

SMART CITY CONCEPT IN THE CONTEXT OF AMOCHHU LAND DEVELOPMENT & TOWNSHIP PROJECT (ALDTP)

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Abstract

Smart city concept has gained a lot of attention and popularity, and planners around the world are trying to integrate the concepts of smart city for ensuring sustainable, safe, and efficient infrastructures deal with the issues of rapid urbanization. In Bhutan, the concept of smart city is new, and efforts have been made to make Amochhu Land Development & Township Project in whatever ways possible to apply the concepts of Smart city in it. Some of the key areas where the concepts of Smart Cities have been applied in ALDTP are Planning, Infrastructure, ICT, Transportation, Environment & Quality of Life and City Management System. So this paper presents in developing our cities and towns smart and green and aims in beginning the concept of Smart City with Amochhu Land Development & Township Project, which will also provide as a pilot project for other cities in Bhutan.

Introduction

It is estimated that more than 54%¹ (United Nations, 2014) of the world's population are now living in urban areas, which implies that there are more people living in the urban areas than in the rural areas across the globe and is projected to increase to 66%² in the next 3 decades.

It is indeed hard to imagine that less than a decade ago, there were less than 20 cities which had a population of less than a million people, now it is projected that by the year 2025 there will be more than 600³ cities which will have a population of more than one million in the near future.

Therefore cities and urban centers all over the world are facing tremendous pressures to grow, innovate, and improve infrastructure in order to become increasingly sustainable, safe, efficient and improve the quality of life for its citizens. The concept of smart cities around the world has been rising rapidly. The concept of smart cities started after cities needed consideration on issues of urbanization such as Congested Traffic, Unplanned Urbanization, Insufficient Infrastructure,

¹Population Distribution, Urbanization, Internal Migration and Development : An International Perspective 2014

²World Urbanization Prospects 2014, Department of Economic and Social Affairs, United Nations

³Megacities: The Past, Present and Predictions for the Future, Miskel, P.H. Liotta and James F.

Exploding population, Scarce resources, Energy Crisis, Natural disasters, Rural Urban Migration, Lack of supervision, Increasing mobility, etc.

The figure below shows the key issues of urbanization:

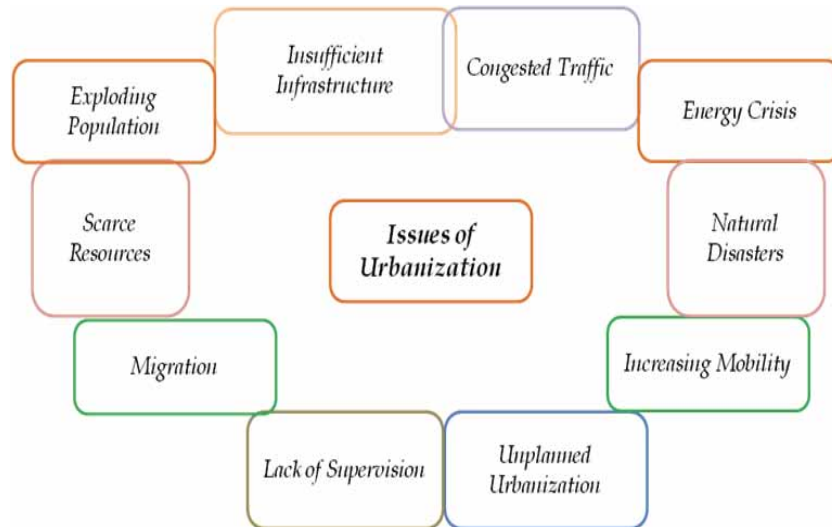


Figure 1: Key Issues of Urbanization (source: NETAS)

In order to resolve the pressing issues of urbanization the concept of Smart City developed. In 2008, IBM began work on a ‘smarter cities’ concept as part of its Smarter Planet initiative⁴. By the beginning of 2009, the concept captivated the imagination of various nations across the globe.

The concept of smart city is a recent phenomenon and a buzz word in the urban forums. There are numerous definitions and terms used to define the Smart City. The other terms that have been used for similar concepts are future cities, sharing cities, digital city, sustainable city, electronic communities, flexicity, information city, intelligent city, knowledge-based city, etc.

This paper covers the following broad topics:

1. What is a Smart City?
2. Ranking of the World’s ‘Smartest’ Cities
3. Smart City Concept in ALDTP
4. Key Benefits of ALDTP
5. Conclusion
6. References

⁴IBM, Smart Planet Initiative.

