Urban Resilience Roadmap

Duhabi Muncipality
Koshi Pradesh, Nepal
March 2024

URBAN RESILIENCE ROADMAP OF DUHABI MUNICIPALITY

KOSHI PRADESH, NEPAL
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FOREWORD

Increased urbanization has led to a rise in both development and city growth. However, this growth frequently occurs without adequate planning and can result in a variety of challenges, including environmental damage, social problems, and economic difficulties. Given the increasing growth of Duhabi Municipality and its location between two significant economic hubs, Biratnagar and Itahari, it is critical that we consider how we might make our city more resilient. This means that we must be better prepared to deal with natural disasters and other issues, such as climate change, in a thoughtful and structured manner.

I am delighted to present this final report of the Urban Resilience Roadmap for Duhabi Municipality, a collaborative effort of the municipality and United Nations Development Programme Nepal. This roadmap is a comprehensive approach with four important components: i) Diverse and inclusive socio-economic opportunities, ii) Environment, climate change, and disaster risk reduction, iii) Infrastructure and services, and iv) Governance and investments. The fundamental goal of this roadmap is to strengthen our resilience in the face of the ever-increasing hazards of natural disasters and the effects of climate change. It provides us with a strategic framework for building a more resilient and sustainable Duhabi Municipality.

One of the notable features of this roadmap is the participation of diverse stakeholders in a series of productive workshops, including municipality office, marginalized population and industrial sector. These interactions and participation have expanded our understanding of resilience and ensured that our roadmap matches our community's needs and ambitions. I applaud our municipal team's effort, as well as UNDP Nepal's crucial assistance. We are committed to building a resilient Duhabi that will serve as a model for sustainable urban development.

Duhabi Municipality has a long history of turning goals into practical results. The Integrated Urban Development Plan (IUDP) demonstrates our ability to effectively implement policies. With the Urban Resilience Roadmap, we have the potential to build on this legacy, ensuring that our development operations are carried out with minimal environmental risks with due consideration of climate change adaptation. Most importantly, the continuing collaboration and engagement with all the stakeholders is critical to the success of our initiatives. As we work together to achieve our resilience objectives, we must promote a sense of ownership and shared responsibility in our communities. Milestones can only be met if we all work together, unified in purpose and vision.

As the Mayor of Duhabi Municipality, I am committed to support implementation of Urban Resilience Roadmap which shall enable us in developing a city that is adaptive, inclusive and capable of overcoming any obstacles that may arise.

Thank you.

BED NARAYAN GACHHADHAR
Mayor
Duhabi Municipality

PREFACE

Over 4.4 billion people, which accounts for 56 percent of the world's population, are living in cities. It is projected that by 2050, about 7 out of every 10 people would live in cities. Urbanization can present opportunities for sustainable development, while at the same time rapid urban growth can result in environmental pollution, loss of agricultural land, and rise in urban inequalities which further exacerbates environmental, social, economic and food security risks.

In midst of these multifaceted challenges, it is important to build resilient cities that can withstand the current and future risks and challenges of urban development. Resilience has emerged as a core aspect of Sustainable Development Goals (SDGs), and Nepal as a member country of UN is committed towards achieving of SDGs by 2030. This necessitates embedding and mainstreaming resilient strategies and actions by all three tiers of government – federal, provincial and local, with an aim to foster sustainable urban development.

UNDP has been supporting the national efforts to achieve the Sustainable Development Goals (SDGs) by fostering inclusive economic growth, good governance and resilience to risks. Given that local governments are at the forefront of dealing with the impacts of disasters, and are mandated by the Constitution and Local Government Operation Act with roles and responsibilities related to urban planning, socio-economic development and disaster risk management, UNDP Nepal supports local governments in building resilient communities. In 2023, we supported Waling Municipality of Gandaki Province to formulate Urban Resilience Roadmap which provides a holistic framework to foster resilient urban development.

More recently, UNDP collaborated with Dhankuta Municipality to formulate a strategic framework that holistically addresses disaster and climate risks, socio-economic challenges, inaccessible physical infrastructure and services, and urban governance and investment issues to promote risk-informed urban development. I would like to congratulate Duhabi Municipality on successfully formulating an 'Urban Resilience Roadmap' and thank the leadership of the municipality for accounting resilient strategy into city development activities. I believe this roadmap will serve as a guiding and strategic tool to embed resilience in its development activities, and render holistic benefits to the citizens.

Mainstreaming the Roadmap into municipal annual planning and budgetary plans will lead to its effective implementation. However, implementation of the Urban Resilience Roadmap can be challenging as it requires coordination, partnership and multi-agency collaboration. I believe the concerted efforts from the municipality will overcome this challenge through its strong commitment to build its resilience and stride towards resilient urban development. We look forward to the implementation of the roadmap and will be happy to support the municipality to every possible extent.

MS KYOKO YOKOSUKA
Resident Representative
UNDP

ACKNOWLEDGEMENT

I am delighted to express my heartfelt gratitude and appreciation to everyone who helped Duhabi Municipality draft this Urban Resilience Roadmap. This extraordinary accomplishment would not have been feasible without the support of the United Nations Development Programme (UNDP) Nepal.

Our journey to developing an urban resilience roadmap has been a collaborative one, with the active participation of numerous stakeholders from provincial ministries, district agencies, municipal officers, and local communities. The Urban Resilience Roadmap is a big step forward in our effort in building a more secure and sustainable municipality. It is a detailed document that lays out strategic action plans for mitigating the vulnerabilities that endanger the well-being of our community. The roadmap, with its emphasis on preparedness and resilience, provides a clear path for our municipality to thrive in the face of adversity.

Now that we are on the verge of implementation, it is critical that we remain steadfast in our commitment to the roadmap's strategies and proposals. The roadmap is a guiding document. It demands a firm commitment to developing policies and strategies that are in line with the municipality's vision, as well as allocating resources as advised for the prioritized initiatives. In doing so, we will pave the ground for radical change that will safeguard the resilience of our community. The sustained participation of diverse stakeholders is critical to the success of our work. The effectiveness of the roadmap will be determined by our capacity to collaborate and coordinate activities across all levels of government, the economic sector, civil society, and our local community guided by the principles of inclusion and collaboration. The municipality is committed to successfully implement the roadmap by including the recommendations into annual plans and budget.

I express my sincere appreciation to all who contributed in different capacities to prepare this document. Together, we can transform Duhabi Municipality into a model city showcasing examples of urban resilience.

Thank you!

HIMALAYA BARAL
Chief Administrative Officer
Duhabi Municipality

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
APF	Armed Police Force
ASP	Agricultural Support Programme
ATM	Automated Teller Machine
BBB	Build Back Better
BCP	Business Continuity Plan
BID	Building and Infrastructure Department
BMC	Biratnagar Metropolitan City
CAO	Chief Administrative Officer
CBS	Central Bureau of Statistics
CC	Climate Change
CCA	Climate Change Adaptation
CDO	Chief District Officer
CF	Community Farming
CMS	Compliance Monitoring System
DEOC	District Emergency Operation Centre
DHM	Department of Hydrology and Meteorology
DMIS	Disaster Management Information System
DoR	Department of Road
DP	Development Partners
DPR	Detailed Project Report
DPRP	District Disaster Preparedness and Response Plan
DRR	Disaster Risk Reduction
DRRM	Disaster Risk Reduction and Management
DUDBC	Department of Urban Development and Building Construction
EBPS	Electronic Building Permit System
EIA	Environmental Impact Assessment
EWS	Early Warning System
FG	Federal Government
FGD	Focus Group Discussion
FNCCI	Federation of Nepalese Chambers of Commerce and Industry
GESI	Gender Equality and Social Inclusion
GIS	Geographic Information System
HH	Household
IEE	Initial Environmental Examination
IPCC	Intergovernmental Panels on Climate Change
IRA	Initial Risk Assessment
ISMC	Itahari Sub-Metropolitan City
ICT	Information and Communication Technology
IT	Information Technology
IUDP	Integrated Urban Development Plan
KB	Knowledge Building

KII	Key Informant Interview
LDCRP	Local Disaster and Climate Response Plan
LDMC	Local Disaster Management Committee
LEOC	Local Emergency Operation Centre
LGOA	Local Government Operations Act
LISA	Local Government Institutional Capacity Self-Assessment
MMC	Market Management Committee
MoFAGA	Ministry of Federal Affairs and General Administration
MoUD	Ministry of Urban Development
NBC	National Building Code
NDC	Nationally Determined Contribution
NDRRMA	National Disaster Risk Reduction and Management Authority
NEA	Nepal Electricity Authority
NGO	Non-Governmental Organization
NIURS	Nepal Institute for Urban and Regional Studies
NPR	Nepali Rupees
NRA	National Reconstruction Authority
NSO	National Statistics Office
NTC	Nepal Telecom
OHS	Occupational Health Safety
OJT	On-Job Training
OSR	Own Source Revenue
PG	Provincial Government
PMEP	Prime Minister Employment Programme
PPE	Personal Protective Equipment
PS	Private Sector
PWD	Persons with Disabilities
RIA	Risk Impact Assessment
SDGs	Sustainable Development Goals
SDTS	Skill Development Training School
SEAM-N	Strengthening of Environmental Administration and Management at Local Level
SMEs	Small and Medium-sized Enterprises
SMS	Short Message Service
SWM	Solid Waste Management
UN	United Nations
UNDP	United Nations Development Programme
UPS	Uninterrupted Power Supply
VDC	Village Development Committee
WGA	Whole of Government Approach
WHO	World Health Organization
WSA	Whole of Society Approach
WTP	Waste Treatment Plant

EXECUTIVE SUMMARY

Rapid urbanization increases vulnerability of cities to various natural and manmade disasters. Events like flood, fire, landslides, earthquakes, and storms have devastating effects on the urban areas, disproportionately harming the socially and economically disadvantaged groups. Likewise, the climate change impacts have exacerbated the intensity of disastrous events and increased loss of lives and investments. Countries worldwide are mainstreaming disaster preparedness and management through programmes such as the International Decade for Natural Disaster Reduction, the Hyogo Framework, and the Sendai Framework for Disaster Risk Reduction. Nepal, a South Asian country lying on the laps of the mighty Himalayas, is highly vulnerable to the effects of climate change. It is highly susceptible to flooding and landslides. Its geological location between the Eurasian plates makes it highly prone to earthquakes. In such context, Nepal has committed to and adopted various national and international charters, policies, and frameworks to minimize the effects of disaster, manage disaster risks and adapt against the climate change effects making cities resilient.

Resilience can be defined as the capacity to withstand or to recover quickly from difficulties. The concept is better defined by the Rockefeller Foundation (2015) which defines resilience as "the capacity of individuals, communities, and systems to survive, adapt, and grow in the face of stress and shocks, and even transform which conditions require it". The topography of Nepal, ranging from the high Himalayas to flat Terai, poses a special difficulty in resilience building. Duhabi Municipality is an example of an emerging city in the Terai region which is exposed to various natural and manmade hazards like flooding, earthquake, and fire. With potential of agricultural and industrial growth and strategic linkage with Biratnagar, the capital of Koshi Province, Duhabi can promote resilient growth by identifying the key issues and addressing them through an urban resilience roadmap.

The Urban Resilience Roadmap is a comprehensive framework for encouraging sustainable and resilient urban development in Duhabi Municipality. The roadmap has been developed by following a series of steps including, a) decoding of urban resilience in the context of Duhabi, b) identification of key components and indicators, c) fieldwork involving stakeholders' engagement, focused group discussions, and workshops, d) analysis of data and interpretation to identify key issues and provide strategies and e) action plan to build resilience. The roadmap has been prepared in close consultation with the municipality and related stakeholders.

The conceptual framework for Urban Resilience of Duhabi Municipality has been developed considering the socio-economic opportunities, environmental conditions, climate change implications, disaster scenario, conditions of urban infrastructure and services, and status of urban governance, budgeting and investment in the municipality. A total of 4 major components, 12 sub-components, and 78 indicators have been used to prepare the roadmap. The key components are:

1) Diverse and inclusive socio-economic opportunities
2) Environment, climate change, and disaster risk reduction
3) Infrastructure and services
4) Effective governance and Investment

The roadmap aims to holistically address the key disaster and climate risk issues and challenges of the municipality to build urban resilience. For each major component, a set of key issues have been identified which led to formulation of a list of key strategies to address them. Objectives were developed for each of the major components followed by action plans. Action plans include milestones to achieve, interventions to achieve the milestones, broad time frame, major stakeholders to achieve the milestones and a tentative budget.

The roadmap has identified that inadequate economic diversification, limited impact of subsistence agriculture, poor adaptation to climate change, insufficient support for entrepreneurship, and a lack of targeted opportunities for women and vulnerable communities all impede inclusive and sustainable economic growth. Enhancing municipal-industry collaboration, aligning skill development with industry needs, promoting climate-resilient agriculture among local farmers, coordinating efforts for skill development and entrepreneurship, and focusing on targeted initiatives to financially empower women and marginalized communities will help to foster inclusive and diverse socioeconomic opportunities.

Environment, climate change and disaster risk related challenges include industrial pollution, inadequate capacity of the municipality office, increased climate change risks and flooding, underutilized partnerships, and slow integration of disaster considerations into local development efforts are major challenges. To address these challenges, it is recommended to implement strategies such as engagement of industries for pollution control, upgraded data systems and compliance, climate-resilient disaster preparedness with community involvement, expansion of Disaster Fund, multi-sector collaboration, and integrated risk reduction into development planning.

Non-compliance with building regulations, unplanned urbanization, limited open spaces, inadequate drainage systems, inadequate housing for marginalized communities, vulnerable settlement locations in floodplains, limited accessibility for emergency services, ineffective waste management practices, encroachment of ponds and wetlands, and insufficient clean drinking water represent some of the infrastructure and service challenges. For increased resilience of infrastructure and services, strategies include robust infrastructure, smart solutions, safeguarding critical resources, water sources management, community participation, and private sector collaboration.

Likewise, Duhabi suffers from limitation on technical capacity, financial restrictions, technology underutilization, weak community engagement, lack of private sector involvement, coordination gaps, and insufficient legislative frameworks for effective governance and investment in DRR and climate change adaption. Collaboration among government levels, civic society, and communities is critical to addressing these difficulties. Strategies include incorporating resilience into municipal plans, promoting e-governance, encouraging multi-stakeholder collaboration, exploring funding mechanisms, and implementing comprehensive monitoring and evaluation.

Duhabi Municipality's Urban Resilience Roadmap is a significant step towards a more sustainable urban future. It addresses urbanization, environmental, and climate issues while emphasizing inclusive socio-economic opportunities and encouraging entrepreneurship and innovation. For a better quality of life, the roadmap promotes green infrastructure, climate-resilient communities, and improved infrastructure. Effective governance and investment are critical for engaging stakeholders and ensuring successful implementation. The Urban Resilience Roadmap of Duhabi guides projects towards sustainable development of the municipality. Its implementation will be guided by strategic interventions from the municipality through formation of multi-sectoral groups and integration into municipal functions. The next step includes a detailed implementation plan of prioritized recommendations to promote sustainable and resilient urban development in Duhabi Municipality.

