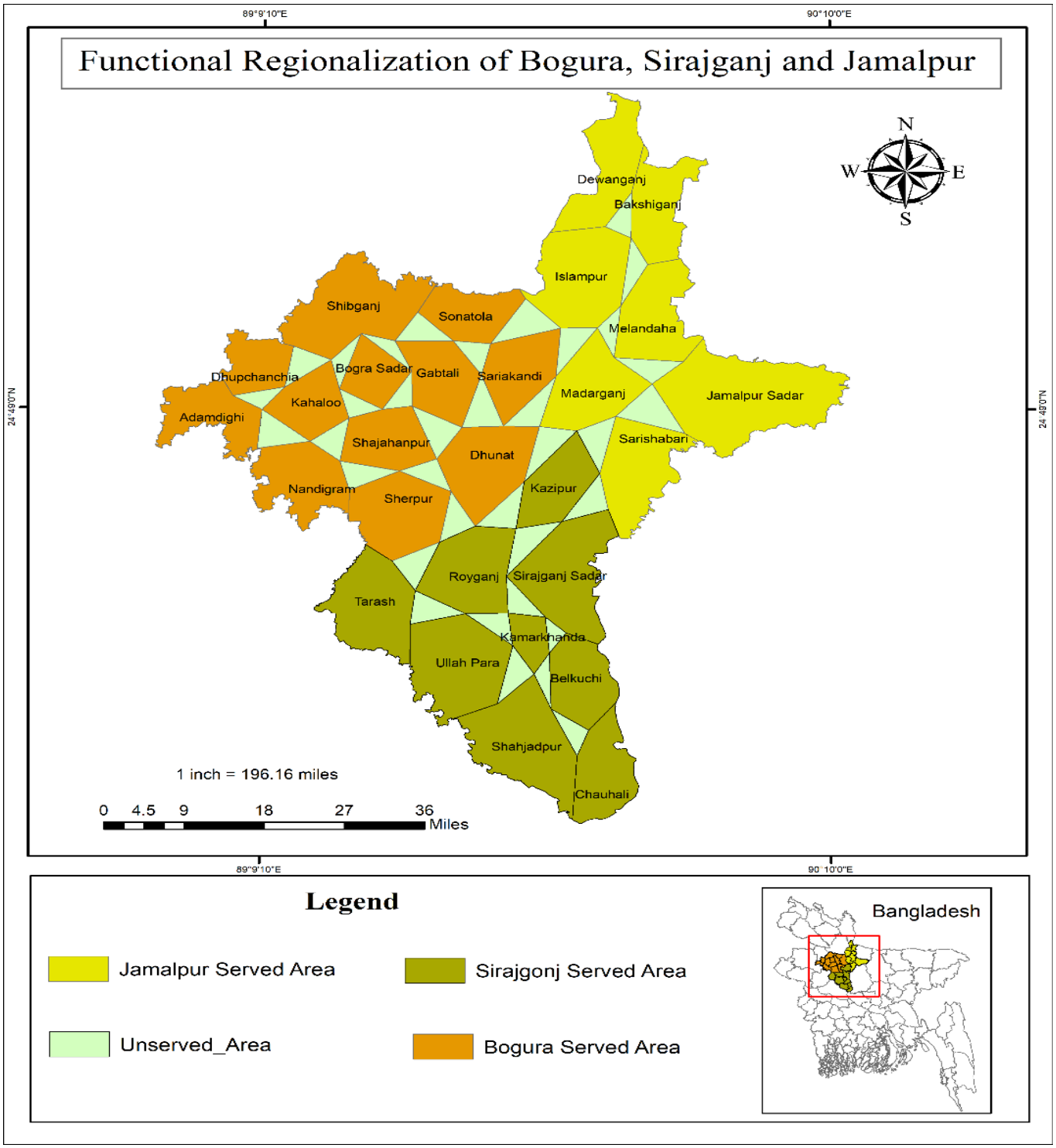
The data from the BBS were processed in GIS software using the methods outlined in the methodology. Then a map of the influenced and unserved areas of the districts of Bogra, Sirajganj, and Jamalpur is established. The functional regionalization of Bogra, Jamalpur and Sirajganj district which helps to understand the interdependency among the districts. This ascertains the level of influence of each district on its surrounding districts in order to fulfill administrative, economic, and social interests.

