Lack of Infrastructure Blurs Mega City Vision

ABSTRACT
Gelephu faces significant infrastructure challenges, hindering its transformation into a major commercial hub. Despite its flat terrain, which is conducive to development, the town has repeatedly failed to evolve due to inadequate infrastructure. A notable issue is water scarcity, exacerbated by climate change and poor management. Other primary infrastructures such as sanitation, waste management, housing, educational facilities, health amenities and transport are not well planned to cater to the need of a futuristic city. This article traces the challenges of Gelephu in attaining these basic infrastructures that are fundamental to building a mega city.

Keywords: Infrastructure, Hospitals, Sanitation, Road Network, Universities, Banks

Introduction

Gelephu has a flat terrain that supports building infrastructures essential for a growing population. The town was repeatedly proposed for conversion into bigger commercial hub of Bhutan but has so far failed at every attempt. The primary reasons for those failures were absence of adequate infrastructure for the metropolis to take off and the ability of the government to attract investment for these infrastructure.

Sanitation And Water Supply

Water Supply

Bhutan has the highest water availability per capita value. But water scarcity continues. Bhutan has poor water resources management (Hagg et al., 2021).

Gelephu, rich in rivers during the monsoon, experiences water shortages in peak winter, lacking a consistent and reliable drinking water source. The situation is expected to worsen as existing sources continue to dry up due to climate change. The region is not a home to any of the major river system of the country, raising concerns about future water availability for domestic and agricultural uses.

The domestic water supply infrastructure in Gelephu was last renovated in the early 1990s with funding by Asian Development Bank (ADB) and Danish International Development Agency (DANIDA). Mau river is the major source for drinking water supplies while Passang river north of the city, supplements the drinking water during summer. Water is treated at the Mau River Infiltration Gallery and the Pelrithang Treatment Plant which is then stored in a reservoir and supplied to the town through a combination of gravity flow (25 per cent) and pumping (75 per cent). There is a separate raw water supply line from Pelrithang to the Royal Guest House, a residential place for royal family members and their guests during visits to the region.

However, water shortages occur frequently (Wangdi, 2018), primarily due to unreliable power supply - the gravity-fed system traverses landslide-prone areas, necessitating regular maintenance.

A new Gelephu Landmark Water Project inaugurated in 2023 (Wangdi, 2024) is expected to address the problem. However, this source is not expected to cater the future metropolis. The project has the capacity of treating 12million litres per day. It can cater to 83,500 individuals – 143 litres of water per person per day which is slightly lower than the international average of 170 litres. This future city is likely to have more than 100,000 people. The per capita daily water consumption is approximately 148 litres in Thimphu (Dorji, 2016).

The local rivers are unlikely to supply additional water in winter. Though the supply may be improved during summer, it is likely to face challenges in filtration considering the amount of gravel and soil it carries from the mountain, generated by mudslides. A government report in 2024 pointed out that most of the natural water sources in and around Sarpang have dried up due to either lack of proposal water management system in place or climate change impact.

Sarpang's population in 2023 was estimated to be 50,000. One projection for GMC population is 83,000 while others put over 100,000. Bhutan may plan for controlled population growth, in which case the economic growth of the city will be literally shattered.

Residents outside the municipality also face intermittent water shortage (Wangdi, 2018). The proposed city incorporates the whole of Sarpang district that does not have robust drinking water supply infrastructure in place or plan to put in place immediately.

In a separate plan by the government to convert the current Gelephu city into a Special Economic Zone, the projected water need was 2.6 million litres per day for domestic purposes and 2.3 million litres per day for commercial establishment.

The current water supply network does not cover the entire area of the municipality, let alone the satellite settlements. The existing settlements in the extended areas are scattered in small numbers. Some of the extended areas are covered by Rural Water Supply Schemes, which do not have basic water treatment mechanisms, as a part of their network. This has resulted in a situation where the quality of water supplied throughout the town is not uniform due to the inherent differences in the kinds of networks in use.

In the absence of any metering system in certain areas of the town and villages, billing for the services being provided poses difficulties. Strengthening the existing networks in some other areas might prove to be difficult, owing to the lack of sufficient capacity in the existing infrastructure to be upgraded to a network covering villages outside the current central business district in Gelephu.

Currently, about half of the households with municipal water connections have water metres; the rest pay a flat rate of around Nu. 50 per month.