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Introduction

1.1. Background

Rapid urbanization has increased cities' vulnerability to natural disasters and the negative effects of climate change. Fires, landslides, earthquakes, floods, and storms all have devastating results in highly populated metropolitan areas, disproportionately harming the urban poor. It is critical to prioritize disaster and climate change resilience in urban planning and design in order to improve sustainability and preparation. Nepal typifies rapid urbanization tendency of South Asia, with 293 urban municipalities[1] where approximately 66% of total population of the country resides. Local governments now have the authority to draft and adopt laws, levy taxes, and develop disaster preparedness, risk reduction, and recovery strategies- as mandated by the constitution and the LGOA. The international attention on disaster prevention and management has led governments to take proactive measures, as seen by programs such as the International Decade for Natural Disaster Reduction, the Hyogo Framework for Action, and the Sendai Framework for Disaster Risk Reduction. Recognizing the importance of these activities, Nepal has adopted legislation and established specialized authorities and committees. These actions are intended to strengthen disaster risk reduction activities, with a focus on improving coordination, promoting community resilience, and ensuring the participation of marginalized communities and individuals with disabilities.

In the context of Nepal, National Disaster Relief Act[2] was enacted in 1982 to guide the provision of aid for people affected by natural disasters. Likewise, to tackle the pertinent threat of earthquakes, the National Disaster Risk Management Strategy 2009 was introduced. This was relevant because Nepal is in 11th position in terms of earthquake risk (Global Report on Disaster Risk). In the aftermath of the 2015 Gorkha Earthquake, National Disaster Risk Reduction and Management Act 2017 was introduced which paved the establishment of a dedicated National Disaster Risk Reduction and Management Authority (NDRRMA). Additionally, the Act mandates the establishment of disaster management committees at the local, provincial, and national levels. In order to promote successful disaster management, the Act highlights the significance of coordination and cooperation between diverse range of stakeholders, including the government, civil society organizations, and the private sector. Building community resilience and guaranteeing the participation of underrepresented groups and people with disabilities in measures to reduce disaster risks are also prioritized.

Resilience can be defined as the capacity of individuals, communities, and systems to survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it.[3] The characteristics of a resilient city can be reflective, resourceful, inclusive, integrated, robust, flexible, and redundancy.[4] The following key points for building urban resilience are also highlighted.

Tools for Building Resilience

- Risk Assessment
- Socio-Economic Cost-Benefit Analysis
- Risk-Based Land Use Planning
- Urban Upgrading
- Ecosystems Management
- Participation of Communities and Stakeholders
- Geographic Information System
- Recognition of Residual Risk
- Disaster Management Framework
- Investments in Early Warning Systems
- Financial Approaches

Source: The World Bank, Building Urban Resilience: Principles, Tools, and Practice, 2013

1.2. Rationale

The topography of Nepal , which ranges from high mountains to hills and plains (terai), poses challenges in formulating a common approach for building resilient cities. The exposure of natural disasters such as landslides, flash floods, riverine floods, and earthquakes are different in each ecological region. For instance, due to their steep slopes and frequent rainfall, cities in mountainous areas are more vulnerable to landslides and flash floods, whereas those in the Terai are more susceptible to earthquakes and riverine floods. When it comes to urban growth, each area faces a unique combination of issues and challenges, owing to disparities in natural resource distribution.

Given these diverse challenges, it may not be possible to develop resilient cities in Nepal using a one-size-fits-all approach; instead, different approaches must be used based on the unique characteristics of each location. In any strategy, a resilience roadmap should pave ways for identifying and evaluating risks, enhancing infrastructure, and increasing community preparedness for disasters. By encouraging risk-informed development and boosting the ability of local authorities and communities to effectively plan and respond to disasters, the roadmap can foster risk-informed development in Nepalese cities.

1 The following requirements are established in the Local Government Operation Act 2017 to define the municipality: Population sizes for municipalities: districts in the mountain - 10,000, districts in the hill - 40,000, districts in inner Terai - 50,000, districts in Terai - 75,000, and districts in Kathmandu Valley - 100,000. Furthermore, the municipality must have the following facilities: roads and pedestrian walkways, water supply, telephone, solid waste management and landfill site, open space, park and playground, public toilet, 25-bed hospital, airport, bank, financial institutions, community center and convention hall, slaughterhouse, cremation center, and a city Master Plan.

2 This act enabled a committee to recommend declaration of affected areas, formulate national policy regarding the relief work, associate with and coordinate social organizations in National Calamity Relief Work. Importantly, this act enabled the committee to keep money, food, clothes, medicine, construction materials received from within and outside the country as aid or donation under Central Natural Calamity Aid to send them as required for relief work in disaster area.

3 The Rockefeller Foundation, 2015

4 Resilient Cities, 2019

5 According to Asian Disaster Reduction Center 2019, among 200 countries, Nepal ranks 4th, and 11th most vulnerable to climate change, earthquake risks respectively. The country is in top 20 of all multi-hazard countries in the world.

Duhabi Municipality is an example of an emerging city in the Terai which is exposed to various natural and human induced hazards. It has a strong agricultural and industrial base and is growing as an annex to the province capital Biratnagar. UNDP is supporting Duhabi Municipality to develop its roadmap for building resilience and providing recommendations for sustainable and resilient urban development.

1.3. Objective, Scope and Limitations

A planned urban development provides various opportunities for enterprises and economic growth. Unsustainable and uncontrolled urbanization, on the other hand, exposes the population and physical infrastructure to climate and disaster risks and threatens socio-economic development. To promote resilient and sustainable development, a comprehensive and inclusive urban development strategy must be pursued that takes into consideration both existing and anticipated disaster risks. Duhabi Municipality's urban resilience roadmap identifies such hazards at various stages of the municipality's growth and tries to integrate resilience building into overall urban development planning and management. The objectives of this Urban Resilience Roadmap of Duhabi Municipality are:

- To advocate for risk informed urban development using integrated planning approach aligned with urban development plans, DRR policies and other plans developed for Duhabi Municipality
- To guide the process of understanding climate and disaster risks and identifying steps towards addressing those risks.

The outcomes and knowledge gained from the formulation of the Urban Resilience Roadmap will inspire additional initiatives in urban disaster risk reduction and foster the interest and practical expertise of relevant partners. Taking precedents from similar works in Nepal and other countries, the roadmap provides an action plan to guide multi-sectoral resilient development of Duhabi Municipality. The roadmap is not, however, an implementation plan.

1.4. Methodology

The study for preparation of urban resilience roadmap of Duhabi was carried out as a social science research. Exploratory research of the situation of the municipality through the lens of resilience was accomplished using consultative and participatory data collection methods. Stakeholders' engagement was prioritized throughout the study and were carried out with diverse stakeholders. The initial phase involved review of literature and conceptualization of the framework followed by a series of field studies were carried out to collect data as well as to conduct orientation training and workshops with the concerned stakeholders. Data collection methods included key informant interviews, focused group discussions and transect walks. Various maps, graphs, and tables along with descriptive analysis were used during data compilation and analysis phase. All these led to the development of urban resilience roadmap.

Figure 1-1 Overall process of urban resilience roadmap preparation

DUHABI PROFILE & ANALYSIS

Duhabi Municipality, situated in Sunsari district of the Koshi Province, has a population of 66,074 (National Population and Housing Census, 2021) within 76.67 square kilometers of area with population density of 862 people per sq km. In post federal restructuring of local governments, Duhabi was declared a municipality through the amalgamation of the then adjacent Village Development Committees, including Baluwa, Purva Kushaha, Sonapur, Duhabi, Simariya, and Tanamuna. Strategically positioned along the Sunsari-Morang industrial corridor and at the crossroads of the Biratnagar-Dharan and Biratnagar-Inaruwa segments of the Koshi Highway, Duhabi Municipality holds significant economic potential. The growth of settlements and industrial activities in the area further accentuates its prospects. Its advantageous location between the prominent cities of Biratnagar and Itahari, coupled with excellent connectivity to the national highway and the Indian border, has created substantial opportunities for housing, trade, and industrial development.

However, inadequate basic infrastructure and services, weak intra-urban connectivity and poor management of industrial waste are some of the major issues that the municipality has been facing for some time. Other challenges include urban sprawl following rampant conversion of agricultural land with no designated land use zones for industries and rise in flooding events due to encroachment and growing climate change impacts.

Besides the Budhi Ganga River on the eastern side of the municipality, other rivers include Tengra, Manushna and other local streams. During monsoon, the river originating from foothills/chure flows with huge quantity of water discharge resulting in outflanking of rivers causing flood to the entire city. The eastern corridor study of Ministry of Urban Development has outlined the need for regional efforts in flood management of the Budhiganga River as it affects numerous municipalities and rural municipalities in the region including Itahari and Biratnagar. Similarly, the Mega City study of eastern region has identified Duhabi as hotspot for industrial accidents and disaster and hence proposed to have a trauma center or labor hospital in the city. ADB is carrying out scoping for its livable and resilient city project which has identified the various stresses like flood, drought/heat wave, cold wave etc. that the city will be facing in the days to come.

2.1. Geography and Demography

Duhabi Municipality is located in the east of Nepal at Koshi Province. It lies in Sunsari District and is surrounded by Itahari Sub Metropolitan City on the north, Gadhi Rural Municipality on the west, Barju Rural Municipality on the South, and Budhiganga Municipality and Biratnagar Metropolitan city of Morang district on the east. Duhabi municipality is at average 14.9 km away from Biratnagar metropolitan city and around 13.0 km from Itahari. The Koshi Highway connects Duhabi with Biratnagar, Itahari Dharan and Bhedetaar. At Itahari, the East-West Highway intersects with Koshi Highway, that provides access to Inaurwa in the west and Damak in the east. Major feeder roads allow access of Duhabi to other centers of growth like Rangeli.

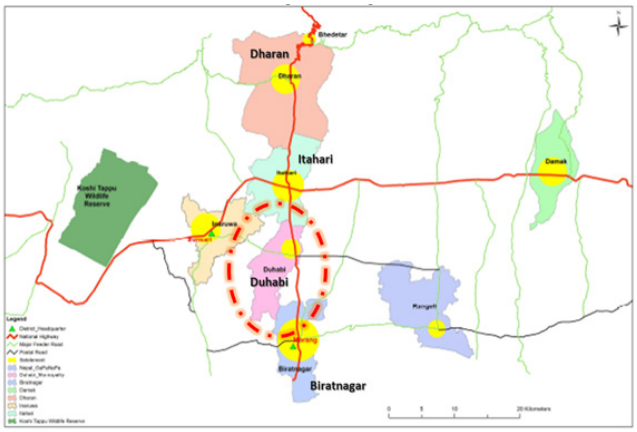

Figure 2-1 Strategic Location of Duhabi Municipality

The physical location of Duhabi, with flat plains and proximity to the Budi and Tengra rivers presents both opportunities and problems for instituting urban resilience, including potential flooding threats and the need for robust infrastructure planning to withstand natural disasters.

6 Stretching from Dharan to Biratnagar and from Itahari to Damar, "Eastern Urbanizing Corridor" is the main theme of Integrated Development Strategy for Nepal's Eastern Urbanizing Corridor that was prepared under the ADB technical assignment on "Nepal- Economic Corridors Initiative: Preparation of Sub-National Development Strategies". The corridor was identified by the Ministry of Urban Development in the National Urban Development Strategy.

According to the census report of 2021[7], the total population of Duhabi is 66,074. The population density is 862 per sq km with a total of 15,030 households in the municipality. Of the twelve wards, ward number 12 has the most population (8641) and ward 5 has the least population (3225). There are 98.56 males per 100 females. The population pyramid of the municipality reveals that the average population is young with approximately 30% falling in the age group of 15-29 years, indicating potential for a significant demographic dividend. To realize this potential, the municipality needs to focus on improving the quality and access to education, healthcare and creating job opportunities- addressing the rural-urban divide.

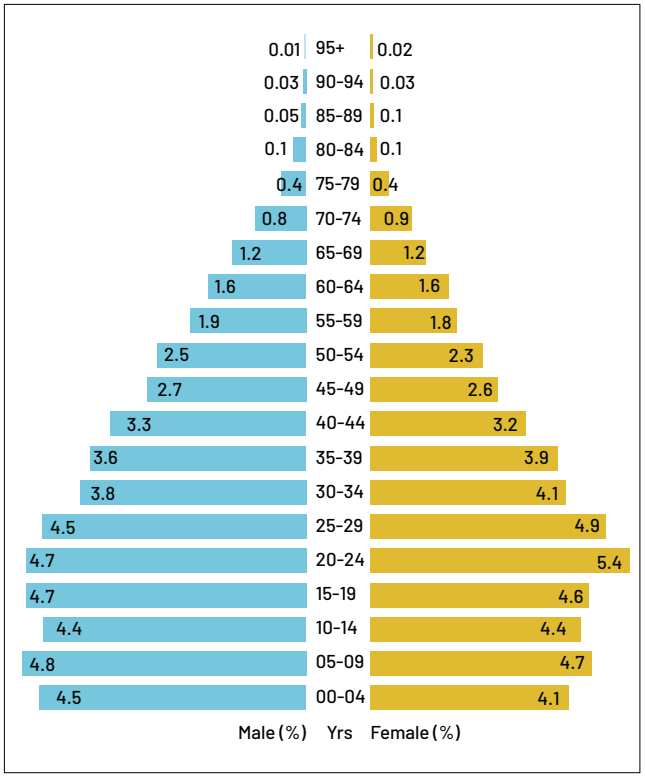

Figure 2-2 Population by 5-year age group and sex (National Population and Housing Census, 2021)

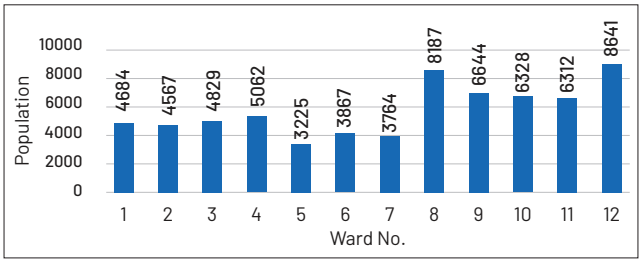

Figure 2-3 Ward-Wise Population Distribution (National Population and Housing Census, 2021)

2.2. Socio-Economic Characteristic

Duhabi is home to many ethnic groups following many religions. The majority of the population are from Tharu, Muslim and Musahar[8] ethnicity. Hinduism is the major religion, followed by Islam.