Figure 2: Adjacent Network Map of Upazilas under Bogra, Sirajganj and Jamalpur



From (Figure 3.) it's showed the unserved area which is the specific area between two administrative boundaries where it cannot serve the people or residents. In this map, the light green color specifies the unserved area of Bogra, Jamalpur and Sirajganj districts. And the Influence area is where a certain region has influence in terms of various factors like commercial activities, administrative work, social contribution or financial interest on its surrounding regions. As the level of influence differs on the factors, here in the map, the level of influence has been categorized into four sectors. Further assessing factors, we can determine the tendency of internal migration among the three districts.

Figure 3: Functional Regionalization of Upazilas Under Bogra, Sirajganj and Jamalpur



Sources: (Author's Preparation, 2024)

4.2. Functional Gap Analysis

Table 1: Ranking the Region based on the Population, Geographical Area and Served Area

District	Upazila	Population	Rank	Area (sq. km)	Rank	Influenced Area	Rank
Bogra	Adamdighi	206777	23	168.83	24	184.8	19
	Bogra sadar	657688	2	176.58	23	113.8	28
	Dhunat	307512	15	247.73	16	251.2	10
	Dhupchanchia	195051	25	162.44	25	128.1	27
	Gabtali	344883	11	239.61	18	184.4	20
	Kahaloo	234555	21	240.42	17	148.5	26
	Nandigram	200280	24	265.22	12	217.7	16
	Sariakandi	276195	19	408.5	3	182.5	22
	Shajahanpur	333653	14	221.69	21	174.9	23
	Sherpur	383507	8	295.93	10	249	11
	Shibganj	400407	6	314.92	8	347.9	3
	Sonatola	193455	26	156.75	27	158.8	25
Sirajganj	Belkuchi	401152	7	158.87	26	184.3	21
	Chauhali	138054	28	210.39	22	192.2	17
	Kamarkhanda	154385	27	90.8	28	649	1
	Kazipur	281429	18	328.79	5	170.8	24
	Royganj	348142	10	259.74	14	246.1	12
	Shahjadpur	601613	4	324.15	6	334.9	4
	Sirajganj Sadar	631877	3	320.15	7	311.1	6
	Tarash	211840	22	300.07	9	267.9	8
	Ullahpara	588977	5	409.06	2	317.18	5
Jamalpur	Bakshiganj	239853	20	508.8	1	191.7	18
	Dewanganj	288160	16	238.29	19	224.8	15

	Islampur	319746	13	267.51	11	307.2	7
	Jamalpur Sadar	668212	1	353.31	4	489.9	2
	Madarganj	285987	17	225.39	20	233.4	13
	Melandaha	354508	9	258.32	15	230.3	14
	Sarishabari	343161	12	263.5	13	251.4	9
	Total			**6833.17**		**6360.6**	

Sources: (Author's Preparation, 2024)

Table 2. illustrates the Functional Gap Analysis carried out following Reilly's Retail Gravitational Theory. The analysis identifies that upazilas such as Adamdighi, Shibganj, Sonatola, Belkuchi, Kamarkhanda, Shahjadpur, Islampur, Jamalpur Sadar, and Madariganj possess influence areas larger than their geographic areas, indicating that their facilities and services extend beyond administrative boundaries and effectively reach surrounding regions.