1. What is a Smart City?

The concept of “Smart City” is different for different cities, as there is no common or universal definition. It is often associated with wide range of technology from municipal operations to all types of service deliveries.

According to Internet sources, “A Smart City is an urban development vision to integrate information and communication technology (ICT) and Internet of things (IoT) technology in a secure fashion to manage a city’s assets.

These assets include local departments’ information systems, schools, libraries, transportation systems, hospitals, power plants, water supply networks, waste management, law enforcement, and other community services”.

Business dictionary defines “Smart City as a developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas; economy, mobility, environment, people, living, and government. Excelling in these key areas can be done so through strong human capital, social capital, and/or ICT infrastructure”.

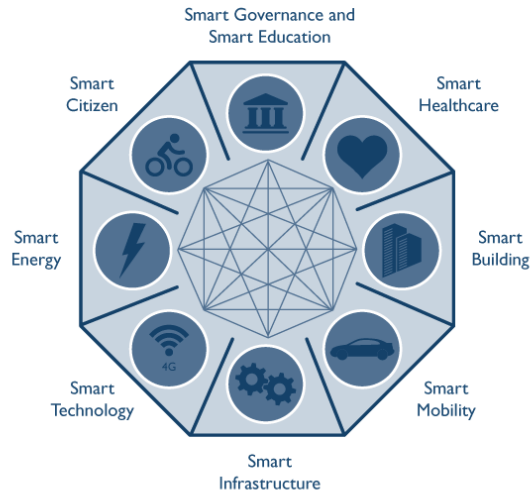
Smart City in a Bhutanese context could mean urban centers with planned basic facilities like transportation systems, electricity, sewerage systems, clean and safe drinking water supply, complementing advanced applications and modern technology by the use of information & communication system to accelerate economic growth and improve the quality of life of people by enabling local development.

This ideally could contribute towards the 9 domains of the Gross National Happiness framework namely Psychological Wellbeing, Standard of Living, Good Governance, Health, Education, Community Vitality, Cultural Diversity and Resilience, Time Use and Ecological Diversity and Resilience.

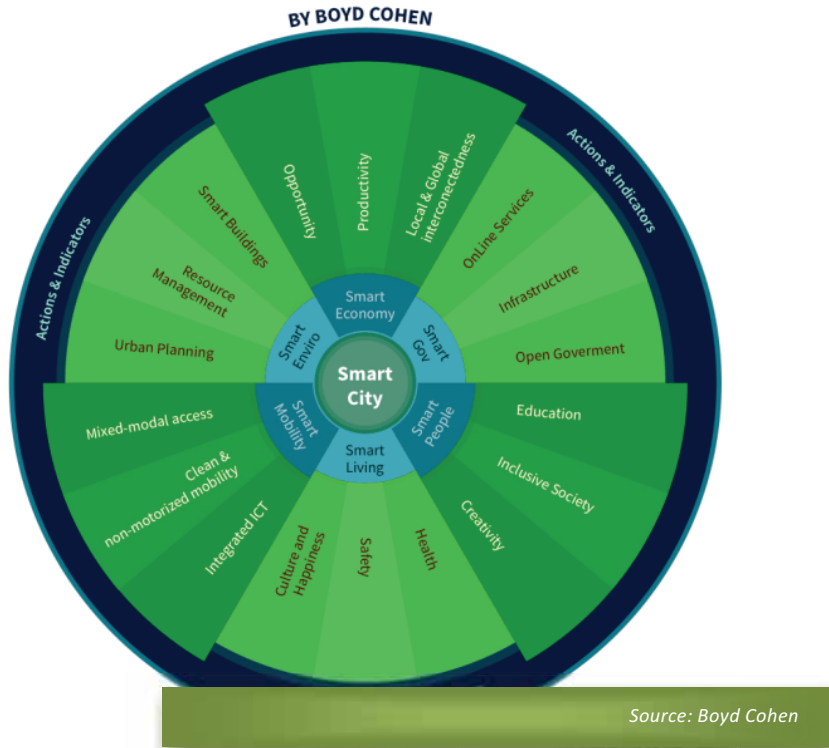
2. Ranking of The World’s ‘Smartest’ Cities

There are various rankings based on different parameters and indicators to rate the smartness of the cities. Some use the smart city wheel as the indicators while other uses different indicators and indices to rate the city as smart.