Ethnic Group	Population (Number)
Tharu	14702
Musalman	12709
Musahar[9]	6317
Uraunwa/Kudukh	4288
Brahman – Hill	2810
Chhetree	2607
Other Minorities[10]	90
Others	**22551**

Table 2-1 Population of ethnic groups of Duhabi Municipality (National Population and Housing Census, 2021)

Due to intentional/unintentional discrimination, marginalization, or limited access to resources, ethnic and religious minorities may endure higher levels of socioeconomic inequality and vulnerability. As a result, resilience capacities in different communities within an urban region may differ. Ethnic and religious communities tend to be crucial in disaster response, recovery, and resilience-building processes. Their cultural and religious organizations, networks, and leaders can be useful platforms for spreading information, coordinating actions, and helping during times of crisis. With more than 80% of its land being arable, agriculture is the municipality's primary source of income. The appropriate growth of the municipal agricultural system has been hampered by inadequate irrigation facilities and high fertilizer costs[11]. Since Duhabi is an industrial city, a significant portion of the population is employed in industries. Unfortunately, the daily life of the marginalized class is based on subsistence farming system and daily wages in factories.

The municipality has 65.6% economically active population[12]. About 33% of the population aged 10 and above are involved in agriculture, 23% in manufacturing, 12% in construction and 15% in wholesale and retail trade, repair of vehicles.

7 National Population and Housing Census 2021 published by the National Statistics Office (NSO)
8 Tharu, Muslim, and Musahar are considered to be marginalized communities in the country.
9 A detailed case study of the Musahar Community of Duhabi is present in the annex document.
10 The minority population belongs to people of Sunuwar, Loharung, Satar/Santhal, Khawas, Bahing, Kumhar, and Sampang ethnicity
11 DUDBC & Duhabi Municipality, IUDP of Duhabi Municipality, 2020.
12 National Statistics Office (NSO), National Population and Housing Census, 2021

Study of Musahar community of Duhabi

Musahar community dwellings are mostly composed of bamboo and metal roofing, with mud-plastered bamboo mesh walls- making them vulnerable to harsh weather conditions. The community in Ward 1 is housed on privately-owned land, with the municipality paying the land rent. The majority of residents in Ward 3 owns their land. During significant flooding, residences in Ward 1 along the Budi River are at risk of erosion. During heavy rain, houses in Ward 3 along the Tengra River are prone to flooding and waterlogging. During severe rain, families in Ward 1 take shelter in nearby school buildings. Basic infrastructure like roadways, drinking water and electricity get affected during heavy rain and flooding. Earthen roads become inaccessible, tube wells and toilets become submerged, and electricity transmission is obstructed. Failure of these infrastructures during critical hours signify that the resilience of the community against natural shocks and stresses is quite poor. The municipality's response is usually slow, with relief in the form of essential food items arriving after a few days.

Despite the community's overall poverty and vulnerability, some families have managed to improve their living conditions through foreign employment. Education has also improved, with local government schools offering free schooling, meals, stationary, and uniforms to youngsters without gender discrimination. However, young boys frequently drop out of school to work as laborers. Even individuals with a high school diploma are frequently relegated to animal care occupations that pay the same as their competitors who have no formal education. Basic health services are provided by local health posts and female health volunteers resulting in better health status. In case of an emergency, the roads are suitable for ambulances. Similarly, the municipality has supplied adequate immunization and nutrition for infants. The municipality also provides social security to persons with disabilities in the community.

The rate of domestic violence is high which further impacts gender parity. In some cases, police interventions and legal actions are taken. Nonetheless, people believe that increasing awareness in recent years has resulted in a decrease in alcohol consumption and domestic violence instances. There are also several reports of difficulties obtaining birth certificates and citizenship in the neighborhood which further limited the youngsters to attend school and get employment opportunities.

The major source of income for the communities is working as laborers in agriculture, industry, or sand extraction. The trend of migrating for foreign employment is rising. The residents are also provided some skill training by the municipality to create local employment, however its contribution on creating job opportunities is yet to be realized. Industries also provide training to the people for various skill development. There is a lack of financial literacy in the community resulting in less daily wages which can only support daily subsistence of the community limiting their capacity to invest on education and health aspects. This vicious cycle of sustenance economy can increase social inequality and conflicts.

2.3. Urbanism, Urban Growth, and Urban Development

Duhabi has developed two Integrated Urban Development Plans (IUDP)[13] in the past. Many projects recommended by IUDP 2018 of the municipality have been implemented. These include management of the market area, facility for solid waste management, development of transportation network connecting ward centers to municipal center and management of open spaces. The IUDPs of Duhabi Municipality have suggested several activities that have potential to strengthen resilience of local communities. The plans adopt a comprehensive strategy by taking into account urban resilience in physical, social, economic, environmental, and institutional dimensions with the participation of all stakeholders in building the resilience of the city, including the public and private sectors, civic society, and the general public. This highlights that resilience-building strategies are already put into practice in an organized and efficient way.

The urban pattern of the municipality can be understood as a city developed alongside the roadway. The Koshi highway transects the city along which the commercial, trading, and other business activities occur. The Budhi Ganga River restricts large scale development in the east. The highest density of housing can be seen in wards 5 and 6 which are closest to the commercial hub of Biratnagar city. There is no definite urban road network pattern, most of the city development is taking place in an ad-hoc manner without adherence to any land use plan, except for a grid iron pattern in ward 5 in which the Municipality office lies. There are other scattered built-up areas in all the wards, and they are mostly developing along the roadway present in them[14].

Duhabi Municipality is a part of the proposed Eastern sector Mega City[15] and has been identified as a residential and recreational zone along with the Industrial Hub.[16] The study proposes river training and river front development, development of industrial village and haat bazaar besides construction of trauma center along with blue and green[17] corridors. These are a few important plans and programs that help to enhance the resilience of Duhabi Municipality.

Similarly, the Eastern Urbanizing Corridor Plan 2019[18] identifies Duhabi as a secondary and tertiary settlement area with medium to high density residential retail and mixed-use development. It also considers Duhabi to be a center for consumer services that include retail, personal services, and restaurants. It also projected that the population growth in Duhabi will be the highest

13 The municipality prepared IUDP in 2018 with the technical and financial support of The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Ministry of Urban Development supported the municipality in preparing the second IUDP in 2020.

14 Existing land use map of the municipality is present in the annex document.

15 Mega City in context of Nepal has been defined as a polycentric urban agglomeration with population more than 1 million and population density of 20 persons per hectare in urban core and 5 PPHA in fringe/peripheral settlements. Other characteristics of a Mega City include higher level of infrastructures embracing inclusiveness and green city concepts.

16 Report on "Identification of Strategic Projects, Feasibility Study and Preparation of Detailed Engineering Design of major Infrastructure Projects for Development of Biratnagar -Dharan as a Mega City" by DUDBC, MoUD

17 Blue corridor in urban planning refers to areas incorporating water features, while green corridor pertains to spaces emphasizing greenery, both aimed at enhancing sustainability and aesthetics.

18 Eastern Urbanizing Corridor Plan was developed by Asian Development Bank in 2019 under the ADB technical assistance (TA) assignment on "NEPAL-Economic Corridors Initiative: Preparation of Sub-national Development Strategies".

due to its strategic location between Biratnagar and Itahari where it experiences spillover of agglomeration benefits. With respect to improving the resilience of Duhabi, the Eastern Urbanizing Corridor Plan recommends various plans and programs under various components. It proposes urban connectivity improvements through improvement of urban arterial roads and bridges, strategic water supply and wastewater management, solid waste management, establishment of regional agro-processing zone, establishment of cold storage facilities, regional Bus Rapid Transit, ring road, regional logistic hub, and integrated water and flood management.

2.4. Environment, Disaster Risk Reduction and Climate Change

The environment of Duhabi can be studied as a combination of various environmental attributes like air, water, soil, and vegetation. The air quality of Duhabi and region is a function of traffic along the Koshi highway and the emissions from the brick kilns and other industries in the vicinity. The construction sector and hay burning are other contributors to the air pollution. The air quality in general is poor during winter and pre monsoon (summer) time causing not only discomfort but health hazard to the local inhabitants. The water resources are getting polluted due to poorly managed solid and liquid waste disposal, mainly industrial effluents.

Figure 2-4 Budi River (Source: Authors)

The Budhi Khola and Tengra Rivers originating in Chure area are seasonal in nature. However, the wastewater disposed from upstream and even from the industries have changed the river into perennial nature. These river systems are highly polluted and cause disasters during monsoon through flash flood. Besides rivers, the municipalities have numerous ponds which have been used for various purposes (drinking, livestock, bathing and cleaning, irrigation, cultural functions) in the past but are losing their relevance due to encroachment. Developing fishponds in private lands is emerging in the city which has commercial viability.

The municipality, with the help of development partners, has set up a solid waste management facility that helps to recycle inorganic waste. The extension of this facility could help to better manage the waste of the municipality as well as the surrounding local bodies.

The municipality lies in the tropical climate zone. Natural disasters like flooding and erosion that are characteristics of tropical climate are prevalent here. Heavy flooding can be considered as a major disaster in the city. Especially during the rainy season, flooding causes land erosion and damages infrastructures resulting in economic loss. Apart from this, it also damages the local livelihood, livestock, and industrial production.

Figure 2-5 Solid Waste Management facility at Duhabi Municipality (Source: Authors)

According to the DRR portal[19] of government of Nepal, between 2011 and 2017, there were 7 incidents of fire, 7 incidents of flood and 1 incident of windstorm, accounting for an estimated loss of NPR. 154,655,000 in the municipality. The BIPADportal[20] of the government mentions a total of 56 incidents between 2013 and 2023 which are recorded as fire incidents, flooding, thunder bolt, and windstorm. An estimated loss of NPR 36 million has been recorded in the portal during these years. With the changing climate and shift in weather patterns, agricultural production has been affected due to intense precipitation and untimely rainfall.

2.5. Governance and Budgeting

The constitution of Nepal and the LGOA 2017 provides the framework for municipal governance in Nepal. The constitution outlines coordination, collaboration, and cooperation among the three tiers of governance with participation of private sector and civil society in planning, budgeting, and monitoring. Duhabi has adopted the participatory planning and budgeting approach[21]. Efforts have been made in the past and are still going on to bring private sector in municipal project funding through PPP. However, collaboration with the private sector is weak. Provincial government is not very active as it is still evolving and institutionalizing. The coordination with other relevant stakeholders including industries and neighboring municipalities is also weak. Dissemination of disaster related information is not adequate between the two tiers of government and also other partners and stakeholders. Another area of concern within the governance involves unwanted influence by social and political communities.

Separate Disaster Funds are present, both in the municipality and the Koshi province[22]. The total budget allocated by Duhabi municipality for environment and disaster risk reduction in the fiscal year 2021/22 was NPR. 128 million[23] . Hazard mapping, early warning systems, early response and recovery, emergency service centers are mentioned in the budget plan presented in the 9th Municipal Annual Meeting Event. Legal frameworks to mainstream disaster and climate change risks into development projects are lacking. Additionally, collaboration between the municipality and industries is weak.

19 http://drrportal.gov.np/

20 https://bipadportal.gov.np/damage-and-loss/

21 The municipality includes and engages people from various sections of the society (including persons from marginalized communities, various disabilities, minority groups) in its planning and budgeting. Various stakeholders are consulted, and various programs are conducted to improve participation (including trainings for economic development)

22 The Ministry of Internal Affairs and Law of the province is planning to establish a building for emergency services (Chief Ministry Emergency Service Centre) and about NPR 80 million has been allocated for it. For the facility, NPR 10 million has been designated for DPR, NPR 10 million for search and rescue equipment, NPR 5 million for awareness and around NPR 6 million for disaster drills.

23 Municipality's 9th Budget Presentation (page 8, http://www.duhabibhaluwamun.gov.np/sites/duhabimun.gov.np/files/Bajet%20baktabya%202078.pdf)

CONCEPTUAL FRAMEWORK

3.1. Conceptual Framework and Operational Structure

The urban resilience of Duhabi municipality has been decoded[24] considering the local context and existing geophysical, socio-economic and governance system at the local level. The major components for resilience have been identified through review of existing national and international frameworks, as well as through brainstorming sessions with experts, city officials, and stakeholders of Duhabi Municipality.

A resilient city needs to offer enough economic opportunity to all its citizens with due consideration of socio-cultural diversity. The city through its structure and form provides access to services to people irrespective of their age, gender, disabilities, caste, and ethnicity. The infrastructure and services need to be robust enough to withstand the natural or manmade shocks that may occur in the city. The city systems should be strong, flexible, and adaptive[25] to absorb the shocks or become operational in the shortest possible time. Accordingly, four thematic areas are identified to bolster resilience in cities i.e. Diverse and inclusive socio-economic opportunities, effective institutions supporting investments, environment, climate change and disaster, and responsive infrastructure development.

Diverse and Inclusive Economy: A diverse and inclusive economy refers to an economic system that promotes equal opportunities and participation for people of all backgrounds, regardless of their race, ethnicity, gender, sexual orientation, age, disability, or other characteristics. It promotes equal opportunity, workforce diversity, inclusive hiring practices and equitable pay besides providing access to financial services, small business supports and capacity building/entrepreneurship development programmes. A diverse and inclusive economy provides economic benefits to the marginalized communities thereby promoting social justice.

Effective Institutions supporting Investment: Effective institutions that support investment play a crucial role in fostering economic growth, attracting both domestic and foreign investments for infrastructure and services development. The municipalities can provide a conducive environment for investment and Public-Private Partnerships (PPPs) by developing proper legal frameworks and regulatory oversight.

Leveraging data and technology is also essential for monitoring and managing resilience. Collaboration between cities, governments, NGOs, and the private sector is essential for scaling up resilience efforts. Sharing best practices, lessons learned, and resources can help cities through knowledge transfer and collectively tackle global challenges.

Environment, Disaster and Climate Change: With increasing population, population density and accumulation of wealth. Cities are becoming more and more vulnerable to environmental degradation, disasters, and climate change implications. City Resilience encompasses understanding of vulnerability and its assessment along with outlining the exposure and internal capacity. Cities must develop and implement adaptation strategies to address their unique vulnerabilities. These strategies may include improving infrastructure, land-use planning, and disaster preparedness, as well as promoting sustainable practices like green infrastructure and renewable energy adoption.

Responsive Infrastructure, Services and Housing: Robust infrastructure, essential services, and adequate housing are key for urban resilience. The ability of a city to withstand and recover from shocks and stresses is closely intertwined with the quality and accessibility of these three components.

Infrastructure: Adaptive and inclusive infrastructure can have capacity to absorb both natural or manmade shocks. The city infrastructure should be designed for multifunctionality, for instance a flood-control channel can also be a park. Creating redundant systems can help ensure that critical services are available even in the face of disruptions. For example, multiple water sources are used that can provide backup in case one system fails.

Services: Resilience can be enhanced by diversifying service providers. Public-private partnerships can help maintain essential services even when one provider faces difficulties. Involving local communities in the planning and management of services can improve the responsiveness of these services during times of crisis. Ensuring robust digital infrastructure and access to information during crises is a critical aspect of urban resilience.

Housing: It should be safe, sustainable, and accessible to all, irrespective of socio-economic status. National Building Codes and local building bye-laws should be enforced in building and infrastructure construction. Sustainable housing, with energy-efficient design and materials, reduces the environmental impacts and contributes to long-term resilience in the face of climate change.