Table 2: Functional Gap Analysis

Attributes	Upazilas
Influence area increased than geographic area	Adamdighi, Dhunat, Shibganj, Sonatola, Belkuchi, Kamarkhanda, Shahjadpur, Islampur, Jamalpur Sadar, Madarganj
Influence area decreased than geographic area	Bogra sadar, Dhupchanchia, Gabtali, Kahaloo, Nandigram, Sariakandi, Shajahanpur, Sherpur, Chauhali, Kazipur, Royganj, Sirajganj Sadar, Tarash, Ullahpara, Bakshiganj, Dewanganj, Melandaha, Sarishabari

Sources: (Author's Preparation, 2024)

Conversely, upazilas like Bogra Sadar, Dhunat, Gabtali, Kahalu, Nandigram, Sariakandi, Shahajanpur, Sherpur, Chauhali, Kazipur, Raiganj, Sirajganj Sadar, Tarash, Ullapara, Belkuchi, Dewanganj, Melandaha, and Sarishabari have influence areas smaller than their geographic extents, suggesting that certain parts of these upazilas remain outside the effective coverage of essential facilities and services. These uncovered regions are identified as unserved areas. The analysis also indicates a spatial link between functional gaps and child marriage. Upazilas with smaller influence areas tend to have higher rates of child marriage due to limited access to education and social services, while those with larger influence areas generally show lower prevalence, highlighting the impact of service accessibility on social outcomes.

Table 3: Attributes of Upazila According to Geographic and Influence Area

District	Upazila Area (sq. km)	Influenced Area (sq. km)	Unserved Area (sq. km)	% Of Unserved Area (sq. km)
Bogura	2440.43	2341.5	98.93	4.054
Sirajganj	2328.7	2090.15	238.55	10.244
Jamalpur	2064.04	1928.95	135.04	6.543
	6833.17	6360.6	472.52	20.841

Sources: (Author's Preparation, 2024)

The spatial variation between the geographic and influence areas of three districts: Bogra, Sirajganj, and Jamalpur to identify the extent and proportion of unserved areas (table 3.). The results reveal that each district contains certain zones that fall outside their effective influence coverage. Among them, Sirajganj District shows the largest unserved area, covering 238.55 sq. km (about 10.24% of its total area), indicating notable functional deficiencies in service accessibility. Jamalpur District follows with 135.04 sq. km (approximately 6.54%), while Bogra District exhibits the smallest unserved area, 98.93 sq. km (around 4.05%). However, although the proportion of unserved area in Bogra is relatively lower, it is

not substantially different from the neighboring districts Jamalpur and Sirajganj indicating that functional service gaps persist across all three districts to a comparable extent.

These findings highlight a clear spatial disparity in the distribution and accessibility of urban and social facilities. Districts with higher proportions of unserved areas, such as Bogura, Sirajganj and Jamalpur, are likely to experience more limited access to basic services and opportunities. Consequently, these functional gaps may contribute to higher social vulnerabilities including the increased propensity of child marriage.

The table 4. presents the comparative change in ranking between the geographical area and the influence area of different upazilas. The analysis reveals that several upazilas experienced a ranking upgrade when evaluated based on their influence area, indicating that their functional impact extends beyond their geographical boundaries. These include Bogra Sadar, Dhunat, Gabtali, Kahalu, Nandigram, Sariakandi, Shahajanpur, Sherpur, Kazipur, Ullahpara, and Bakshiganj. The upgraded ranking suggests that these upazilas provide wider access to facilities and services, contributing to an expanded area of influence.

Table 4: Table Showing the Attributes According to Change in Geographical Ranking

Change in geographical ranking to influence ranking	Upazillas
Ranking Upgrade	Bogra sadar, Dhupchanchia, Gabtali, Kahaloo, Nandigram, Sariakandi, Shajahanpur, Sherpur, Kazipur, Ullahpara, Bakshiganj
Ranking Degrade	Adamdighi, Dhunat, Shibganj, Sonatola, Belkuchi, Chauhali, Kamarkhanda, Royganj, Shahjadpur, Sirajganj Sadar, Tarash, Dewanganj, Islampur, Jamalpur Sadar, Madarganj, Melandaha, Sarishabari