Storm Water Drainage

Gelephu's storm water drainage relies on a combination of an unconstructed natural system and constructed open drains, which handle stormwater, sullage, and septic tank overflow. The drainage system, built along natural drainage pathways, features rectangular and trapezoidal main drains with slopes of one to four percent. Much of the town core is served by lateral open drains, although many covers are missing or damaged. Utilising the terrain, runoff is directed to the town's outskirts, where it is dumped into natural drains along the Mau river, creating potential health risks. The open drain system is public safety hazard and ideal place for mosquito breeding. Frequent blockages in the stormwater system are common, attributed to improper disposal of household waste, the absence of drainage screens, and inadequate regular maintenance.

Sewerage Management

Gelephu, and the whole Sarpang district, lacks a proper sewerage system. Most buildings rely on septic tanks or soak pits. Apartment complexes typically use a shared septic tank. Gelephu city residential buildings generate approximately 1,865 cubic meters of sewage daily, alongside an equivalent amount of industrial waste.

Without proper sewerage system, septic tank overflow often drains into natural water course, posing significant hygiene risks. Many septic tanks and soak pits are seldom cleaned.

Not all buildings in Gelephu have required level toilet facilities either. The commercial and business hub require additional facilities to support as people flock during the day. There are only two public toilets in the Gelephu municipality and many commercial areas have no public toilets (Wangdi, 2021).

There is an urgent need to rethink Gelephu's sewerage infrastructure by establishing sewer lines and a treatment plant, with DANIDA already proposing improvements to sanitation and public health.

Solid Waste Management

Gelephu municipality generates about six tons of solid waste daily (Kuensel 2024 March 15). Daily domestic waste collection amounts to approximately 4.96 tons, while commercial establishments and hospitals generate about 0.3 tons and 0.06 tons, respectively. Community bins are provided for roughly half the population, while those without access often resort to dumping waste in vacant areas. Individual houses have no waste bins supplied even though the municipality collects waste daily from the residential area in town centre and once a week outside the town centre. Commercial establishments are supplied with individual bins. However, waste is often disposed of in open fields along Aipole river and burned. This contributes to air pollution.

There is no formal mechanism in place for solid waste disposal in the town. Some schools and institutions incinerate their waste in open areas. A frequent issue is the overflow of solid waste from open bins, which poses a risk to the town's hygiene.

The town facing the challenge is the absence of an effective solid waste disposal area. The current approach does not prioritise reducing the waste load sent to disposal sites by failing to implement source segregation of solid waste. This over sight necessitates larger disposal facilities and increases transportation costs. Approximately 25 per cent of the total solid waste consists of plastics, bottles, papers, cardboard, tin, aluminium products, and bamboo baskets. By segregating these materials at the source, they can be recycled and reused, thereby decreasing the overall volume of waste transported to disposal sites.

Other substantial components of the solid waste stream include organic waste, which can be managed through composting methods. Innovative natural treatment processes can be employed to break down biodegradable waste, further reducing the volume that needs to be transported for disposal.

Waste generated from construction sites should be carefully separated and disposed of appropriately. The existing open concrete litter bins in residential areas have contributed to littering, as waste is often scattered by stray dogs.

The current waste disposal system requires re-evaluation, focusing on alternative disposal methods and efficient collection strategies. It is essential to ensure that waste is collected from all locations to maintain a clean and healthy environment in Gelephu.

Road and Transport Network

As of 2020, Bhutan's road network has a total road length of roughly 18,000 kilometres, of which 61 per cent are farm roads, around 15 per cent are national highways, and about 11 per cent are the district

roads (ADB, 2023). Sarpang district has a total road network of approximately 250 kilometres. Most road networks are vertical – connecting northern cities with border towns.

The GMC region has poor road network and lack sealed road that cater to the need of a metropolis. There are two highways (one lane) connecting Gelephu with Trongsa and Punakha. Gelephu has no highways connecting the other southern plains of the country or other major business hub in India that facilitates the easy movement of commercial goods and services. Several attempts were made in the past to improve the road network within the core Gelephu and its satellite area but ended without action.

In 2009, the Department of Urban Development proposed Sibsu-Daipham National Highway (SDNH) as a key transportation route connecting urban centres in the south - Sibsu, Samtse, Phuentsholing, Sarpang, Gelephu, and Daipham. This highway was envisioned to open acceleration commercial activities in southern region. The GMC leadership has not clarified if this road network is still on table to connect the commercial hub with other satellite cities in southern region.

The robust road network connecting the GMC is required not just within the Bhutan to help ferry Bhutanese products to and from Gelephu but also beyond Bhutan's borders to ensure the Bhutanese produce reach the international market within stipulated time. While the mountain terrain and frequent landslides in the country are challenges to build reliable road network, gaining confidence from the Indian governments is equally challenging to build road infrastructure to facilitate Bhutanese exports.