These conceptual themes have been translated and operationalized into four major components and twelve sub-components to study, collect data, analyze, and recommend actions for building urban resilience of Duhabi. The first operational component of the roadmap is diverse and inclusive economic opportunities. With over 80% land currently used for agriculture, and the potential of Duhabi in the sub-regional industrial corridor, the economy of Duhabi is dominated by

24 Various national and international resilience literatures and frameworks were studied including making cities resilient 2030 (UNDRR), Sendai Framework (UNDRR), Resilient Cities (OECD), Framework for resilient cities (NUDS), Building resilient cities (ADB), resilient roadmap of Waling Municipality, City RAP (UNHabitat), and Resilient Cities Index (Arup). These studies helped understand resilience in totality and contextualize resilience in the study area.

25 Definition and characteristics of Resilient Cities (Rockefeller Foundation, 2014)

agricultural and industrial activities. Considering the environmental and disaster risk of heavy rain, flooding, fire, road accidents, and industries, as well as the implications of climate change in agriculture and disaster, environment, climate change and disaster risk reduction has been identified as another major component. Similarly study and analysis of building construction practices, waste management, drinking water supply and potential for housing sector growth suggested infrastructure and services as the third component. Keeping in mind the growing trend of urbanization, urban governance including development of IUDPs, provision of budget for DRR and climate change, coordination, and effectiveness of urban governance, as well as situation of e-governance (digitization and automation), effective governance and investments, has been identified as the fourth component of the roadmap.

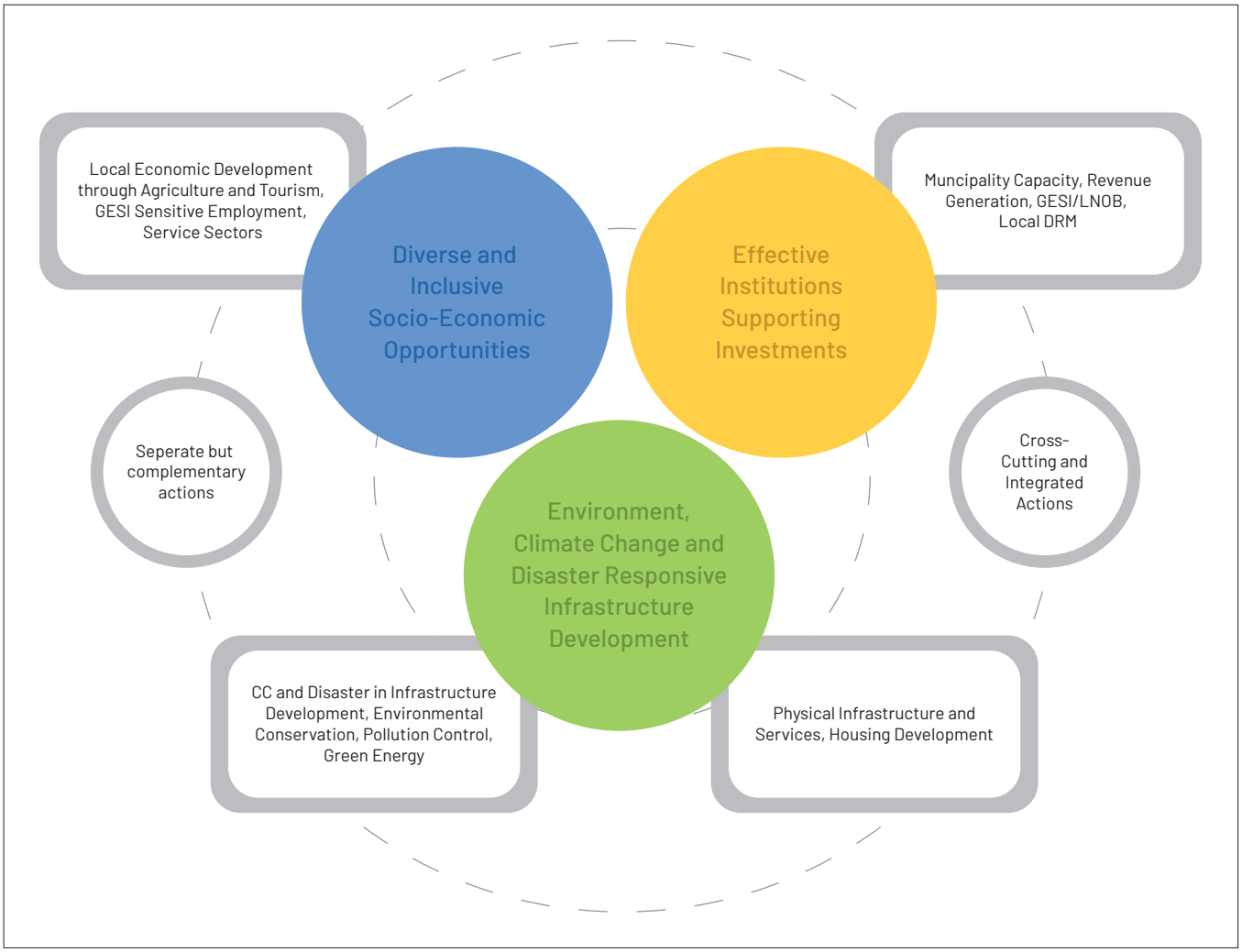

Figure 3-1 Conceptual Framework of the Study

3.2. Data Collection Tools and Processes

Using the 4 major components, and 12 sub-components, 78 indicators were identified (refer to Annex for complete list of indicators). Questionnaire was developed based on the indicators and data was collected accordingly using key informant interviews, focused group discussions, and workshops[26]. A transect walk of the municipality provided insights about the situation of various urban infrastructure and socio-cultural dynamics prevalent in the city. Secondary data were collected from various sources – including but not limited to the National Statistics Office, and Duhabi Municipality Office.

26 Details of the key notes and discussions in Key Informant Interviews, Focused Group Discussions, stakeholders' engagement, and workshops have been shared in the annex document.

Primary Data Collection	Various Key Informant Interviews, Focused Group Discussions, Stakeholders Consultations, Transect Walk	Mayor, Deputy Mayor, Different Sections of the Municipality, Local Groups, Marginalized Communities, Provincial Government Institutions, District Institutions
Secondary Data Collection	Standard Publications, Reports, Guidelines, Manuals, Policies, etc.	Global and Regional, National, Provincial, Local Level institutions
Workshops and Group Exercise	Vulnerability Assessment of the municipality and capacity development	Various stakeholders including municipality, development partners, security officials, industries, press, etc.

Table 3-1 Data Collection Tools and Techniques used in Urban Resilience Roadmap of Duhabi

Figure 3-3 [Left] Workshop and training conducted with various stakeholders, [Centre] Stakeholders consultation with the mayor of Duhabi, [Right] Consultation with the local people affected by flooding of the rivers

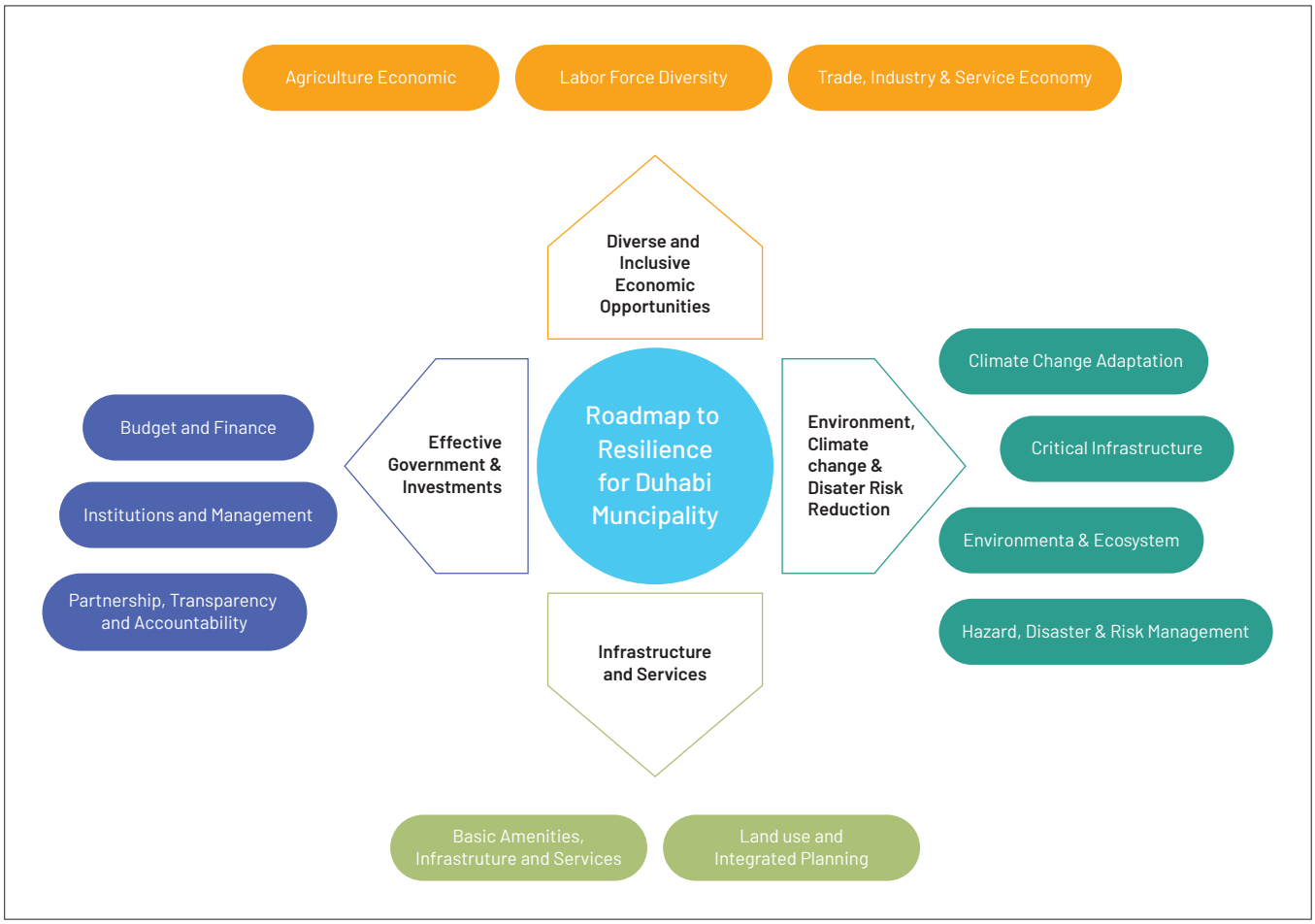

Figure 3-4 Components and Sub-Components of Urban Resilience Roadmap for Duhabi Municipality

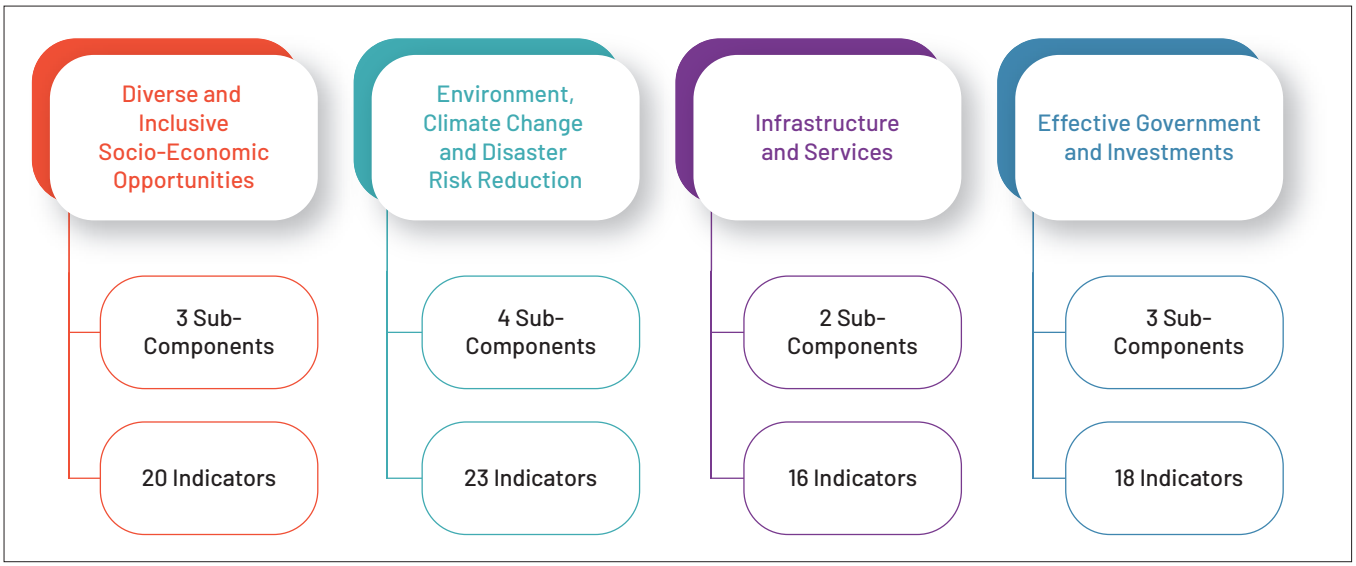

Figure 3-5 Number of indicators under each component

DATA ANALYSIS AND INTERPRETATION

4.1. Diverse and Inclusive Socio-Economic Opportunities

4.1.1. Agriculture Economy

The economic opportunities are slowly expanding and deepening in the municipality. The agriculture sector, which engages 50 percent of the total economically active women population, is gradually diversifying with the wide range of agriculture support programme (ASP) being implemented by the Duhabi Municipality. The ASP mainly includes activities like distribution of improved seeds, fertilizers, and equipment at subsidized rates; research, training, and skill development; access to market and cold storage; introduction of new cash crops. The 'Agriculture Market Development Project' is a landmark initiative, which is expected to add new feathers to this sector in the short run[27]. The municipality is proactively implementing the "Prime Minister Agriculture Modernization Programme" and "Ghumati Krishak Talim" besides supporting and mobilizing the agriculture-based cooperatives and agriculture groups for the wholesome development of the agriculture sector in the town. The former programme provides market knowledge and information, relevant training and technology, credit, and subsidies to local farmers active in the field. In addition, the programme also promotes adaptive agriculture, new research and commercialization and modernization of agriculture products and systems. Although agriculture sector supports local economy, farming is largely done at the subsistence level, the city has a strong character and structure of buying and selling of agriculture products using a very effective network of 'haat bazar', which is prevalent both at the city and ward level. More than 70 percent of the sellers in the 'haat bazar' are women except the 'livestock haat bazar', which takes place once in a week and is dominantly traded by males. The engagement of women in 'haat bazar' is more prevalent in 'Tharu' community.