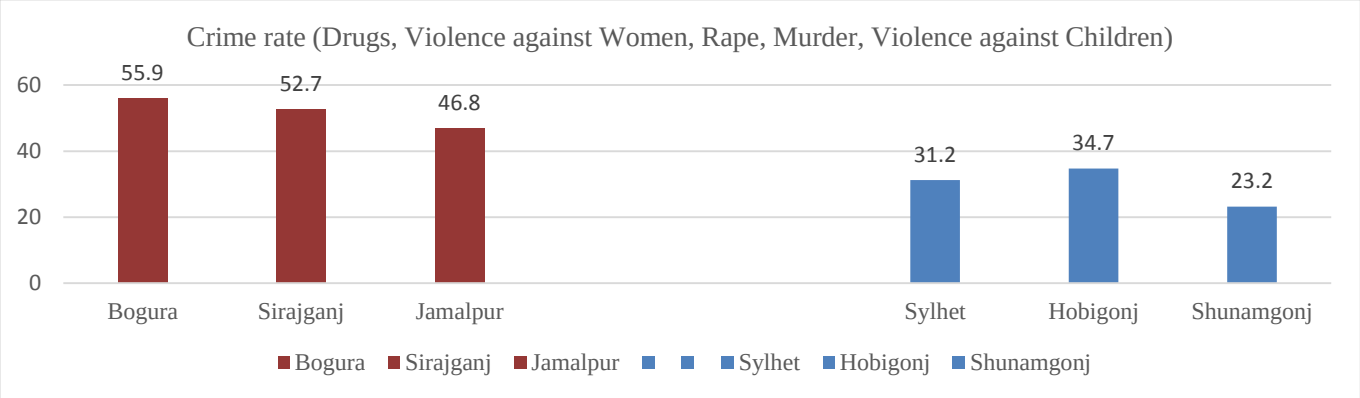
Sources: (Author's Preparation, 2024)

Conversely, some upazilas experienced a ranking degrade, meaning their influence area is smaller relative to their geographic extent. These upazilas such as Adamdighi, Dhunat, Shibganj, Sonatola, Belkuchi, Chauhali, Kamarkhanda, Raiganj, Shahjadpur, Sirajganj Sadar, Tarash, Dewanganj, Islampur, Jamalpur Sadar, Madarganj, Melandaha, and Sarishabari exhibit limited-service accessibility and reduced functional reach, possibly due to demographic, infrastructural, or locational constraints.

4.3. Analysis

The BBS (2011) and Justice Audit Bangladesh (2018) are utilized to gather the factor data. The four criteria chosen will help in understanding why certain locations are more impacted than others.

Figure 4: Comparison Between High Child Marriage and Low Child Marriage District on the Basis of Crime Rate.



Sources: (Justice Audit Bangladesh, 2018)