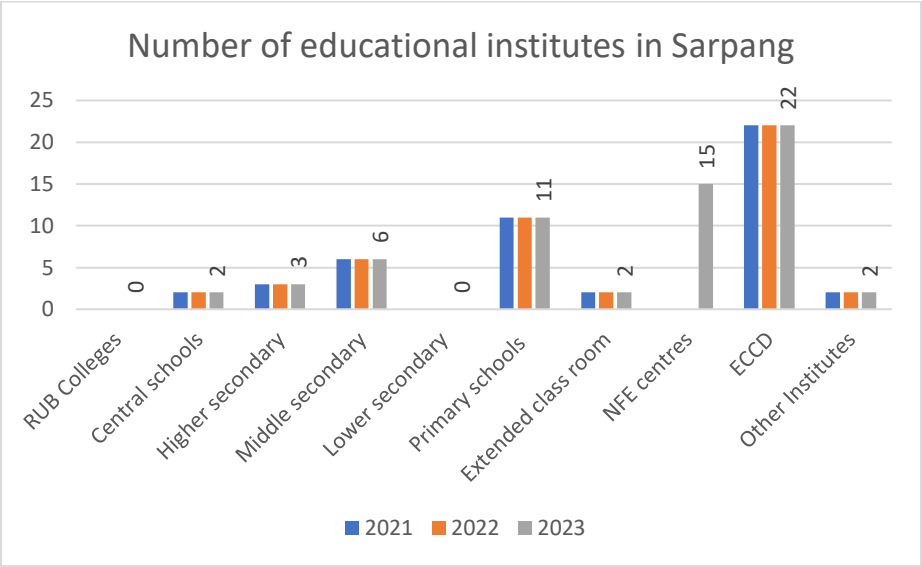
Indian Rail

Commercial success of Gelephu heavily depend on the road network in India. Indian government has prioritised its road infrastructure investments in key strategic location. Roads in India linking Bhutanese town is not a priority for India which will hinder the vision of the GMC.

Rail line linking Gelephu with Kokrajhar has been in discussion since 2017. Two countries have so far agreed for survey for location of the route (Mishra, 2023) which will, if agreed, follow a feasibility studies and other formalities. The process is at initial stage (Brij, 2025). The rail network connects Gelephu with India but plans are to extend these network to Bangladesh which does not serve the purpose of Bhutan being connecting point for India and South East Asia. India does not have adequate freight and passenger train services to north east region that will eventually connects Gelephu to South East Asia.

Education Infrastructure

The GMC's vision is to have world class education and wellness centre. The vision requires adequate education infrastructure and skilled human capital. Today Bhutan was two universities – Royal University of Bhutan (estd 2003) and Khesar Gyalpo University of Medical Sciences of Bhutan (estd 2015). The former has 11 colleges while latter has two. Sarpang does not have a single college under these universities that provides tertiary education. Students interested in university education either have to travel northern districts or India. The education destination in recent year have rather opened up in overseas such as Australia (Stachel, 2023) and Canada (Namgyal, 2024). Sarpang district provides education up to higher secondary.



Source: Statistics collated from district reports and National Statistics Bureau.

The Sarpang Central School was the first educational institution established in the district in 1962 which then provided education up to year six. The number of schools in the district has increased to 22 by 2024 but they remain institutions for basic education. While the country had its first university in 2003, Gelephu is far away from presenting itself as the education and knowledge hub.

A metropolis aiming to offer world-class education must fulfill several basic requirements. It needs a robust infrastructure consisting of sufficient schools and learning institutions that can accommodate the existing and prospective population. These facilities should be equipped with modern amenities, including libraries, playgrounds, laboratories, and computer labs. Ensuring spaces conducive to learning is essential.

The metropolis should have a substantial and well-qualified teaching workforce. Teachers should possess not only educational expertise but also the skills to engage students in the learning process. At the time country facing brain drain and new generation unwilling to pursue teaching as their preferred profession, the country has yet to answer how the skilled workforce can be sourced. Adequate training and continuous professional development opportunities are key to maintaining their competence and motivation. Furthermore, competitive salaries and benefits are necessary to attract and retain top teaching talent.

Other essential requirement is the implementation of a comprehensive curriculum that is both challenging and adaptive to the evolving needs of the global job market. This curriculum should include not only core subjects like mathematics, science, and literature but also critical thinking, problem-solving, and 21st-century skills. Integrating technology and promoting digital literacy is crucial in today's digital age.

Funding is another critical element. Sufficient public and private investment is required to maintain the educational infrastructure, compensate the teaching staff, and procure necessary resources. The metropolis must allocate a significant portion of its budget to education and seek additional resources through grants, partnerships, and philanthropic efforts.