SMART CITY CONCEPTS



Source: Frost & Sullivan



Source: Boyd Cohen

Figure 2: Smart City Wheel & Indicators

The rating of the World's smartest cities according to Forbes, an American Business Magazine, focusing on business, investing, technology, entrepreneurship, leadership, and lifestyle has been used for the purpose of this paper. Every year Forbes brings out the list of the smart cities in the World. According to Forbes listing of July 6, 2016, ratings have been carried out for 181 key cities of the world. The index or the parameter examines all aspects that make up sustainability and quality of life. The index takes into account 77 indicators, covering 10 distinct dimensions of urban life: the economy, technology, human capital, social cohesion, international outreach, the environment, mobility and transportation, urban planning, public management and governance. In order to top the list, a city must perform well across a range of metrics, not just excel in one area.

The top ten World's Smartest Cities in 2016: According to the Forbes listing are No 1. New York (U.S.), No 2. London (UK) and No 3. Paris (France) who performed the best across a variety of indicators. New York ranks first in Economy, third in Technology and fourth in Human Capital, Public Management, Government, International Outreach and Mobility and Transportation. However, it still performed poorly in regards to Social Cohesion, in which it ranks 161st out of 181. This dimension is also one of the biggest weaknesses of London (129th) and Paris (91st). Social cohesion measures inequality, unemployment rate, prices of property and the ratio of women workers, among others.

The other top 10 cities are San Francisco 4th, Boston 5th, Amsterdam 6th, Chicago 7th, Seoul 8th, Geneva 9th and Sydney 10th.

The two cities with the lowest ranking are Lagos (Nigeria) and Karachi (Pakistan) and they performed poorly in every dimension of the ranking.

3. Smart City Concept in ALDTP

The concept of Smart City is new to Bhutan. But a lot of emphasis and effort has been put in ALDTP to make it a model town for Bhutan. From the beginning of the project planning, when the Terms of Reference (ToR) for the Integrated Detailed Project Report (IDPR) for the Amochhu Land Development & Township was drafted, a vision with a smart city concept has been envisaged in ALDTP. Usually in Bhutan, most of the lands in and around the towns are privately owned and the planning concept comes after the town has developed. So it is very challenging for planners and designers to bring considerable changes. However, in the case of ALDTP, it is unique in itself, firstly the whole land is government owned and there is immense scope for proper planning, and there are possibilities to incorporate the concepts of smart city.

ALDTP is a twin city planned to be developed adjacent to Phuentsholing city. However, like any other cities around the world, the existing Phuentsholing city which is the second largest city in Bhutan and regarded as the commercial hub of the country also faces a lot of issues. Some of the key issues are:

1. Phuentsholing's rapid growth from a small hamlet in 1950s⁵ into a bustling city with an projected average growth rate of 3% annually has a population close to 30,000⁶ not including the floating population. The growth in the last decade has taken place in an organic manner with very little planning and regulations in place. This has resulted in unorganized development, insufficient infrastructure, congestion and low quality urban environment.
2. Amochu River flows with high velocity posing a constant threat of flooding and erosion to the existing town every monsoon.
3. The combination of geographic elements including the river and the fine textured soil of the mountains make Phuentsholing prone to landslides and soil erosion.
4. Growth of the existing town is physically restricted due to the terrain and the topography of surrounding hills, resulting in lack of availability of land for expansion.
5. The forest areas, natural areas and hill slopes around Phuentsholing are experiencing anthropogenic pressures caused by the unplanned growth and development.
6. The growing population and economy has resulted in rising demand for development. However, lack of developable land, insufficient infrastructure and lack of supply of affordable housing has not allowed Phuentsholing to develop to its potential. It has also pushed a significant number of Bhutanese population to live in Jaigaon, the bordering town in India. Several security related incidents have been reported relating to the Bhutanese citizens residing across the border in Jaigaon⁷.
7. Phuentsholing lacks the distinct Bhutanese architectural character that is dominant and visible in other Bhutanese towns and cities and reflects fragmented and chaotic urban character and nature. In spite of being one of the key physical entry points into Bhutan, it falls short in reflecting the socio-cultural ethos and identity of Bhutan.