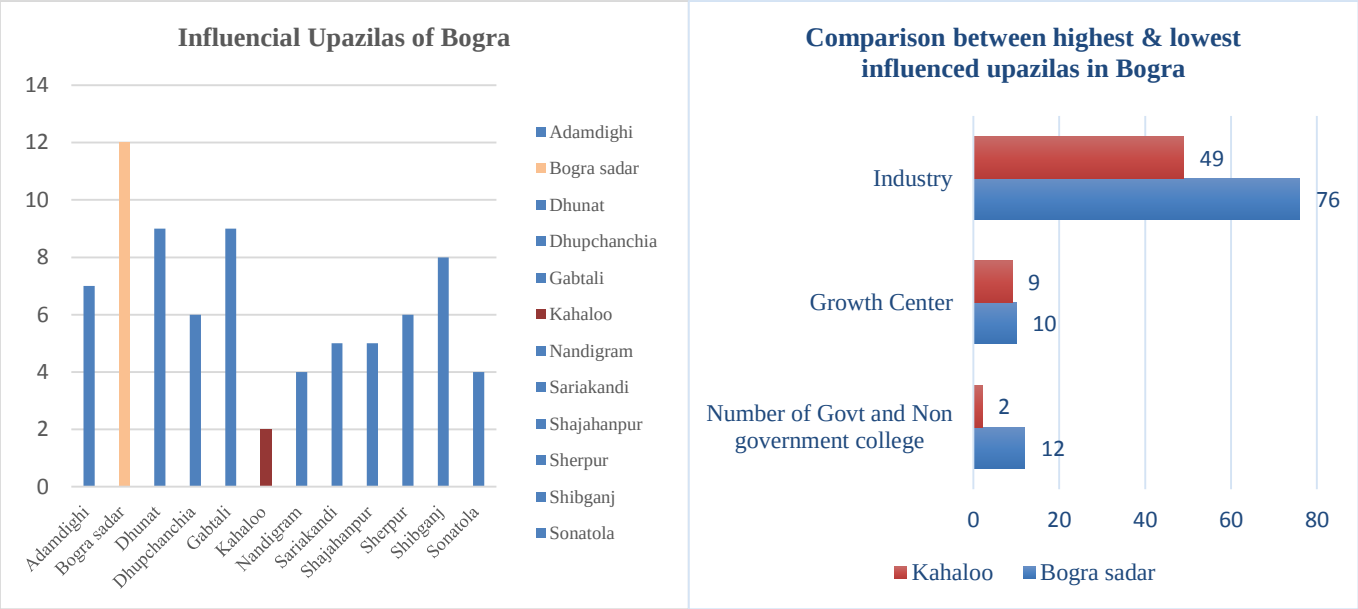
4.3.1. Social Security Condition

As figure: 4, shows the rates of crime in different areas, with an emphasis on categories including drugs, rape, murder, violence against women, and violence against children. Although the graphic does not explicitly indicate it, there may be indirect connections between these crimes and the prevalence of child marriage. The highest crime rate is 55.9 in Bogura,

followed by 52.7 in Sirajganj and 46.8 in Jamalpur. These regions might indicate a greater rate of violence against women and children, which may be related to a higher rate of child marriage because of the cultural and socioeconomic factors that frequently promote this type of violence. The crime rates in Shunamgonj (23.2), Hobigonj (34.7), and Sylhet (31.2) are comparatively lower. This could indicate that there are relatively less violent incidents in these areas, which could be due to stronger enforcement of child protection laws or a decline in the number of child marriages. Many of these crimes are connected to child marriage. Rape, domestic abuse, and other forms of abuse are more common among young females who are compelled into marriage. Due to the possibility of early or forced marriages, a higher crime rate in these categories may indicate a higher danger for young girls.

4.3.2. Socio-economic Condition at Bogra

Figure 5:Influential Upazilas and Comparison Between Upazilas in Bogra



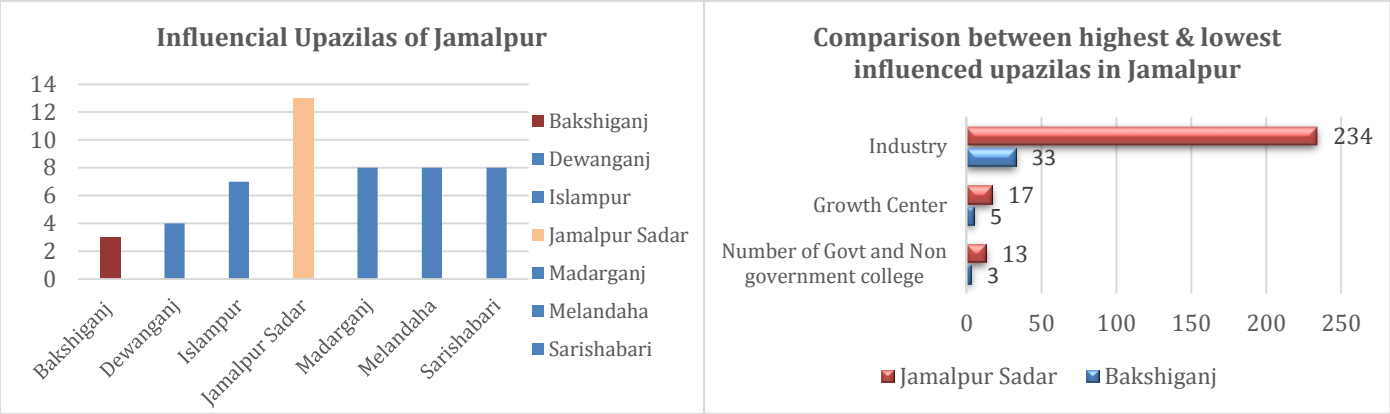
Sources: (Author's Preparation, 2024)