Moreover, inclusive education policies that ensure accessibility and equity are vital. Measures should be in place to provide equal educational opportunities to all children irrespective of their socio-economic background, gender, or physical abilities. This may involve subsidising or providing free education for underprivileged children, ensuring transportation facilities, and employing special educators.

There are questions whether Bhutan and particularly Gelephu is ready to adopt and adapt to these basic requirements to realise its core objective to be the centre of education and knowledge. Barely being educational centre for Bhutanese students may not materialise the vision to be called mega city.

Name of School	Gewog	Boys	Girls	Total	Teachers	Support Staff	Estd
Chokhorling MSS	Dekidling	364	328	692	40	17	2013
Chuzagang PS	Chhuzanggang	107	129	236	14	16	1998
Dechenperli PS	Samtenling	67	89	156	10	7	2005
Dekiling MSS	Dekiling	185	201	386	28	17	1999
Gakiling PS	Jigmechoeling	41	39	80	6	3	1983
Jangchubling MSS	Chhudzom	171	178	349	21	12	2008
Jigmecholing MSS	Jigmechoeling	213	237	450	27	16	1997
Jigmeling PS	Dekidling	97	88	185	10	10	1991
Lharing PS	Gakidling	59	58	117	8	7	2008
Lhayul PS	Chhudzom	55	49	104	8	8	2009
Norbuling CS	Serzhong	427	471	898	58	28	1976
Pelrithang HSS	Gelegphu	429	434	863	56	20	1981
Retey PS	Jigmechoeling	22	19	41	2	3	2002
Samkhara ECR	Jigmechoeling	19	16	35	2	0	2010
Samtenling PS	Samtenling	147	141	288	18	12	2008
Sarpang CS	Shompangkha	216	257	473	35	20	1962
Sarpang MSS	Shompangkha	455	470	925	57	21	2001
Serzhong PS	Serzhong	62	53	115	9	5	1978
Singye PS	Sengye	80	95	175	7	10	2010
Tareythang PS	Tareythang	53	44	97	7	4	2010
Umling MSS	Umling	146	185	331	24	16	1998
Losel Gyatsho Academy	Gelephu	307	254	561	34	11	2013
Total		3722	3835	7557	481	263	

Health Facilities

There are only three hospitals in Sarpang district and none of these have facilities to meet the needs of a mega city residents. Key health amenities in the region include the Central Regional Referral Hospital, the National Malaria Control Program (NMCP) office and the Veterinary Hospital.

Central Referral Hospital in Gelephu is a 150-bedded hospital. It was established in mid-1960s as dispensary. The NMCP office was established in 1964 with an ambition to eradicate malaria from the country. Although the NMCP started as a separate program, it is now integrated into general health services. The Veterinary Hospital is located north of the town along the Gelephu-Trongsa highway.

If Gelephu aspires to be a mega city, it requires a comprehensive health infrastructure. At the forefront of this infrastructure are primary healthcare centres that serve as the first point of contact for individuals. These centres should be equipped with basic diagnostic tools, pharmacies, and staffed with general practitioners, nurses, and healthcare technicians to handle common ailments and provide preventive care.

In a mega city, the provision of basic health infrastructure is a complex yet crucial endeavour for ensuring the well-being of the urban populace. According to the World Health Organisation, a well-functioning health system consists of six building blocks: service delivery, health workforce, information, medical products, vaccines, and technologies, financing, and leadership and governance (WHO, 2018). These blocks form the backbone of healthcare infrastructure in a densely populated urban setting.

To meet the demands of a mega city, primary healthcare centres must be widely accessible, providing essential services such as vaccination, prenatal and postnatal care, and management of common diseases (WHO, 2018). Secondary healthcare facilities, such as district hospitals, should offer diagnostic and treatment services for more complex conditions. Tertiary healthcare facilities, including specialised hospitals and academic medical centres, are essential for advanced care, including intensive care units, organ transplants, and specialised surgeries (Barnett et al., 2015).

Emergency medical services (EMS) are critical, ensuring timely responses to medical emergencies. The Institute of Medicine (2007) emphasised the importance of integrating EMS with hospitals to improve patient outcomes. This integration facilitates smooth handovers and continuity of care during critical moments.

Mental health facilities are another indispensable component. According to the WHO (2014), mental health services should be integrated into primary care systems to ensure accessibility. This integration can help reduce the stigma associated with mental health issues and encourage early treatment.

Public health institutions play a pivotal role in monitoring health trends, implementing preventive measures, and guiding policy. These institutions are vital for outbreak management and devising strategies to combat emerging health threats (CDC, 2018).