The recent focus of municipality in agriculture has allowed this sector to grow both horizontally and vertically[28]. Addition of crops like maize, wheat, lentils, mushroom, tomato and livestock products like chicken, fish and goats have allowed this sector not only to diversify but also reap better income, which ultimately contributes to better life and improved living of local citizens. This change in trend and pattern is greatly influenced by climate change and its impact on agriculture practices and solutions. The farmers are not hesitant in acknowledging the impact of climate change (causing flash floods, droughts and recently more severe heat and cold wave) and need of adapting their produce and practices to better suit the changing local context. The improvisation in the agriculture sector is expected to promote inclusiveness and benefit members of marginalized communities as the majority of them are engaged in farming and livestock raising. Being strategically located between the two major cities (BMC and ISMC) and along the highway, Duhabi municipality has a significant advantage in the market and transportation of goods. The prospect of developing the agriculture sector is unlimited, provided sufficient funds are invested in building agriculture focused infrastructures and services in town.

Upgrading of intra-urban roads is required to ease the transportation of agriculture produces to the city market. Similarly, the ward level 'haat bazar' needs to be better organized for securing undisrupted business (even during rain, heat wave and strong wind) and avoiding disturbances caused to local traffic and human mobility. The formation of Bazaar/Market Management Committee (MMC) is expected to streamline and contribute to effective and efficient management of the 'haat bazaar' as expected[29]. Spending one percent of the total budget in the agriculture sector will not be sufficient to achieve exponential growth in any short span.

The women are dominant participants (90 to 100 percent) of skill development and training programme recently implemented by the Duhabi municipality[30]. More than 60 percent of the trained personnel were reported starting their own enterprises soon after receiving the training. This trend of opening new enterprises offers alternatives in employments to local labor force in Duhabi Municipality. Opening of few agro-processing and packaging industries in partnership with the private sector will add significant value to the local products, besides better income to farmers and new jobs in town[31]. The Swiss government supported enterprise development programme (Switch-

27 The 'Agriculture Market Development Project', funded through different sources (donors, municipality, federal and provincial government) is expected to play a major role in organizing selling and buying of agriculture livestock products in the Duhabi municipality. Soon it will offer multiple facilities of agriculture market including dedicated stalls, cold storage, water and sanitation facilities, operation unit and others. Recently, the World Bank, REED (Rural Enterprise and Economic Development) project has agreed to support the municipality in the systematic management of the 'Haat Bazaar'.

28 "Horizontally" suggests an increase in the overall acreage or land area dedicated to agriculture, while "vertically" implies growth in terms of productivity, efficiency, or value-added activities within the agricultural sector. In essence, the municipality's focus has contributed to the comprehensive development and improvement of the agricultural industry.

29 The MMC is a significant step towards organizing 'haat bazar' in the municipality. The committee was long due. Training has been provided to MMC members while they have also visited Butwal Municipality to understand and learn, how similar committee is functioning there. An Operational Manual for MMC (Bazaar Nirdeshika) has been drafted, which is currently under review. Presently, the private contractors are managing the 'haat bazaar' based on their agreement with the Duhabi Municipality.

30 The training was conducted in multiple areas including tailoring, embroidery and dress making; A/C and fridge repair and maintenance; plumbing; manufacturing of sanitary pads and baby dolls and others. In addition, training was also provided in areas like pig and goat farming, chips and achar making and others. On successful completion, all participants received license and training certificate, which improved their job prospects outside Duhabi Municipality as well.

31 Since recently, Duhabi municipality has started producing tomato in huge quantity. Having a tomato processing industry (making tomato-juice, sauce, paste and achar) in partnership with the private sector and packaging and branding of local products like rice, lentil, mushroom, maize will not only generate new jobs but will also provide better income to the farmers.

up) is instrumental in promoting a culture of entrepreneurship and new enterprises in the agrarian society[32].

4.1.2. Labor Force Diversity

The Prime Minister Employment Programme (PMEP) is found effective in recruiting people from marginalized groups like Musahar, Rishidev, and Chaudhary communities, in multiple areas including drain cleaning, maintenance of road and electrical Grid and others. This is helpful in making employment opportunities inclusive and locally available. In fiscal year 2022/23, the PMEP signed up 690 people and gave 100 days of employment to each participant. Out of total employed, women accounted 30 percent. In general, there was no special consideration provided in any of the above opportunities for people with disabilities. The municipality is building a dedicated program for Musahar communities in Wards 8 to 12, whereby they will be provided skill development training as well as financial assistance to open new enterprises. In addition, Duhabi Municipality is also developing a Detailed Project Report (DPR) for establishing a Technical and Vocational School which is expected to add significant value towards creating new economic opportunities which is more diverse and contemporary.

4.1.3. Industry, and Service Economy

Industry is a dominant sector that provides economic opportunities to the majority of populations in Duhabi Municipality. It engages about 30 percent of the total employed followed by service and informal sectors of the local economy. Out of total employed by the industries, the percentage of women and persons from marginalized communities is very low (less than 20 percent). In general, the women are responsible not only of doing farming but also buying and selling of agriculture produces using a network of local markets. The long history of industrial base offered an easy means of employment to the local populations and as a result, the scope to diversify economic opportunity till recently was not considered necessary.

In industries, locals from the municipality make up the majority of the workforce as laborers. Professional and technical positions are mostly led by Indian residents, with few exceptions. The majority of local workers perform manual labor as they lack skills to hold skilled and technical positions. This stresses the need of capacitating the local workers.

The need of industries is not linked with the skill development programme of the municipality due to the lack of coordination between municipality and industries. Duhabi Municipality has about 15 public and private banks and more than 35 microcredit institutions and cooperatives. These financial institutions also support local businesses and small and micro enterprises operating in the town. Besides, cooperatives are also engaged with municipality in implementing agriculture support programme targeted to local communities.

Industries, which are the key source of economic employment, must be safeguarded from climate and disaster risks prevalent in the region. Entrepreneurs should be made aware on prevalent risks and mainstreaming risks in entrepreneurial development. The Business Continuity Plan (BCP) of the new enterprises must assess and adhere to climate risks to ensure minimal damage and loss and also disruption of business during any disaster. A more integrated, risk sensitive and institutionalized approach is needed to guarantee that the undertaken initiatives are sustainable, robust, and resilient. The recent experience of COVID-19 was very explicit, which categorically emphasized the need of diversified and risk integrated socio-economic opportunities to build and strengthen communities' resilience on the ground.

4.2. Environment, Climate Change and Disaster Risk Reduction

4.2.1. Environment and Ecosystem

Being an industrial city situated along the highway, environment is a principal concern of local authorities and people of this city. The environmentally vulnerable areas identified by the IUDP 2020 are rarely considered in their use and management. There are few community forests managed by the local communities, but they need a well-conceived conservation plan, to better protect and use forests as a resource for the municipality. Owing to the lack of designated industrial zone, the industries are scattered along the highway and surrounded by both high and medium density residential settlements. In many places, industries also act as catalysts for development of slums, which are mainly housed by laborers primarily working in those industries. This trend may encourage the emergence of slum settlements in other areas of the city.

The present industrial development trend does not follow any planning norms and control measures. The same norms and standards applied for private housing and human settlements are applied in the case of development of industrial areas as well. This haphazard practice will ultimately cause disputes and put significant challenges to balance the development needs of housing and industrial sectors[33]. Without 'industry disaster management plan', it is difficult to expect any concrete preparedness measures undertaken by the local authorities to secure industries from potential disaster and climate risks prevalent in this region. The industries are equally vulnerable to inundation and flooding (a major disaster threat to the city), followed by growing fire risk and 'occupational, health and safety' (OHS) concerns of their local staff. To better address these issues, more frequent coordination and partnership between the municipality and industries is required.

On the other hand, industries are also causing water and air pollution, and both are significantly threatening to the city dwellers and their livelihood opportunities. The untreated industrial wastewater, which gets mixed with the river water is directly impacting the vegetation and causing an apparent decline in the agriculture yields including threat to the animals exposed to the same untreated water. To date, there is no common and/or integrated 'waste treatment plant' (WTP),

32 This programme is launched jointly with Province Chapter of FNCII (Koshi Province) whereby unemployed youths of Koshi Province selected through local governments are provided 6 months apprentice training out of which one month is lecture class while rest of the five months is 'On Job Training' (OJT) attached with selected industries. Duhabi Municipality is also a recipient of this programme. Presently, nine industries are partners of this employment programme. Trained personnel are often hired by the same industries where they receive OJT. Please check - https://www.swisscontact.org/en/projects/step-up-improving-labour-market-access-for-unemployed

33 The standards and specifications used for the development of infrastructure and services (design, width, and quality of roads; water supply system; waste management, wastewater treatment and others) including other development norms and controls are not in consistent with the requirements of industrial development and other facilities (parking, loading, and unloading, and others) attached with it.

which can provide access to multiple industries and operates on cost sharing basis. This is probably the best option available to make WTP economical and affordable for the individual industries. This requires coordination efforts from the municipality. It is important to note that the few selected industries are better managing their waste by putting some measures in place, which was also supported by SEAM-N project[34], operational in Dharan-Biratnagar industrial corridor during 2002 to 2011. Both cement and a few other industries inside the city and outside the administrative boundary of Duhabi Municipality are the major sources of air pollution, which is hazardous to the health of the local citizens. In such cases, transboundary (inter-city) partnership and collaboration is indispensable to find solutions. The disputes related to occupational health safety (OHS) of industrial labor and other staffs are generally managed by the industries without interventions from the municipality.

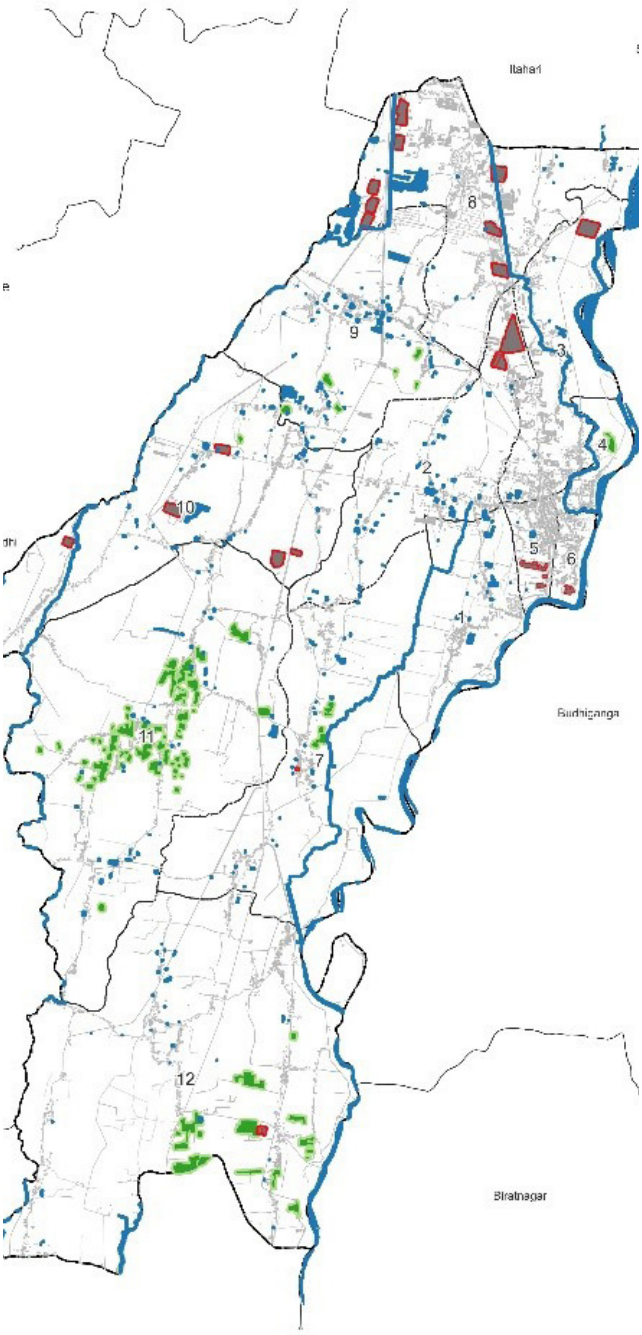

Figure 4-1 Environmentally Sensitive Areas

The vision and strategy adopted by the Duhabi municipality for appropriate management of solid waste is quite doable and robust. However, the efforts invested on the ground at all three stages (collection, transportation, and disposal) of SWM is indeed insufficient and inadequate. At the same time, how to manage medical waste (also in view of COVID-19 response) is not yet thought by the existing SWM programme, which is more focused on household waste. The concept of 'reduce-reuse and recycle' is not yet well integrated in the SWM programme, which is presently under implementation. Though EIA is conducted before awarding the contract to extract sand and aggregates from the local rivers, its appropriate monitoring and reporting is lacking. The long-term environmental impact as a result of this situation is expected to trigger more flooding and frequent inundation in the city. This needs to be checked with no further delay, by developing an open and transparent system of monitoring and reporting of the contractual deals. The water table is decreasing at a rapid pace and it is more prevalent in the market areas of the city. Following rapid urbanization, the installation of deep boring by the majority of industries to meet their water needs also contributes to this problem of depleting water table[35].

4.2.2. Hazard, and Disasters

Duhabi Municipality is highly prone and vulnerable to multiple climate risks and the most disastrous is flooding followed by urban and industrial fire, drought, cold and heat wave. It is important to understand the overall river system of the municipality. The following three rivers- Budhi khola, Tengra khola and Dhanusna khola cut across the Duhabi Municipality and cause frequent flooding and inundation throughout the city. There is no Early Warning System installed in any of the above rivers to inform local citizens in advance and minimize both human and economic losses. This calls for inter-municipality and inter-district discussions and negotiations including exchange of information.

Around 150 households, majority from the marginalized communities, are living along the riverside and hence are highly vulnerable and exposed to frequent floods. These households need to be relocated to a safer place without compromising their livelihood opportunities. Municipalities needs to have relocation policy and relocation plan tailored to this situation.

34 Strengthening Environmental Administration and Management in Nepal (SEAM-N) project was funded by Finish Government and was implemented in Biratnagar-Dharan Industrial Corridor area in the year 2002 to 2011. Three municipalities (Biratnagar, Itahari and Dharan) and the-then seven VDCs including selected industries were partner of this project. The major components of this project were: Environmental Administration and Management, Industrial Environmental Management and Environmental Monitoring which included Environmental laboratory, Environmental Information Unit, and Industrial Environmental Unit.
For further details - https://www.climatenepal.org.np/project/strengthening-environmental-administration-and-management-local-level-nepal-seam-n-project

35 In market areas, the water table has gone down from 30/40 ft to 150/200 ft in last many years. The situation in rural wards of the municipality is not as bad as in the core areas of the city. The water needs of industries is huge.

The frequency and severity of flooding has significantly increased in recent times due to extreme precipitation and prolonged rainfall. Besides flooding, Duhabi Municipality is also facing drought, which is directly impacting the agriculture yields. Although 80 percent of the agriculture land is accessed to irrigation facility, the system is not functional due to lack of upgradation and maintenance.