Figure 5. compares the highest and lowest influenced upazilas (sub-districts) in Bogra, focusing on three categories: Industry, Growth Center, and Number of Government and Non-Government Colleges.The industrial presence in Bogra Sadar is substantially higher (76) than that of Kahaloo (49) (Figure 5.). Delays in child marriage can be related to higher industrialization, which is generally associated with improved economic possibilities. Families in areas where work opportunities are more favorable might place more value on education and financial progress than on getting their daughters married off early. On the other hand, places like Kahaloo that have less industrial activity could be more deprived and experiencing stress financially, which is frequently linked to greater rates of child marriage.

The growth center development is similar between the two upazilas, with 10 in Bogra Sadar and 9 in Kahaloo. Development centers have the potential to improve the local economy and decrease child marriage rates by providing better access to markets, jobs, and resources. Moreover, Bogra Sadar has a notably higher number of colleges (12) compared to Kahaloo (2) (Figure 5.). One of the most significant barriers against child marriage is access to education. Because Bogra Sadar has more colleges than other areas, it is possible that girls in this area have more access to higher education, which may prevent marriage. Alternatively, Kahaloo's small number of educational facilities might make female dropout rates greater, which would raise the risk of an early marriage. Economic opportunity and education are essential in prevailing against child marriage. Compared to less developed areas like Kahaloo, the data indicates that areas like Bogra Sadar, which have stronger economic and educational infrastructure, may be less vulnerable to child marriage.

4.3.3. Socio-economic Condition at Jamalpur

Figure 6: Influential Upazilas and Comparison Between Upazilas in Jamalpur

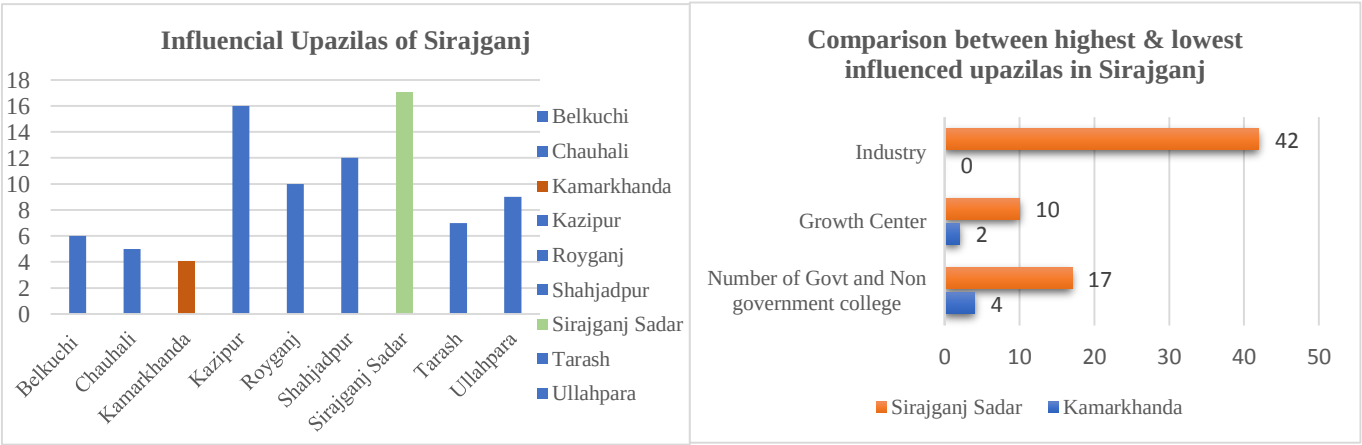


Sources: (Author's Preparation, 2024)