The World Bank (2019) highlighted the significance of pharmaceutical infrastructure, ensuring that urban populations have access to affordable, quality medicines. Community health education programs, as advocated by the WHO (2018), are also necessary to promote healthy lifestyles and prevent diseases.

Health information technology (HIT), according to the American Health Information Management Association (2017), streamlines healthcare delivery, improves patient outcomes, and reduces costs. HIT includes electronic health records, patient portals, and telemedicine services.

Finance

The GMC aspires to be a financial services hub, especially in wealth management, pointing to the opportunity created by two big economies – India and China. While a new fintech Oro Bank is designated to be the official bank of the proposed city, there are 11 branches of seven banks in operation in the Sarpang district currently. In recent years, the traditional banks of the country increased their dependency on remittances from overseas Bhutanese. However, with the Oro bank joining the foray has become popular among overseas Bhutanese for sending remittances making it harder for other banks to expand their services further. The obvious questions now is whether one bank is sufficient to cater the financial need for a future metropolis.

Financial infrastructure is a critical component that facilitates economic growth and development. Drawing on from international practices, a robust financial infrastructure include banking institutions, capital markets, microfinance, insurance, and efficient payment systems. These elements are vital for supporting business activities, encouraging investment, and providing financial services to both individuals and corporations.

According to the World Bank (2019), a well-developed banking system is fundamental for stimulating economic activities. This includes commercial banks, development banks, and specialised

banks that offer a variety of financial products such as deposits, loans, and credit facilities. The Bank for International Settlements (BIS, 2018) emphasises the importance of banking regulation and supervision to ensure financial stability and consumer protection.

Capital markets, including stock and bond markets, help in channelling savings to investments, thereby spurring economic growth. The International Organisation of Securities Commissions (IOSCO, 2017) advocates for well-regulated capital markets that protect investors and ensure market transparency. Evidence from developed countries like the United States and the United Kingdom shows that efficient capital markets contribute to economic dynamism (Levine, 2005).

Microfinance institutions (MFIs) provide financial services to low-income individuals and small businesses. The work of the Grameen Bank in Bangladesh exemplifies the transformative power of microfinance in alleviating poverty (Yunus & Jolis, 1998). The Consultative Group to Assist the Poor (CGAP, 2018) highlights the need for regulatory frameworks that support sustainable and inclusive microfinance services.

Insurance markets mitigate risks associated with unforeseen events, contributing to economic stability. The adoption of solvency standards, such as the Solvency II directive in the European Union, ensures insurers have adequate capital to meet obligations (European Commission, 2016).

Payment systems facilitate the smooth flow of financial transactions. The adoption of digital payment systems, as seen in countries like China with Alipay and WeChat Pay, has significantly enhanced economic efficiency and financial inclusion (IMF, 2018).

Gelephu is far away from setting up all these amenities to meet the standards of a metropolis. The lone official bank, Oro, is unlikely to meet the needs of all the future businesses and consumers. The monopoly of Oro bank would rather erode the competitive advantage required in a financial services industry.

Current Industrial State

Today Gelephu has poor industrial base. There are hardly any Bhutanese products ready for exports, except hydropower. Bhutanese consumers are depended on imports – mostly from India. The existing industrial estate in Gelephu was conceptualised in 1970s and 80s. Some 12 hectares of land was acquired for the purpose in 1980s. The '1986-2000 Urban Development Plan for Gelephu' took advantage of this land and proposed an industrial estate to the west of the national highway to Trongsa. About 35 per cent of the total urban land, equivalent to the land reserved for residential development, was allocated for industrial development in the town. But the project were later abandoned.

Gelephu's industrial sector is primarily dominated by small and medium-sized enterprises (SMEs) focused on agriculture, food processing, and handicrafts. The region is known for its fertile land, making agro-based industries a significant contributor to the local economy. For instance, Gelephu is home to several rice mills, fruit processing units, and dairy farms that cater to both domestic and regional markets (NSB, 2022). The GMC aims to attract foreign investment in other industries such as renewable energy, information technology, and eco-tourism (Kuensel, 2023).

Army Welfare Project is the major industry in the town. It manufactures liquors – for domestic consumption and exports.

There are other small services and timber based industries like Namcha Automobiles, Tenzin Automobiles, Gyeltshen Sawmill and Lhaki Wood Industry.

Shortage of manpower, raw materials (Wangdi, 2023 June 26), lack of progress in building industrial estates (Dorji, 2021) and government interventions (Wangdi, 2024 October 28) impact the continued growth of the industries in Gelephu. Newly established industrial estates lack tenants, posing threat to their survival (Pelden, 2023 August 3).