Riverbeds are shrinking due to rampant encroachment and weak compliance of land and infrastructure development norms in the city. Though the hazard maps of the municipality are available, the morphology study of the major rivers is yet to be done by the provincial government. Because

of poor drainage system, (and where it is available, the open drains are clogged) around 30 percent of the municipal areas (wards-2,3,10,11,12) get inundated by mild rainfall. PDSP design manual[36] is used for the construction of new drains without considering the climate data (provided by DHM). Similarly, soil erosion as a result of severe flooding has become a threat posing a serious challenge of forced displacement in a few wards (1,4,7 and 11) of the municipality. The growing trend of soil erosion (vertical soil erosion) is leading to the need for relocation of several families to safer places. This trend of uncontrolled soil erosion needs to be checked with priority by doing river training using nature-based solutions like bioengineering and others. Both industries and public buildings are also affected by flooding, which halts their operation and services, sometimes for an extended period.

Both industrial and urban fires are on the rise, mainly because of electric short-circuit due to use of poor cable and low-quality wiring and high fluctuation in electricity supply. Like in other towns, the practice of using fire alarming system and fire extinguishers at the individual property level is less in Duhabi Municipality as well. The only fire brigade vehicle available in the town is often not enough to manage medium to large scale fire breakdowns in the city. Besides, the fire brigade team lacks capacities in terms of equipment and trained human resources required for preparedness. It is often very taxing for a small municipality like Duhabi to maintain a full-fledged team of fire brigade on its own. In such context, the concept of a shared facility through inter-city coordination is feasible.

4.2.3. Disaster and Climate Change Risk Reduction

Duhabi Municipality has made some targeted progress to deliver improved climate and disaster risk reduction and management support. The municipality established a dedicated section on Forest, Environment and DRM, in 2016 which is led by a designated and an experienced Focal Person with suitable background and experience. The municipal level DRRM Act already exists, while LDCRP is also developed. The municipality has also constituted DRRM fund, however the total amount allocated to this fund is minimal (NPR. 300 thousand). This fund is scarcely available to support climate change's impacts on the ground. In the present context, disaster preparedness activities are largely limited to public awareness and some training activities. The role of Local Emergency Operation Center (LEOC) is yet to be over-arching and effective in planning and implementing DRRM activities in the municipality. In the absence of EWS, the role of LEOC remains important in view of coordinating with and sharing alert messages to local communities on time. The system of group messages is yet not in practice in this municipality, in-spite majority of people have access to mobile including smart phone[37]. As reported by DEOC, its linkage with LEOC of municipalities is generally weak. The municipality yet to have a stockpiling facility for emergency response[38].

> The use of schools to provide emergency shelter during flooding, forces the schools to shut down, which causes discontinuation of classes and also delays the session. The school buildings may not provide all essential facilities to cater the increased number of families housed during the emergency. A project proposal of NPR 40 million to develop 'emergency shelters' is submitted to MOFAGA while the decision is pending. Many school buildings are in need of retrofitting to increase their resilience, and while some fund is allocated, there is still no progress due to some conflict of interests.

36 PDSP (Planning and Design Strengthening Project) is a design manual used frequently for irrigation projects in Nepal. This was developed in 1990 and hence it does not capture climate change concerns and need of change in design specifications accordingly.

37 Use of group messaging system is very effective in flooding, and this has already been tried in many places in collaboration with NTC and NCell. Both the carriers are also operating in Duhabi municipality, and their network is spread all over the city. The LEOC is not utilizing local FM stations and social media for communicating with local communities during emergency response.

38 However as reported by the municipality, in the absence of stock piling facility, they still manage the emergency food and medicines with the support of relevant industries (existing within their close reach) on short notice.

Pop-up is displayed on the municipal website as soon as there is any threat of disaster due to heavy rainfall and rise in water level in the Budi or Tengra river. However, no pre-information system is available to further communicate the same information to the local people in advance. Later, details of relief materials provided to disaster victims is uploaded on the website. The landline phone of municipality is used to receive request from the people affected in disaster.

The DEOC is a unified communication hub led by the APF, which acts in close coordination of Nepal Police, the CDO Office, and the Fire Fighting units available in the districts. The DEOC allows these groups to coordinate and communicate effectively, boosting their ability to response to emergency situation quickly and swiftly. The DEOC is also expected to maintain close network with LEOCs established at local municipalities. The centre has insufficient and inadequate personnel with relevant background and disciplines respectively. The centre lacks sufficient space, furniture, power back-up, quality electric wiring and communication tools to perform timely and effectively during emergency. Working in this environment, it is hard to expect the high morale of the staff responsible to operate this centre round the clock.

The rapport between the municipality and industries including their umbrella associations is not found very effective and efficient. The recent decision of federal government to transfer the right from the local to provincial government to provide 'pollution control certificate' to the industries further reduces roles of municipalities in coordinating with industries to make them accountable on management of industrial waste. The municipality coordinates with DDMC and other surrounding municipalities while implementing knowledge building and awareness raising programme also aiming at accessing and sharing information common to all. However, the partnership between the municipality and provincial government (DRRM division) also needs to be strengthened in order to access and benefit from the latter's plan and budget available to implement DRRM activities in the province.

The present efforts of Duhabi municipality in areas of environment, DRR and CCA need to be further consolidated, harmonized, and strengthened. The agriculture section of the municipality can play a pivotal role in addressing and adapting to the growing impacts of climate change on agriculture by taking necessary adaptation measures on the ground. The same approach can apply to other sectors as well and as for making the overall development of Duhabi municipality risk informed and resilient. The municipality is already taking targeted activities in some sectors like agriculture, health, education, and others.

4.3. Infrastructure and Services

4.3.1. Land Use and Integrated Planning

Duhabi with population growth of 1.5% per annum is experiencing rapid growth (2.8%) in core wards (1,4,5 and 6) around the Koshi Highway and commercial markets. The municipality is struggling to extend infrastructure, enhance the quality and foster planned development. The enforcement of the National Building Code is crucial in creating resilient cities that can withstand the challenges posed by natural disasters and rapid urbanization. Duhabi's experience exemplifies the need for a concerted effort by both the local government and the private sector to ensure compliance. The municipality has been enforcing building bye-laws and NBC for the last 5 years. With limited technical capacity in both private sector and the local government, the municipality is struggling to ensure code compliance. The municipality is moving ahead to adopt eBPS, recognizing the need for efficiency and digitization of the building permit process[39].However, a common tendency has grown in which many buildings are documented in Archives (Abhilekhikaran) rather than getting a building permission. It is critical to stress that archival recording does not mean the municipal building permit or completion certificate to the people and financial institutions which requires such documents for mortgaging.

The municipal records reveal that about 77 buildings received official building permits in fiscal year 2021/22 (B.S. 2078/79), with approximately 60 of them being NBC compliant. In contrast, 84 buildings were documented in the archives. However, it is quite concerning that more than twice as many buildings were constructed without legal permissions making the built environment vulnerable to geological shocks and other disasters. Further the private buildings designed and permitted for residential use are invariably used for commercial, educational as well as health clinic and hospitals making city more vulnerable and loss of revenue too.

4.3.2. Basic Amenities, Infrastructure, and Services

The piped water supply is available in core wards only while other wards rely on private hand pumps. Municipality has been providing facilities for arsenic tests, protecting communities from the adverse effects. Network of ponds are prevalent in the municipality used for social function, winter irrigation and fisheries. The community ponds are in dilapidated condition due to encroachment and lack of maintenance. These ponds, the crucial infrastructure to combat scorching heat during summer, need conservation with adaptive reuse. During heat waves specially for school going children and senior citizens, the city lacks cooling centers[40] or water distribution facilities. The pond network is a traditional infrastructure for water retention during flooding and water for fire engines during fire disasters. The city is drained through the natural drainage system led by Budhi Khola, Keshaliya, Tengra khola and a few other local drains. The city core has limited drainage facilities without outfall structure. As the municipality is vulnerable to flood, an integrated water management system in collaboration with municipalities in the North

39 To get a permit for a building in the municipality, there is a 21-day process. During this time, byelaws and NBC compliance are checked. Municipality does not have structural engineers, designers in private sector are not skilled enough for NBC compliance design.

40 Designated facility or location that provides relief from excessive heat during periods of extreme temperatures. Pipal Chautaris on the banks of ponds used to provide such function in rural setting in the past and could be recreated in urban parks

– South corridor is necessary including implications of climate change in the design of urban drainage systems[41].

Duhabi has fairly developed road network linking rural wards and urban core with local road network LRN in core wards. The LRN in fringe wards have inadequate road width limiting the movement of ambulances and fire brigade. The LRN is still dominantly gravel, however quality is improving every year with investment from the municipality. Road furniture, roadside plantations and greeneries are very limited in the city. The ROW issue of Koshi Highway and conflict with local community has hindered the redevelopment within the city fabric. Due to inadequate public transport, the city dwellers use private motorbikes, e-rickshaw and cycle. Considering the city size, landform and the distance between work-home-market, there is a potential of developing Duhabi as cycle city with dedicated cycle lanes. The critical infrastructure like bridges and culverts over Budhi khola, Keshaliya, Tengra khola and other local drains need periodic inspections and maintenance. The traffic police's management plan for reducing vehicle speeds involves using a radar gun to conduct speed checks on vehicles 2-3 times each day. Vehicles that exceed the speed limit face penalties. Speed limit signs, as well as other signage, are currently in place. However, new signage is required to promote better compliance with speed limits and to improve road safety within the municipality. The main challenges highlighted within the municipality include reckless driving and failing to comply with lane discipline, notably among safaris (eV rickshaws). These factors add to concerns about road safety and highlight the need for steps to promote responsible driving and encourage adherence to traffic regulations, thereby improving overall road safety within the municipality.

Basic health facilities are provided with one health post in each ward with no emergency response protocol in place. A 15-bed hospital is under construction in ward no 11. In context of disaster, the city has to rely either on health facilities of Biratnagar or Dharan exposing the city to higher vulnerabilities. The Covid-19 pandemic had an immense impact because it heightened public awareness of health issues. During this time, the momentum for building a municipal hospital gained traction . Further a rapid response team of 11 members with 10-15 oxygen cylinders, security items like PPE and some lifesaving drugs are in store.

Housing is emerging as a vital infrastructure specially for marginalized community, The population of Duhabi is dominated by marginalized communities like Musahar, Muslim and Tharu. Most of these population are settled there for centuries without land entitlement creating squatters and slums. Some of them have been evicted and resettled in the past leading to development of settlements along the riverbanks and flood plain of Budhi Khola and Tengra Khola. While there have been some initiatives from the municipality to support marginalized communities to enhance their access to safer housing under Janata Awas Yojna and Mayor's Awas Yojna in the peri urban area, the success of such efforts is yet to be examined. The federal government supported to upgrade the thatched roof to a CGI roof. However, access to safe land is still a big challenge for communities like Musahar and Muslims living in the city core along the riverbanks. With the rise in population in core area, the demand for serviced land parcel for commercial and residential uses is increasing. There is need for multi-criteria vulnerability assessment and develop a Risk and Inclusion Sensitive Land Use Plan of the city to address the issues of increasing risks, inclusion of marginalized communities in development, access to safe housings and create thriving environment for local economy i.e. agriculture and industries.

4.4. Effective Governance and Investments

4.4.1. Budget and Finance

The Duhabi Municipality has prepared a budget of NPR. 837.76 million for 2023/24 (B.S. 2080/81) which is marginally less that than NPR. 896.3 million for 2022/23 (B.S. 2079/80). However, the internal revenue has increased from NPR 210.8 million to NPR 248.4 million in 2023/24. The trend shows that internal revenue has been increasing. The major source of the budget is the grant (fiscal equalization grant and conditional grant) from the federal government (65%) followed by internal revenue (30%) and about 5% from the provincial government. The municipality has allocated about 64 percent of its budget to recurrent expenditure while only 36 percent to the capital expenditure. The municipality has exhibited remarkable spending capacity with about 90 percent of the capital expenditure that has been spent during the last fiscal year. The municipality has been spending about 70 percent of its capital budget on development and maintenance of physical infrastructure.

Major sources of internal revenue include land transaction revenue, rent of municipal shops, Hatiya contract and animal market. The contribution of property tax, business tax is meager and needs rethinking in taxing. The majority of businesses in the municipality are informal in nature and are out of tax coverage. The tax regime needs to be reviewed and properly strategized. However, through community mobilization, the municipality has been creating necessary infrastructure in the core as well as fringe wards. The municipality has been allocating approximately NPR. 2 million annually in disaster fund[43] and GESI budget each, which is less compared to recovery costs required in case of disasters. Further the municipality has been spending on skill development for women and deprived community and linking them with the industries through its employment sub section. The municipality has been spending about NPR 170 million on "Samuhik Suraksha Allowance" including allowance for senior citizen, disabled, widowed women and deprived children (Dalit). In the context the budget is clearly inadequate and largely depends on federal grant for creating any infrastructure in the city. The municipal administration and monitoring committee under the chairmanship of Deputy Mayor ensures that the expenditures are responsive, efficient, and transparent.

All municipal staffs are insured while a special programme is launched by the municipality to insure families of marginalized communities under subsidized rate[44]. This initiative reflects the municipality's commitment to ensuring the well-being and financial security of its employees and vulnerable groups within the community.

41 Integrated Water Management is critical to mitigate risk of flood hazards and make infrastructure investment sustainable. (EUC Report 2019)

42 The construction of the municipal hospital is ongoing.

43 According to the municipality's account section: The municipal DRR budget remained unaltered from the previous fiscal year's DRR budget- the municipal DRR fund amounted to NPR 2 million, with an allocation of NPR 100-200 thousand to each ward. However, during floods, the actual expenditure per ward varied between NPR 1-1.5 million. During the Covid-19 pandemic, each ward received around NPR 3 million in funding.

4.4.2. Institutions and Management

The organization structure of the municipality includes 7 divisions and subdivisions with defined roles and responsibilities. The municipality is on path to adopt e governance and "green" approach towards daily office administration with universal networking and data sharing within the municipality and ward offices leading to considerable reduction in storage space, malpractice and increase in efficiency in service delivery. This ensures easy access to data and sharing of information from municipality offices to the wards. In case of power outage, the computers and routers are connected with UPS or inverter systems. This helps in resilient connectivity and aid in electrical supply during disasters. The meeting time and reminders and information are shared to municipality officers via SMS notifications.

The LISA[45] result outlines the need for the municipality to work on collaboration and coordination with development partners and other government agencies. The municipality needs to enhance coordination and collaboration with the private sector, province, and external development partners in creating and managing infrastructure. LISA indicates the necessity to deliver on GESI and physical infrastructure development.