Figure 6. focuses on comparing two upazilas (Jamalpur Sadar and Bakshiganj) in Jamalpur district based on three factors: industry, growth centers, and the number of government and non-government colleges. Greater industrialization can provide families with economic options and decrease the pressure to marry of their daughters at a young age. Conversely, labor-intensive businesses that frequently use child labor may also make early marriage more usual. Jamalpur sadar has 234 industries which is higher than that of Bakshiganj. More educational establishments are able to offer girls options other than getting married early. Having access to education can help females make more educated decisions about their life, delay marriage, and raise understanding of their rights. Jamalpur is such kind of district which is far behind from other districts on the context of educational facilities and economic condition. There is lack of educational institutions at the upozilas of Jamalpur. In Bakshiganj, there are only 3 govt. and non-govt. colleges which are not sufficient.

4.4.4. Socio-economic Condition at Sirajganj

Figure 7: Influential Upazilas and Comparison Between Upazilas in Sirajganj



Sources: (Author's Preparation, 2024)

Two upazilas (sub-districts) of Sirajganj, Sadar and Kamarkhanda, are compared in the figure: 7 in three categories: Number of Government and Non-Government Colleges, Growth Center, and Industry. Kamarkhanda has no industrial base at all, but Sirajganj Sadar has a greater one at 42. Greater economic opportunities are frequently correlated with the existence of industry, and this can help prevent child marriage by giving families more money and better chances for their daughters. Families may be more unwilling to marry off their daughters' young in industrialized areas like Sirajganj Sadar, preferring to place more emphasis on education and career possibilities. Lacking an industrial foundation, Kamarkhanda may have economic difficulties that make child marriage more common as a means of survival for families

experiencing financial challenges. There are growth centers in both upazilas; Kamarkhanda has two and Sirajganj Sadar has ten. Growth centers provide families greater financial security and provide access to markets and economic possibilities, which may help lower the number of child marriages. There are much more colleges in Sirajganj Sadar (17) than in Kamarkhanda (4).

One important factor in preventing child marriage is having access to education. Due to the considerably greater number of educational institutions in Sirajganj Sadar, girls are probably more likely to have access to higher education, delaying marriage. On the other hand, Kamarkhanda's limited educational opportunities might cause more females to drop out of school, which would raise the risk of young marriages. Kamarkhanda might experience greater rates of child marriage because of its limited access to education and lack of economic possibilities, as seen by the significant differences between its industrial growth and educational facilities compared to Sirajganj Sadar.

5. Discussion

This study examined the spatial variations and inter-district dynamics of child marriage propensity across Jamalpur, Bogra, and Sirajganj districts of Bangladesh, emphasizing the influence of educational, economic, and social factors. The findings reveal a distinct spatial pattern, indicating that child marriage is concentrated in areas characterized by weak institutional presence, poor educational accessibility, and limited economic diversification. Regions with higher connectivity, stronger urban influence, and better access to education such as Bogra Sadar and Sirajganj Sadar demonstrate comparatively lower rates of early marriage. In contrast, peripheral upazilas like Kahaloo, Bakshiganj, and Kamarkhanda exhibit higher propensity levels due to their limited socio-economic integration and inadequate service networks. These results underscore that spatial inequality and regional underdevelopment are crucial determinants shaping the persistence of child marriage in Bangladesh. The analysis further establishes that economic and educational factors are the most significant predictors of child marriage propensity. Districts with relatively developed industrial and employment structures show lower rates of early marriage, suggesting that access to livelihoods provides an alternative to marriage for young women and relieves economic pressure on families. Education also emerged as a decisive factor, as it enhances girls' awareness, self-efficacy, and agency in resisting early marriage. This finding aligns with the observations of (Ainul et al., 2020; Kamal, 2010), who reported that secondary and higher education substantially delays the age at marriage. Conversely, school dropout driven by poverty, gender norms, and lack of institutional access increases vulnerability to early marriage, particularly in rural contexts where education is undervalued for girls.