Housing

Housing has always been a major concern for urban planners in Bhutan (Tenzin, 2021) and overseas (Quinn, 2023). The need for housing is ever increasing on account of growing rural-urban migration. Gelephu had 932 housing units with an average occupancy of 4.69 people per unit in 1986 (1986-2000, Urban Development Plan for Gelephu. Gelephu municipality had focused on increasing housing stock (Wangdi, 2024 March 9) to ease the crunch (Wangdi, 2020 May 29) in the last decade, which though is not sufficient to meet the population of future metropolis.

As per the National Statistics Bureau of Bhutan (2022), the population of Gelephu has been growing at an annual rate of approximately 2.5 per cent, driven by rural-urban migration and economic opportunities. This growth has intensified the need for affordable housing, particularly for low- and middle-income families. However, the current housing supply is insufficient to meet this demand, with only a few government-led housing projects and private developments in progress. For instance, the Gelephu municipality has initiated the construction of 200 low-cost housing units under the Sustainable Urban Development Project, funded by

the Asian Development Bank (ADB, 2021). Despite these efforts, the supply gap remains significant.

The private sector has begun to respond to the housing demand, with several real estate developers launching residential projects. However, these are often targeted at higher-income groups, leaving a substantial portion of the population underserved. The average cost of a residential plot in Gelephu has risen by 15 per cent over the past two years, reflecting the growing demand and limited availability of land (Royal Monetary Authority of Bhutan, 2023).

To address these challenges, the Royal government of Bhutan (RGOB) has prioritised housing development in its 13th Five-Year Plan (2024-2029), with a focus on affordable housing and sustainable urban planning. Locally, the GMC aims to integrate housing solutions into its broader economic and infrastructure development plans (Kuensel, 2023).

Challenges of Mau River

Mau river forms the eastern bed of the town while Setikhare river, the first irrigation channel and the vehicular corridor connecting Gelephu and Sarpang, form the northern, western and southern edges respectively.

Relatively young Mau river has a history of often changing its course, resulting in its banks getting wider and shallower day by day, bringing in huge amounts of silt deposits. As such the town often faces great risks of floods.

The river's unpredictable water levels have historically caused damage to infrastructure, disrupted transportation, and threatened settlements, making flood management a critical concern for urban

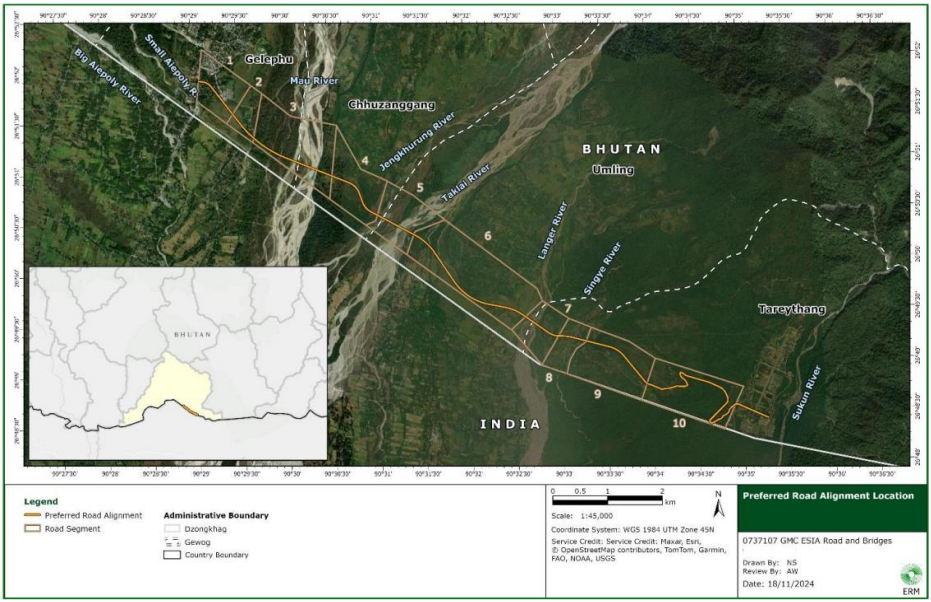
planners (NCHM, 2022). Developing flood-resistant infrastructure and early warning systems is essential but costly and technically demanding.

Another major challenge is the environmental impact of urbanisation along the banks of the Mau river. Rapid industrial and residential development could lead to water pollution, affecting both ecosystems and the local communities that rely on the river for irrigation and drinking water (Department of Environment, 2023). Sustainable development practices are necessary to mitigate these risks, but they require careful planning and enforcement.

The Mau river also limits the availability of land for large-scale development, as its presence restricts expansion in certain areas. This necessitates innovative solutions such as land reclamation or elevated construction, which are expensive and complex to implement (Gelephu Thromde, 2023). The river complicates transportation network development, requiring the construction of bridges and flood-resistant roads to ensure connectivity.