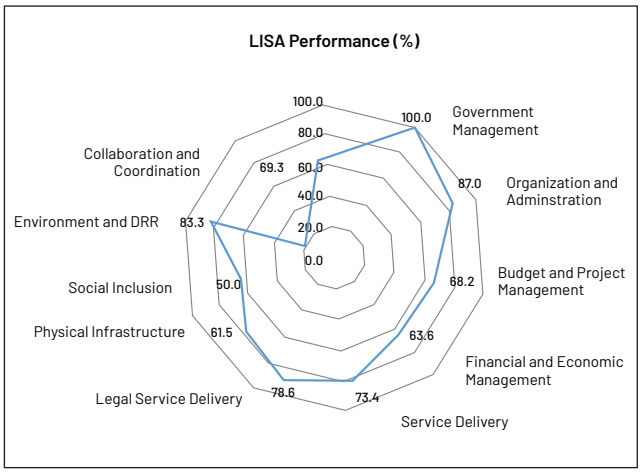

Figure 4-2 Lisa Performance of Duhabi Municipality (LISA website lisa.mofaga.gov.np)

4.4.3. Partnership, Transparency, and Accountability

Partnership, transparency, and accountability are fundamental principles that can significantly impact the performance and legitimacy of local government. While there are positive developments in promoting these aspects through e-governance, e BPS, public participation in planning and budgeting, regular engagement with private sector and civil societies, ongoing efforts are required to be institutionalized and visible to the citizen. The vertical coordination and partnership with provincial and federal governments along with the horizontal partnership with surrounding municipalities, local communities, private sector, and civil society organizations are limited resulting in weak community participation in general meetings and community discussions. Efforts to bring the industrialists and FNCCI on board for partnership and co-creating opportunities for deprived communities are under discussion and have very limited impacts. The municipality, provincial government, and local NGOs have been partnering for last 4-5 years for creating conducive environment for disabled children to attend school, deprived youth get skill development training, helping expectant mothers with health service and proper diets. Such efforts include partnership with local cooperatives and saving-credit groups for promoting entrepreneurship and business environment for marginalized communities. The mayor's housing scheme for Musahar communities is another example of partnership in the municipality.

There is good internet coverage in the municipality, with many residents connected to the internet via the optical fiber (ISP providers: NTC, worldlink, new connect, Nepal technology, etc.) or via mobile data. People can access the municipality website and Facebook page[46] for any notice and information regarding the disasters. The municipality has been using this social network to connect with people and provide useful information. This helps to strengthen e-governance and transparency. Adding human resources in IT department will also help in dissemination of information, study reports, meeting minutes are updated in time.

44 The municipality has launched a special scheme, 'Bippana Nagarik Nagar Pramukh Swastha Bima Karyakram', which is linked with the federal government insurance scheme available for all. Through this scheme, families of marginalized communities are insured just by paying Rs. 1000 while the rest Rs. 2500 is paid by the municipality. Majority of families from the marginalized communities are now ensured, which has also improved their coping capacity.

45 Local Government Institutional Capacity Self-Assessment (LISA) is carried out annually to assess capacity of LGs in different aspects

46 The office Facebook account of the municipality has 5000 friends (+1750 followers), and the official Facebook page has over 3000 reaches.

RESILIENCE ROADMAP
STRATEGIES AND ACTIONS

The Resilience Roadmap of Duhabi Municipality is a strategic plan that outlines the city's approach to building resilience against various shocks and stresses. It serves as a guiding framework to enhance the municipality's ability to adapt, respond, and recover from challenges such as natural disasters, climate change, social crises, and economic disruptions. By following the Resilience Roadmap, Duhabi Municipality can become better prepared to withstand and recover from shocks and stresses, creating a safer, sustainable, and thriving environment for its residents.

5.1. Resilience Strategy

Duhabi Municipality shares vision of an inclusive city where all inhabitants, of present and future generations, without discrimination of any kind, are able to inhabit and enjoy the amenities of just, safe, healthy, accessible, affordable, resilient, and sustainable city and human settlements, fostering prosperity and quality of life for all[47].

The overarching goal of the Urban Resilience Roadmap is to make Duhabi Municipality inclusive, safe, thriving, and smart with adequate decent jobs, housing, infrastructure, and services to its citizens leaving no one behind[48].

The prominent strategies for making Duhabi a resilient city involve a combination of proactive planning, infrastructure improvement, community engagement, and policy development. Here are some key strategies:

1. Risk Assessment and Planning: Conduct comprehensive risk assessments to develop 'Risk and Inclusion Sensitive Land Use Plan' and prioritize risk reduction measures.
2. Climate Adaptation and Mitigation: Implement climate-resilient infrastructure and green solutions to address the impacts of climate change and contribute to nationally determined contributions (NDCs). This may include river training works, green roofs, permeable pavements, e-vehicles, decarbonization of industrial and transportation sector and urban forests.
3. Disaster Preparedness, Risk Reduction, and Response: Develop and regularly update disaster preparedness plans that involve all stakeholders, including emergency services, community groups, and businesses.
4. Infrastructure Resilience: Identify critical infrastructure to withstand shocks and stresses. Undertake periodic maintenance and retrofitting of buildings, bridges, hospitals, open spaces, water supply and communication infrastructure to minimize damage during disasters.
5. Social Inclusion and Equity: Engage with marginalized communities to understand their unique challenges and enhance their accessibility to labor market, safe shelter, and in decision-making processes.
6. Community Engagement: Foster community engagement and participation in resilience-building efforts. Empower local residents to build their capacities in disaster preparedness and recovery.
7. Information and Communication Technology (ICT): Utilize ICT to get connected with district and provincial early warning systems and resources during emergencies.
8. Ecosystem Conservation: Protect and restore natural ecosystems within and around cities. Promote ponds and wetlands, green spaces, and create natural buffers against floods and other hazards.
9. Governance and Policy: Adopt transparent and accountable e-governance and enforce policies that support resilience, including enforcing building codes, land-use regulations, building bye-laws, planning norms and standards, universal design codes.

47 Adopted from Habitat III.
48 Outcome of the discussion during workshop, FGDs and discussion with municipal authorities

10. Business Continuity: Encourage businesses, including local markets, to develop continuity plans to ensure they can continue operations during and after disasters. Include deprived communities in city's economic development framework.
11. Partnership and Cooperation: Engage in partnerships with federal and provincial governments, private sector and civil societies and knowledge-sharing networks to learn from other cities' experiences and best practices in building resilience.

5.2. Thematic Strategies and Action Plans

5.2.1. Diverse and Inclusive Socio-Economic Opportunities

A. Key Issues

- Less-diversified industries-based economic opportunities
- Inadequate contribution of subsistence-based agriculture in the economic upliftment of the local population
- Lack of integration of climate change impacts on the prevalent agriculture practices
- Less promotion entrepreneurs and enterprise creation through employment and skill development opportunities
- Lack of targeted opportunities to ensure financial security of women and marginalized communities

B. Thematic Strategies

1. Collaboration with industries: Strengthen the municipality's working relation with industries to enhance economic opportunities for the locals.

2. Skill development programmes: Provide skill development training programmes that are consistent with the human resource requirements of the industries.
3. Climate-smart agriculture practices: Train and support local farmers to practice climate-smart marketable agriculture practices.
4. Diversification of local economy: Consolidate and organize skill development and enterprise creation efforts aiming to expand and diversify the local economy base.
5. Financial upliftment: Prioritize implementation of targeted projects directed to boost the financial autonomy of women and marginalized communities.

C. Objectives and Action Plans

To develop multi-sectoral based diversified and inclusive economic opportunities, and make them accessible to all strata of populations in Duhabi Municipality creating increased and sustained means of income.

Table 5-1 Action Plan for Diverse and Inclusive Socio-Economic Opportunities

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline[49] (Term)	Partners and Stakeholders	Budget (NPR in million)
1	Industries-based economic opportunities are diversified and made inclusive	Strengthen municipality working relation with industries and institutionalize the process by creating a formal coordination platform to facilitate meetings and discussions on regular interval. - Prepare operational guidelines and legal framework of corporate social responsibility (CSR) to encourage a certain percentage of profits from industries on education, healthcare, and environmental conservation. - Develop Standard Operating Procedure (SOP) to establish and institutionalize coordination platform. - Sign Memorandum of Understanding (MOU) between the municipality and District Chamber of Commerce and Industry (D-CCI), CNI and others. - Designate and train focal person for public private partnership (PPP) at the municipality level.	Coordination Platform, PPP Training	Short-term	CNI, DCCI, DPs	7
		Ensure that municipal skill development efforts correspond to the human resource needs of the industries. - Conduct Needs Assessment of type of human resources required in the industries and develop training packages. - Create a pool of trained human resources as per the requirements of the industries. - Refer trained personnel to relevant industries for employment.	Needs Assessment, Training modules, Training and OJT	Short-term	Industries, Training and Academic Institutes (TAI), DPs	
		Provide targeted skill development training to marginalized communities to improve their access to employment in industries. - Conduct Training Needs Assessment of marginalized communities to improve their access to employment in industries and other sectors. - Select eligible people and provide skill development training as per their interest and requirements of the industries. - Refer trained personnel to relevant industries for employment.	Training Needs Assessment, Training modules, Training and OJT	Short-term	Industries, Training and Academic Institutes, DPs	
2	Living standard of the local communities is improved with the promotion of marketable agriculture	Encourage and facilitate local farmers to practice community farming (CF) by forming community groups. - Develop training packages in community farming. - Form community groups by mobilizing local farmers and provide Training to such groups to practice community farming. - Link community groups to potential markets to sell their products.	Training, Knowledge Building	Short to medium-term	Cooperatives, Agriculture Research Center	10
		Provide necessary tools, technology, credit, and information to promote community farming leading to marketable agriculture. - Develop an Integrated Support Package that includes training, production and marketing to promote community farming. - Give farmers' community groups access to Integrated Support Package and link such groups with potential markets to sell their products at reasonable price.	Training, Knowledge building, Market information, FIs	Short to medium-term	TAIs, Agri-Business Groups (ABGs)	

49 The required timeline has been identified as short term (0-2 years), medium term (2-5 years) and long term (5-10 years).

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline[49] (Term)	Partners and Stakeholders	Budget (NPR in million)
3	Knowledge of local farmers on climate change impact in agriculture sector is improved	Study climate change impact on agriculture and disseminate the findings and suggestions to farmers and other stakeholders.	Study and research, Training, CCA tools	Short to medium-term	CC Expert, NARC, TAIs, ABGs, FIs	15
		Provide farmers with necessary training, tools, and technologies to better adapt with the CC impact.				
		Provide subsidy or soft loan to farmers to encourage them to integrate climate change adaptation measures in their existing agriculture practices.	Financial Institutions	Short to medium-term	Banks, FI, Cooperatives	
4	Employment and skill development opportunities are integrated and harmonized	Establish Skill Development Training School (SDTS) and bring it into operation. - Draft Operational Model to bring SDTS into operation and to certify SDTS trained personnel. - Dedicate space, faculty, staff, and regular budget to operationalize SDTS. - Develop training modules with reference to Needs Assessment conducted.	Trainer, Training courses, OJT, Certification	Short to medium-term	TAIs, Industries	40
		Focus SDTS activities for creation of new entrepreneurs and enterprises. - Facilitate SDTS to conduct study to understand the types of potential enterprises in Duhabi Municipality. - Support SDTS to develop training module in 'enterprise development' and train new entrepreneurs in different business areas. - Provide Integrated Package Support (IPS) to allow enterprises grow and thrive in competitive market.	Market study, Training, Training module, IPS	Short to medium-term	TAIs, FIs	
		Ensure SDTS opportunities include on-the-job training (OJT) option and also offer exchange program with other training institutions. - Develop partnership and arrange OJT with industries. - Develop network with similar training institutions/initiatives and arrange exchange programme for SDTS trainers.	Training Module, OJT, Exchange programme	Short to medium-term	Industries, Training	
		Provide subsidy and/or reservation to marginalized communities to better access SDTS opportunities. - Draft and apply 'subsidy and reservation policy' for poor and marginalized communities.	Policy document	Short to medium- term	Institutes Training Institutes	
5	Women and marginalized communities' skills and income are improved	Conduct socio-economic study of the poor and marginalized communities to assess their skills, employment and income opportunities.	Study report	Short to medium-term	RIs, Consulting firms	30
		Implement targeted activities to expand access of women and marginalized groups to wider employment market. - Provide tax-based incentives to industries/companies that focus on creating enabling environment for working women, that primarily employ women and marginalized groups, and companies owned by women and marginalized groups.	Targeted activities	Short to medium-term	Industries, Business	

ATC- Agriculture Training Center, CNI – Confederation of Nepalese Industries, FIs- Financial Institutions, NARC- National Agricultural Research Council, RIs- Research Institutions, TAIs- Training and Academic Institutes

Note: The budget is indicative and estimated with reference from the cost of similar activities in other municipalities of Nepal.

5.2.2. Environment, Climate Change and Disaster Risk Reduction

A. Key Issues

- Rise in industrial waste and environmental pollution due to lack of monitoring indicators and regulations
- Limited compliance of NBC and building bye-laws
- Increasing risk of climate change impacts such as frequent flooding events
- Less practice and implementation of partnership and collaborative approach
- Weak mainstreaming of disaster and climate change concerns into local development

B. Thematic Strategies

1. Management of industrial waste: Build trust and practice a more engaging rapport with industries to better manage the industrial waste and environmental pollution.
2. Monitoring and compliance: Improve municipal database system, build technical capacity, and apply effective system of monitoring and compliance.
3. Use of data and technology: Integrate climate data and prioritize disaster preparedness (including EWS) and risk reduction in flood and drought management.
4. Institutional setup: Build overall capacity of Forest, Environment and DRR (FE-DRR) Section and upscale the size and scope of the Disaster Fund.
5. Collaborative approach: Develop network, build partnership and practice multi-sectoral collaborative approach to better deal with continuously evolving disaster and climate risks.
6. Mainstreaming risk assessment: Prioritize risk assessment and integrate risk mitigation and risk reduction into planning, budgeting, implementation and monitoring of development projects.

C. Objectives and Action Plans

To integrate climate and disaster risks into sectoral development through participatory and collaborative approach to foster risk-informed local development.