Another critical insight from this study is the relationship between social insecurity and child marriage. Districts with higher incidences of gender-based violence, weak law enforcement, and entrenched patriarchal norms also display higher child marriage rates. This supports the findings of (Abdullah & Quayes, 2015), who identified social insecurity and fear of sexual harassment as indirect drivers of early marriage. In such contexts, early marriage is perceived by families as a protective mechanism to preserve family honor and ensure social stability, despite its long-term harmful consequences. The research further reveals that cultural and functional interdependencies among the three districts reinforce traditional practices that sustain child marriage. Shared socio-cultural characteristics, inter-district migration, and economic exchanges contribute to a diffusion of behavioral norms across administrative boundaries. Even in areas where awareness programs exist, these social interconnections perpetuate conservative attitudes that normalize early marriage. The study (Biswas et al., 2019) similarly argued that the persistence of child marriage in Bangladesh is not solely a function of poverty or education but is also sustained by deep-rooted cultural continuity and regional interlinkages.

The functional regionalization approach employed in this study provides an innovative spatial perspective on child marriage analysis. By identifying "influence areas" and "unserved zones," the research highlights how regional functionality or the lack thereof shapes socio-demographic outcomes. The unserved areas, constituting approximately one-fifth of the total study region, represent zones of low institutional density, poor access to educational infrastructure, and minimal development investment. Policymakers should thus prioritize these zones for targeted interventions. Strengthening educational facilities, expanding vocational training, and promoting women's employment in these regions could significantly mitigate early marriage risks. The discussion also implies that a uniform, national-level strategy may be insufficient for addressing the problem. Instead, interventions must be regionally differentiated to reflect local socio-economic and spatial realities. Integrating spatial analysis tools such as GIS with socio-economic planning can facilitate evidence-based policymaking, enabling targeted allocation of resources to high-risk regions.

6. Conclusion

The study has found child marriage continues despite legal prohibitions because of economic hardships, as impoverished families often consider marriage as a means of safeguarding their daughters' future and reducing their financial load. child marriage in Bangladesh as well as particularly ins our selected area is driven primarily by poverty, reinforced by cultural and religious norms. Jamalpur, Bogra and Sirajganj are connected districts. This study explored the spatial distribution and influencing factors of child marriage across Jamalpur, Bogra and Sirajganj districts, focusing on how educational, economic and social conditions shape regional disparities. The findings reveal clear differences between served and unserved areas, where the latter mainly peripheral and less developed upazilas showed higher child marriage tendencies due to weak institutional presence, limited educational opportunities and poor connectivity. In contrast, functionally active centers such as Bogra Sadar, Sirajganj Sadar and Jamalpur Sadar exhibited lower levels of early marriage, reflecting the positive influence of education, industrialization and social awareness. Areas with higher incidences of gender-based violence were also found to have greater child marriage prevalence, suggesting that insecurity and inadequate enforcement of child protection laws encourage early marriage as a perceived safeguard. Access to secondary and higher education, economic participation of women, and better social infrastructure appeared to be the most influential deterrents of child marriage. The study highlights that early marriage in these districts is not merely a cultural or moral issue but a spatially embedded phenomenon shaped by uneven regional development, gender inequality, and social insecurity. To effectively address this challenge, region-specific strategies are essential prioritizing education expansion, women's employment and safety interventions in socially and economically marginalized areas. A spatially informed approach integrating education, empowerment and governance can significantly reduce the persistence of child marriage and promote gender equality across northern Bangladesh.

Declarations

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Conflict of Interest

The authors declare no competing interests.

Ethical Approval

Not applicable. The study is based on secondary data analysis and does not involve human subjects requiring ethical approval.

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