The river divides Gelephu from its eastern villages. There has been several attempts to build a bridge over the river. The promises to build a bridge (Tshering & Dolkar, 2020 January 21) are solid for political parties during the election campaign and gets subsided until next election. People are forced to use temporary bridge during monsoon season to travel for shopping in Gelephu. Finally, funding has been sourced from World Bank to construct a nearly one kilometre bridge over the river (Namgyal, 2025 March 15). The inability of the government in building a bridge was the nature of the river. The river bed is unstable which helps river to change its main course. The river requires a 2km bridge at its widest section to cover

the whole of the riverbed within which river is most likely to change coursing during monsoon.



Conclusion

Gelephu faces significant challenges in balancing rapid urban growth with sustainable development and environmental preservation. The projected population growth and increasing demand for affordable housing underscore the urgent need for comprehensive and inclusive urban planning. While government initiatives and private sector investments are making strides, the current supply remains insufficient, particularly for low- and middle-income families.

Preparing sustainable infrastructures for a metropolis and sustaining continued investment would a herculean task for the GMC government and leadership.

Ultimately, addressing these intertwined issues requires a multi-faceted approach that integrates housing, infrastructure, and environmental strategies. The city requires big investments to prepare the infrastructure ready to invite the investors. The dilemma would be how these initial investors are convinced and guaranteed return on their investment even before the vision of the GMC takes shape.

References

American Health Information Management Association. (2017). *Health information management in the 21st century: A primer*. AHIMA Press.

Asian Development Bank (2023, February 28). *Improving Road Connectivity Planning in Bhutan* (video). https://www.adb.org/news/videos/improving-road-connectivity-planning-bhutan

Asian Development Bank (ADB). (2021). *Sustainable Urban Development Project in Bhutan*.

Bank for International Settlements (BIS). (2018). *Basel III: A global regulatory framework for more resilient banks and banking systems*. BIS Publications.

Barnett, T. R., Horton, R., & Smith, E. (2015). Health systems strengthening: a new framework for global health. *The Lancet*, 386(*9991*), pp. 663-667.

Basel Committee on Banking Supervision (BCBS). (2011). *Basel III: International framework for liquidity risk measurement, standards and monitoring*. Bank for International Settlements.

Brij, A. (2025 March 3). Bhutan To Get First Railway Link With Assam As India Finalises Detailed Project Report, Strengthening Bilateral Ties. *Swarajya Magazine*. https://swarajyamag.com/news-brief/bhutan-to-get-first-

railway-link-with-assam-as-india-finalises-detailed-project-report-strengthening-bilateral-ties

Cabinet Secretariat. (2024). *Thirteenth five year plan 2024-2029*. Royal Government of Bhutan. https://www.pmo.gov.bt/wp-content/uploads/2019/09/13-FYP.pdf

Centers for Disease Control and Prevention. (2018). *CDC Guide to Community Preventive Services*. Centers for Disease Control and Prevention.

Department of Environment [DoE]. (2023). *Environmental impact assessment of urban development in Gelephu*. Royal Government of Bhutan.

Department of Industry. (2204). *Industry Census of Bhutan 2024*. Ministry of Industry, Commerce and Employment. https://www.moice.gov.bt/wp-content/uploads/2024/06/INDUSTRY-CENSUS-REPORT-2024.pdf

DFO, Sarpang (2024). *Ensuring 24/7 Water in Gelephu Region: Key Upstream Interventions (Springshed & PES) for Selected Sites in Maochhu Basin under Sarpang, Bhutan*. Ministry of Energy & Natural Resources.

Dorji, C., & Chhoden, T. (2016). Jungzhina Water Treatment Plant, Thimpu, Bhutan. Network on Water Technology in Asia and Pacific. https://www.jwrc-net.or.jp/english/newtap/report/NewTap_024.pdf

Dorji, P. (2021, June 11). Slow progress at Jigmeling industrial estate. *Kuensel*. https://kuenselonline.com/news/slow-progress-at-jigmeling-industrial-estate

European Commission. (2016). *Solvency II*. European Commission.

Gelephu Thromde. (2023). *Urban development plan for Gelephu*. Gelephu Municipality.

Institute of Medicine. (2007). *Emergency medical services: at the crossroads*. National Academies Press.

International Monetary Fund (IMF). (2018). *Fintech and the Financial System*. IMF Staff Discussion Note.

International Organisation of Securities Commissions (IOSCO). (2017). *IOSCO Principles for Securities Regulation*. IOSCO.