⁵Urban Development Plan, Phuentsholing: (2002 – 2017)

⁶Local Government Plan, Eleventh Five Year Plan, Phuentsholing Thromde

⁷Kuenselonline: <http://www.kuenselonline.com/housing-crunch-driving-people-out-of-town/>

Therefore, in order to resolve the pressing issues of Phuentsholing, the Amochhu Land Development and Township Project (ALDTP) has been envisaged with the following objectives:

- a) To protect the town and the surrounding environment;
- b) To streamline the river course and reduce the risk of erosion and flooding;
- c) To reclaim the land parcels in order to expand the current municipal area where there is scarcity of space;
- d) To rejuvenate vacant or underutilized areas which are currently flooded during summer;
- e) To propose developing the township with “Smart City” design concepts in areas of planning and design;
- f) To provide housing that supports the existing and future needs along the waterfront and the town;
- g) To propose social housing which will ease the current housing shortage in Phuentsholing;
- h) To develop commercial and retail development that supports the riverfront development or promotes tourism in the region;
- i) To develop riverfront parks, promenades and recreation spaces in order to create positive and interactive open spaces;
- j) To create conducive urban environment;
- k) To conserve the river, improve the surrounding environment and ecological balance.

Based on detailed studies, site analysis and various stakeholder consultations, the IDPR has put forward clear set of visions for the new development, which are as follows:

1. **Resilient riverfront:** utilizes River training to create resilient riverfront that protects the new development and creates new opportunities for development benefiting both sides of Indo-Bhutan border.
2. **Inclusive development for all:** Provide inclusive development for people of all communities and provide housing to people of all income groups.
3. **Culturally vibrant economic hub:** Take benefit of its strategic location on Indo-Bhutan border and make it a culturally vibrant economic hub of Bhutan.
4. **Opportunities for economic development:** Attract opportunities for economic

development that will provide employment and generate business opportunities for people of Bhutan.

5. **Environmentally sensitive approach:** Make efficient use of land and resources for sustainable development and preservation of natural areas including Kaileshwar hill.
6. **An identity for Bhutan:** Reflect Bhutanese socio-cultural ethos and architectural vocabulary to establish an identity for Bhutan.

All these vision statements mentioned above are in line with the concept of smart city. Some of the key areas where the smart city concepts have been applied in the context of Amochu Land Development & Township Project are:

a) **Smart Planning:**

Planning forms the backbone for the proper development of any towns or cities. Therefore, sufficient importance should be given at the time of planning. Furthermore, the planning should be aligned with the holistic visions of long term policy documents such as Vision 2020 and the current 11th Five Year Plan documents. For ALDTP following considerations are given for planning:

- Proper master planning of the area in a holistic manner;
- Proper zoning and land use plan;
- Planning principles based on requirement and financial viability;
- Coordinated approach for city management;
- Well-defined Development Control Regulation (DCR) specific to ALDTP.

b) **Smart Infrastructure**

The Common Urban Infrastructures are the key component of the city development. It should provide comfort and ease for the habitants to enjoy the benefits. Therefore it is essential to have reliable, adequate and high quality utility services.

The Common Urban Infrastructure facility in ALDTP covers:

i. **Water Supply**

ALDTP water supply system is planned to provide reliable water source with clean and safe drinking water and efficient supply system. Water meters for measuring water consumption more efficiently will be installed with sensors in the supply system that measure water consumption, water levels, water flow

rates, leakages and water losses detection on a real time basis. Automation instrumentation system such as the SCADA (Supervisory Control and Data Acquisition) system will be installed, which will significantly reduce operating costs, while improving system performance, reliability and enable remote access for monitoring.

ii. Sewerage collection & treatment

ALDTP sewerage system is planned to be equipped with the collection conveyance system and the treatment facilities will be of modular type. This will help in the reduction of the huge initial investment and the capacity can be increased as per the requirement and demand in future. In addition, the ALDTP also has planned sewage treatment recycle & reuse which will be automated by the SCADA system. The main sewerage system connection will be connected through the common utility ducting system.

iii. Power System

The ALDTP will be supplied with reliable power source by designing networks taking into account forecasted future demands to support wide array of equipment while increasing efficiency and supply quality requirements. Energy saving measures will be promoted and energy efficient buildings will be constructed for commercial and residential purpose. Simple but effective methods like the use of efficient LED Lighting will be used at ALDTP to promote energy saving measures.

iv. Telecommunication System

Information & Communication Technology (ICT) plays a pivotal role and is a key index for rating a city smart. ALDTP telecommunication system is planned to provide robust and reliable telecommunication network. Secure, affordable and high quality telecommunication services like broadband services will be provided initially. In the future, use of cloud services and visual communication tools using high speed broadband communication networks in the corporate and local government sectors for improving business efficiency and convenience will be one of the main new value creations for ALDTP.

The other common urban infrastructures that are considered in the project are Fire Fighting System, Storm Water Management, Solid Waste Management & Treatment and Services along the Streets.

c) Smart Transportation

A high quality well connected and integrated transport network has been planned for ALDTP. In order to allow maximum connectivity and mobility to the development within the project area, the streets and transportation network has followed the following principles:

i. Integrated network of complete streets and roads

ii. Pedestrian network

Walking is the most energy efficient, healthy and sustainable mode of transport. Therefore, all streets have been designed as continuous unobstructed well-paved footpaths and pedestrian walkways with friendly environment.

iii. Bicycle Network

Cycling is the second most efficient, healthy and sustainable mode to travel for short to moderate distances up to 5km. Currently, this mode is being used by a very limited user within Phuentsholing City. The terrain of the site and weather conditions is perfect for cycling in Phuentsholing. A Bicycle Network Plan has been prepared that identifies potential streets for bicycle network. The bicycle network comprise of range of bicycle lanes like Dedicated Bicycle lanes, Demarcated Bicycle lanes and Shared Bicycle lanes

iv. Public Transport Network- connecting with Phuentsholing

High frequency and high quality public transportation with proper bus bays and bus stops has been planned. It is proposed to have a well designed pedestrian friendly Bus Shuttle Corridor to serve the ALDTP area and to connect it with existing development of Phuentsholing city.

v. Sufficient parking facilities

It will be mandated by the Development Control Regulation (DCR) to have sufficient parking facilities for the development. The parking facilities will be in the form of underground parking, on the ground and as parking structures.

d) Smart Environment and Quality of Life

Good quality green spaces are an essential element of urban neighborhood, and it makes a profound contribution to the quality of life of the people. They offer many economic, social and environmental benefits. A great importance has been given in the planning to have a green strategy in ALDTP and about 25-30% of the total area has been designated as green areas, which include the following:

- River front promenades and parks;
- Community parks and public gardens;
- Pocket parks in the urban spaces;
- Natural and semi-natural spaces like Biodiversity park with grasslands and buffer zones;
- Green corridors;
- Outdoor sports facilities, stadia, football grounds, basketball , tennis, and all kinds of sports facilities including Archery range, Water sports facilities and amenity green spaces;
- Community interaction spaces for children and young people;
- Roadside green spaces, walking and biking trails;
- City farms;
- Amusement parks;
- Cultural Heritage sites.



Figure 3: View of lower promenade, ALDTP (source: IDPR, ALDTP)

e) Smart City Management System (CMS)

It is essential to have the development with proper data management system which provides proper traffic management, disaster management, road networks, common urban infrastructure facility, air and water quality management, solid waste collection system. In ALDTP, the common urban infrastructure services are

proposed to be integrated with the City Management System and some of the key areas taken into consideration are:

- **Public Safety and Health**

Public Safety is an important parameter for the city to be considered as a smart city. In order to improve the public safety in ALDTP, it is proposed to have proper lighting, design, and surveillance.

- **Single Window Clearance**

A single window clearance system is being planned for providing ease to the citizens and investors by facilitating the approval and clearance process through a single channel. It is also planned to have proper security management system, customer call centers, easy access of information for citizens, transparent system, one stop shops and all city amenity centers such as police, banks, post offices, etc. needed for the proper functioning of the city. Information and updates will be provided on regular basis through websites, media etc.

- **Water Supply**

It is proposed to have full-fledged SCADA (Supervisory Control and Data Acquisition) system for the complete water supply, distribution system. This SCADA system will analyze the daily water demand, leak detection, losses and zonal metering. The system will be integrated with the centralized City Management System for the proposed ALDTP. It is envisaged to have clean and safe drinking water facilities for 24x7 and an efficient supply system. The metered water supply is proposed and the monthly water bills will be generated and circulated to the receptive houses monthly and the collection mechanism will also be developed.