Kuensel (2024, March 15). *Waste generation calls for more focused approach*. https://kuenselonline.com/news/waste-generation-calls-for-more-focused-approach

Kuensel. (2023, January 15). *Gelephu Mindfulness City: A new economic frontier*. Retrieved from https://kuenselonline.com

Levine, R. (2005). Finance and growth: theory and evidence. *Handbook of Economic Growth*, 2, 865-934.

Mishra, A. (2023, November 9). To Bhutan By Rail: India, Bhutan To Finalise Location Of 58-Km Corridor Between Kokrajhar And Gelephu. *India Infrahub*. https://indiainfrahub.com/infrastructure/to-bhutan-by-rail-india-bhutan-to-finalise-location-of-58-km-corridor-between-kokrajhar-and-gelephu/

Namgyal, T. (2024, January 23). Bhutanese undeterred by Canada Visa reforms. *Business Bhutan*. https://businessbhutan.bt/bhutanese-undettered-by-canada-visa-reforms/

Namgyal, T. (2025, March 15). World Bank to finance Gelephu-Tareythang road. *Business Bhutan*. https://businessbhutan.bt/world-bank-to-finance-gelephu-tareythang-road/

National Center for Hydrology and Meteorology [NCHM]. (2022). *Flood risk assessment report for southern Bhutan*. Royal Government of Bhutan.

National Statistics Bureau of Bhutan. (2022). *Annual Population Report*. Royal Government of Bhutan.

Pelden, T. (2023, August 3). Industrial areas fall far short of capacity. *Business Bhutan*. https://businessbhutan.bt/industrial-areas-fall-far-short-of-capacity/

Quinn, S. (2023). Why building more won't make houses affordable. University of Sydney. https://www.sydney.edu.au/news-opinion/news/2023/06/01/why-building-more-will-not-make-houses-affordable.html

Royal Monetary Authority of Bhutan. (2023). *Real Estate Market Trends in Bhutan*. Royal Government of Bhutan.

Stachel, G. (2023, August 1). Bhutanese Youth Look to Australia for a Better Life. *Voice of America*. https://learningenglish.voanews.com/a/bhutanese-youth-look-to-australia-for-a-better-life/7202657.html

Tenzin, U. (2021). Report on Housing Market Demand Survey. Technical Assistance Consultant's Report. Asian Development Bank. https://www.adb.org/sites/default/files/project-documents/51252/51252-004-tacr-en_4.pdf

Tshering, P. & Dolkar, S. (2020, January 21). Finally a bridge over Mao River within 2-3 years. *Bhutan Broadcasting Service*. https://www.bbs.bt/127217/

W. Hagg, et all. (2021). Hazard Assessment for a Glacier Lake Outburst Flood in the Mo Chu River Basin, Bhutan. *Applied Science* 11 (*20*), DOI: 10.3390/app11209463

Wangdi, K. (2020, May 29). Housing shortage no longer an issue in Gelegphu Thromde. *Bhutan Broadcasting Service*. https://www.bbs.bt/132799/

Wangdi, K. (2021, August 23). Lack of public toilet troubles vendors at Gelegphu Industrial Centre. *Bhutan Broadcasting Service*. https://www.bbs.bt/156102/

Wangdi, K. (2023, June 26). Kraft paper industry in Sarpang faces shortage of raw materials. *Bhutan Broadcasting Service*. https://www.bbs.bt/188088/

Wangdi, K. (2024, February 18). Gelephu residents struggle with water shortage amid unfulfilled promises. *Bhutan Broadcasting Service*. https://www.bbs.bt/199331/

Wangdi, K. (2024, January 17). Gelephu Thromde free from drinking water scarcity. *Bhutan Broadcasting Service*. https://www.bbs.bt/197744/

Wangdi, K. (2024, March 9). NPPF completes 120-unit residential complex for Gelephu Hospital workers. *Bhutan Broadcasting Service*. https://www.bbs.bt/200416/

Wangdi, P. (2024, October 28). Construction moratorium strangles wood-based industries in Sarpang. *Kuensel*. https://kuenselonline.com/news/construction-moratorium-strangles-wood-based-industries-in-sarpang

World Bank. (2019). *The Urban Edge: How Cities Contribute to Health, Nutrition, and Population Outcomes*. World Bank Group.

World Bank. (2019). *World Development Indicators*. World Bank Group.

World Health Organisation. (2014). *Mental Health Atlas 2014*. World Health Organisation.

World Health Organisation. (2018). *Health System Building Blocks*. World Health Organisation.

Yunus, M., & Jolis, B. (1998). Banker to the poor: Micro-lending and the battle against world poverty. *Public Affairs*.