- **Flood Protection & Warning System**

The Flood occurrence in Amochhu river is observed every year. Hence it is essential to have the flood warning system in place and has been proposed to be installed at five different locations. These stations will give the data to the City Management System. So during high alert, the messages will be passed on to the residence giving ample time for preparedness and evacuation to the safe location on the higher elevation.

- **Power & Street Lighting**

The power supply system will need to be to be integrated with the City Management System in order to avoid the unaccounted and theft of the

power which will also reduce the losses. The consumer metering will also be integrated with the City Management System. The street lights are proposed with the LED lighting and timer based system. The street lighting control will be automated according to the basis of the day light.

- **Signaling:**

The signaling system for the major roads is proposed to be integrated with the City Management System. The main junctions will be integrated so that there will be less traffic conjunctions.

4. Key Benefits of ALDTP

There are numerous benefits anticipated from the project to Phuentsholing & the Nation as a whole and some of the key benefits are:

- a) Protect the city from the floods and erosion;
- b) Generate employment and business opportunities;
- c) Provide state of art infrastructure that will also serve the new development & Local Area Plan;
- d) Develop local and regional transportation infrastructure to better connect the new areas with the city;
- e) Create housing opportunities for people of all income groups;
- f) Provide amenities, utilities and recreational facilities to enhance quality of life for all;
- g) Plan for special developments such as Specialty Hospitals, University & Educational Campuses, Green Industries etc;
- h) Protect sensitive hill slopes, forest and biodiversity of the surrounding areas;
- i) Ensure no negative impacts downstream across the border;
- j) Create an identity for Phuentsholing and Bhutan.



Figure 4: Vision for ALDTP (source: IDPR, ALDTP)

5. Conclusion

The smart cities concept has gained a lot of attention lately and it will most likely continue to do so in the future. We may not be able to compare the proposed upcoming Amochhu Land Development & Township Project with the other smart cities of the world immediately. However, efforts should be made in every city and town in Bhutan to improve the quality of life of the citizens by integrating the concept of smart city supported by higher policies. Smart planning needs to be done to provide the basic facilities and infrastructures, ample public and green open spaces, smart technologies that provide solutions for cities to save money, reduce carbon emissions and manage traffic flows. Sufficient time should be allowed for the planning process, and the implementation should follow the planning and not the other way round. Bhutanese, as a society are very social in nature and cherish outdoor activities, therefore adequate parks and green spaces in our upcoming towns and cities should be provided. The Amochhu Land Development & Township Project may be a starting step towards a journey, where we could utilize our limited resource in the most efficient manner by taking on interconnected challenges of urban planning through a series of interrelated smart systems involving different departments, sectors and even Dzongkhags. If the movement towards the implementation of smart city is realized, it will enhance towards delivering sustainable prosperity for its inhabitants and contribute directly to the improvement of the 9 domains of the Gross National Happiness for the nation as a whole in the long run.

6. References

1. Integrated Detailed Project Report (IDPR)for Amochhu Land Development & Township Project (ALDTP), CDCL, 2016
2. Request for Proposal for preparation of Integrated Detailed Project Report (IDPR)for Amochhu Land Development & Township Project, DHI-INFRA, 2015
3. Urban Development Plan, Phuentsholing: (2002 – 2017)
4. Phuentsholing Structure Plan, 2013- 2028
5. Forbes: <https://www.forbes.com/sites/iese/2016/07/06/the-worlds-smartest-cities/#1dbef7714ab9>
6. Wikipedia: https://en.wikipedia.org/wiki/Smart_city
7. Business Dictionary: <http://www.businessdictionary.com/definition/smart-city.html>

Author's Profile



Kamala Thapa has been working as Dy. Chief Architect and Urban Planner at CDCL since October 2016. She has a Bachelors Degree in Architecture from Hindustan College of Engineering, Madras University in 2001, India and obtained her Masters Degree in Urban Management & Development from Institute of Housing & Urban Development Studies, Erasmus University in 2005. Before her appointment at CDCL, she worked in the capacity of the Head of Architectural Division and as Project Manager at erstwhile DHI-INFRA from 2013 to 2016. She has also worked as the Senior Consultant Architect at Bhutan Telecom Ltd.

In 2006, She got an opportunity to work for a year in Hawaii, USA at a leading architectural and design firm specializing in Green Architecture called Green Sand Inc,. Prior to that, she worked for four years at Gandhara Designs, which is one of the oldest and the most reputed architectural firms in Thimphu, Bhutan.