Table 5-2 Action Plans for Environment, Climate Change, and Disaster Risk Reduction

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline (Term)	Partners and Stakeholders	Budget (NPR in million)
1	Improved management of industrial waste and environmental challenges	Develop policies to hold industries responsible and accountable for industrial waste and different forms of pollution (air, water, noise) caused by those wastes. - Prepare Industrial Waste Policy, and enforce and monitor its implementation. - Include incentives-based approaches in the Policy with the rule of benefits and penalties.	Policy, Coordination, Monitoring System	Short to medium-term	Industries, Relevant sectoral departments	10
		Coordinate with industries and facilitate the establishment of common Waste Treatment Plant shared by multiple industries. - Sign MOU between the municipality and industries to establish waste treatment plant in Duhabi Municipality. - Develop Waste Treatment Plan and operational modality to operate the treatment plant on cost-sharing basis. - Form a joint team (industries, municipality and others) to lead establishment and operation of waste treatment plant as envisioned.	MOU, Installation Plan, Operational Guideline	Short to medium-term	CNI, D-CCI, Industries, Sectoral departments, Experts	
		Develop and implement Joint Monitoring System and implement effectively in active participation of industries and other key stakeholders. - Develop environmental thresholds and energy efficiency guidelines for industries. - Develop and practice joint monitoring system to check environmental pollution threshold.	Monitoring framework	Short-term	Industries, Sectoral departments, Experts, Media, Civil society	
		Promote health insurance of local communities (living around industries) at a subsidized rate in partnership with industries and municipality. - Facilitate local families to join health insurance scheme supported by the municipality. - Coordinate with industries to share the cost of health insurance.	Health insurance scheme	Short-term	Insurance company, Industries, Beneficiaries	
2	Buildings and infrastructures are compliant to NBC and building bye-laws	Strengthen the human resource capacity of Infrastructure Development and Environment Management Section/Engineering Section to improve NBC and building bye-laws compliance. - Implement electronic building permit system (e-BPS) and train relevant staffs to facilitate implementation of e-BPS. - Procure equipment and automate all the building and properties related data and information (both old and new construction) using GIS and other relevant tools. - Develop effective Monitoring Framework and train local staffs to improve compliance of NBC and building bye-laws.	Training, software, equipment, Monitoring Framework	Short to medium-term	Building Permit Section, Experts	10
3	Improved flood management by better adapting to climate change impact	Study the changing river system (Budhi and Tengra rivers) in view of growing urbanization and climate change impact and provide suitable solutions to prevent flooding in town.	Study report	Short to medium-term	Experts, Sectoral Departments	15 (no structural measures)
		Implement priority preparedness measures (EWS, Evacuation Centers, Warehouse for stockpiling, Risk Insurance, and others) that are instrumental in minimizing damage and loss caused by the regular flooding.	Equipment, Operational Guideline, Emergency Stocks	Short to medium-term	DPs, Experts, Sectoral departments, Civil society, Media	

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline (Term)	Partners and Stakeholders	Budget (NPR in million)
		Develop Relocation Guideline and relocate settlements existing along the rivers to safer locations.	Relocation Guideline	Short to medium-term	Experts, Sectoral departments, Civil society	
		Design and construct structural measures (dike, retaining wall and others) for controlling flood in city area.	Drawing, Design	Medium-term	Experts, Sectoral departments, Local beneficiaries	
		Design and develop soft measures for flood control and management in suburbs and peri-urban area by promoting nature-based solutions (NbS). - Implement awareness raising activities in local communities through knowledge products and media (local radio, FM, TV, and newspaper.	Training, Awareness campaigns	Short to medium-term	DPs, Experts, Sectoral departments, Civil society	
4	Forest, Environment and DRR Section strengthened and Disaster Fund increased	Strengthen Forest, Environment and DRR Section with trained staffs and more robust scope of work with focus on risk assessment and risk reduction, preparedness and mitigation. Develop local level disaster plans (DPRP, LDCRP, Contingency Plan, Flood Response Plan) including RSIULP and implement them following participatory and consultative method. - Prepare GEDSI responsive LAPA.	Training, Assessment, Equipment, Plans	Short to medium-term	DRR Experts, DPs, Training and Academic Institutions	8
		Increase budget allocation in Disaster Fund and prepare guidelines to make the scope of the Fund more comprehensive including both disaster risks and climate change risks.	Scoping Study, Budget	Short-term	DPs, Sectoral Departments	
5	Partnership and collaboration aided improved disaster risk governance Disaster risks mainstreamed in local development	Map out all key partners and stakeholders of DRRM and CCA - Conduct mapping exercise to collect necessary details of all the key partners and stakeholders of DRRM and CCA under one document.	Mapping, partnership,	Short-term	DRR Partners and Stakeholders	3
		Develop partnership and collaboration with relevant stakeholders to improve disaster risk governance. - Strengthen capacity of DRRM committee at the municipality level to promote engagement of all key partners and stakeholders. - Develop SOP, allocate budget and designate focal person to facilitate DRRM committee.	Disaster Committee, SOP	Short- term	DRR Partners and Stakeholders	
6.		Integrate DRR issues through municipal sectoral departments responsible for sectoral development. - Develop and apply Municipal level DRRM Mainstreaming Guideline to promote integration of disaster and climate change risks into sectoral development. - Make risk assessment and risk mitigation a mandatory requirement for development project more than NPR 1 million.	Mainstreaming Framework	Short to medium-term	Sectoral Departments	2
EWS- Early Warning System, DPRP- Disaster Preparedness and Response Plan, LDCRP- Local Disaster and Climate Response Plan						

Note: The budget indicated are very preliminary and estimated with reference from the cost of similar activities in other municipalities of Nepal.

5.2.3. Infrastructure and Services

A. Key Issues

- Weak enforcement of NBC and bye-laws in building construction
- Urbanization and extension of infrastructure without adhering to land use plan
- Inadequate and uneven distribution of urban open spaces
- Inadequate drainage system and encroachment of natural drainage system
- Poor housing quality of marginalized community
- Settlements of communities belonging to Muslim and Musahar groups on marginalized land in the flood plains
- Inadequate and poor accessibility of emergency services such as firefighters and ambulances in fringe wards
- Ineffective segregation of solid waste at household level including poor implementation of 5R principle (reuse, reduce, recycle, refuge and repurpose)
- Depletion and lack of documentation of ponds and wetlands

B. Thematic Strategy

1. Climate-resilient infrastructure: Design and construct infrastructure that can withstand the impacts of climate change, such as extreme weather events like increased flood levels and heatwaves.
2. Smart, sustainable and nature-based solutions: Embrace smart technologies and sustainable practices to optimize infrastructure performance and reduce vulnerabilities. Adopt energy-efficient buildings, smart grids, cycle tracks, green corridors, and integrated transport systems.
3. Identification and strengthening of critical infrastructure: Identify and safeguard critical infrastructure, such as hospitals, Electric Sub Station, communication systems, from potential disruptions. Implement alternative systems and contingency plans for essential services.
4. Green and blue infrastructure: Incorporate green spaces, urban forests, and blue infrastructure (water retention areas, wetlands) to mitigate floods and improve air quality.
5. Integrated water management: Develop resilient water supply and drainage systems to manage increased rainfall and drought conditions. Mainstream rainwater harvesting, stormwater management, and flood control measures in building bye-laws.
6. Infrastructure maintenance and upkeep: Introduce asset management system and establish regular maintenance schedules for infrastructure and services to ensure their reliability during critical situations.
7. Community-based services: Engage local communities in the planning and provision of essential services. Foster community resilience through training programs, citizen participation, and mutual aid networks.
8. Public-private partnerships: Explore engagement with the private sector to share expertise, resources, and innovative solutions in construction of infrastructures and service delivery.

C. Objective and Action Plans

To develop and enhance the infrastructure and service sector that meets the needs of present and future generations integrating disaster risks and climate change impacts.

Table 5-3 Action Plan for Infrastructure and Services

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline (Term)	Partners and Stakeholders	Budget (NPR in million)
1	Critical infrastructures are identified and strengthened	Conduct mapping, vulnerability assessment and retrofitting of critical infrastructure (hospitals, schools, community buildings).	Mapping	Short-term	Federal and provincial governments (Sectoral departments)	4.5 (except construction cost)
		Develop DRR and Emergency Plan for hospital and install signages to guide emergency route plan for evacuation.	Plan, Signage Design, Installation	Short-term	Federal and provincial governments (Sectoral departments)	
2	DRR and climate change responsive building bye-laws is in place and NBC is enforced	Develop climate change and DRR responsive building bye-laws for Duhabi	Consultation meeting, review	Short-term	Engineering/Architectural firms	5
		Develop guidelines for promoting green building technology in housing and other construction.	Guidelines	Short-term	Construction sector	
		Create awareness and establish counselling center (for e.g. Building Permit Studio) for NBC enforcement and adopt universal design for public buildings.	Counselling and awareness center	Short-term	Engineering/Architectural firms	
3	Protective infrastructures are planned and implemented	Prepare Flood and Drainage Management Plan focusing on nature-based solutions	Survey, Mapping, Plan	Medium/ Long-term	Sectoral departments, Development partners	2
4	Vulnerable communities/ settlements are strengthened or relocated	Conduct vulnerability assessment of communities exposed to disasters like flood.	Vulnerability assessment	Short-term	Sectoral departments, Communities	6
		Develop Relocation Plan for communities located in hazard prone areas.	Plan	Long-term	Sectoral departments, Communities, Development partners	
5	Risk and Inclusion Sensitive Land Use Plan (RISLUP) is developed and implemented	Prepare RISLUP of Duhabi Municipality using multi-criteria hazard/risk analysis.	Vulnerability assessment, Mapping, Consultations, Zoning, Plan	Short/ Medium-term	Sectoral departments, Communities, Development partners	11
		Enforce RISLUP linking it with building bye-laws.	Bye-laws	Medium-term	Engineering/Architectural firms	
6	Eco-friendly/ Local/Renewable technologies are promoted	Promote bio-engineering and nature-based solutions for flood management.	Mapping, Nbs	Short/ Medium-term	Engineering/Architectural firms, Communities	8
		Develop guidelines for enforcement of Green Building Technology.	Guidelines	Medium-term	Engineering/Architectural firms, Development partners	
		Develop guidelines for registering and regulating e-rickshaw and promoting electric city bus.	Guidelines, Stakeholder consultation	Short-Medium-term	Private vehicle organizations	
		Develop guidelines for operation, and maintenance of open spaces, ponds and urban forests.	Guidelines, Stakeholder consultation, Adaptive use	Short/ Medium-term	Communities, Development partners	

Note: The budget indicated are very preliminary and estimated with reference from the cost of similar activities in other municipalities of Nepal.

5.2.4. Effective Governance and Investment

A. Key Issues

- Lack of skilled and trained personnel to effectively mainstream DRR and climate change responsive activities in the municipal plans/projects.
- Weak own source revenue due to lack of mobilization of alternative sources.
- Limited application of information technology in governance.
- Inadequate engagement with community in DRR and climate change adaptation.
- Weak private sector engagement in construction, operation and management of infrastructures.
- Inadequate legal and institutional framework to foster risks-informed development.

B. Thematic Strategy

1. Mainstreaming resilience in local Planning: Integrate resilience considerations into local development plans, policies, and strategies.
2. Community engagement: Involve local communities in decision-making processes, particularly those vulnerable to climate and disaster risks. Engage with stakeholders to identify local challenges and co-create resilience solutions. Develop and implement GESI strategies.
3. Fostering e-governance: Improve data collection, analysis, and dissemination at the local level, use new technologies to provide real-time information on hazards, vulnerabilities, and risks to support proactive planning and response.
4. Building local capacities: Enhance the technical and managerial skills of local government officials in disaster preparedness, response, and recovery. Conduct training programs and workshops to build local capacities for resilience governance.
5. Multi-stakeholder collaboration: Foster collaboration and coordination among various stakeholders, including three tiers of government, NGOs, private sector, and civil society by creating dialogue platforms/forums for joint planning, resource mobilization, and knowledge sharing on DRR and CCA.
6. Financial mechanism: Explore opportunities to foster public-private partnership, access to climate funds, and community-based insurance schemes.
7. Monitoring and evaluation: Develop robust monitoring and evaluation mechanisms to assess the effectiveness of resilience governance initiatives.

C. Objective and Action Plans

To promote an inclusive governance system through use of smart technologies and partnerships ensuring transparency, and accountability in decision-making processes.

Table 5-4 Action Plan for Effective Governance and Investment

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline (Term)	Partners and Stakeholders	Budget (NPR in million)
1	Legal framework is developed and resilience is internalized in development planning	Prepare act and regulations for protection of local environment	Community consultation, Review of federal and provincial acts and regulations	Short-term	Federal and provincial governments (Sectoral departments), Development partners	6
		Conduct orientation to the municipal staffs on DRR and climate change. - Conduct orientation on DRR and climate change responsive medium-term expenditure framework (MTEF) and annual planning and budgeting including training on screening checklist of Initial Environmental Examination (IEE) and Brief Environmental Study (BES). - Conduct training on NBC compliance, bio-engineering and nature-based solutions.	Consultations, Orientation and training programmes	Short/Medium-term	Federal and provincial governments	
2	Application of information technology in service delivery and DRR responses	Implement smart systems such as electronic building permit system (e-BPS) and tax collection system.	Existing system	Short-term	Federal and provincial governments, Development partners	8
		Develop mechanism for early warning system to disseminate information on flood risks to communities.	Existing models/ technology	Short/Medium-term	Federal government, Development partners	
3	OSR is strengthened and other sources are mobilized in critical infrastructure development	Develop PPP acts and guidelines. - Develop municipal PPP Policy aligned with the national policy and implement pilot infrastructure projects following the PPP model.	Consultation with private sector and other stakeholders, National and provincial acts and guidelines	Short-term	Federal and provincial governments	2.5
		Develop and implement community-based insurance scheme against disaster risks.	Community consultation	Medium to long-term	Insurance Companies	
4	People's engagement is ensured in decision-making process	Develop a virtual platform to facilitate public engagement.	Virtual platform, Meetings	Short to medium-term	Federal and provincial governments	1
		Constitute an institution for joint periodic monitoring with members from private section and civil society.	Institutions	Short to medium-term	Private sector	

Note: The budget indicated are very preliminary and estimated with reference from the cost of similar activities in other municipalities of Nepal.

CONCLUSION

The formulation of the Urban Resilience Roadmap of Duhabi Municipality is a significant step forward to achieve the goal of a resilient and sustainable urban future. This roadmap has been drafted following rigorous planning and broad stakeholder consultations, integrating emerging and important components targeted at addressing the challenges posed by urbanization, environmental degradation, and the increasing concerns of climate change and disaster risks.

The emphasis on diversified and inclusive socio-economic opportunities is a critical component of this strategy. Recognizing the importance of equal access to economic growth and livelihood possibilities, the Duhabi Municipality aspires to establish an environment that encourages entrepreneurship, innovation, and skill development for all its citizens. The roadmap has identified strategies to empower marginalized and vulnerable groups. Duhabi can tap into the potential of its varied workforce by encouraging social cohesion and embracing diversity to achieve long-term economic growth and prosperity.

Another critical component of the roadmap is environmental issues and the necessity of climate change adaptation. The roadmap has developed measures to maintain and protect the natural environment through promotion of green infrastructure, sustainable behaviors, and climate-resilient communities. This will increase the city's ability to endure and recover from prospective disasters, lowering vulnerability and increasing overall resilience.

The roadmap emphasizes development of infrastructure and services, which are the backbones of any urban region. Duhabi can improve its resilience to shocks and stressors by investing in resilient and sustainable infrastructure, while also improving the safety and quality of life of its citizens. A well-planned infrastructure network promotes not only economic growth but also a greener, more connected, and resilient urban landscape.

The keystone that connects these three components of the Urban Resilience Roadmap is effective governance and strategic investment. Involving stakeholders including local communities will be critical to the successful execution of the roadmap's recommended activities.
The approach for preparation of this resilience roadmap included stakeholder engagement which captured their unique ideas and contextual knowledge. Focused group discussions and transect walks have provided insights on the city's challenges and opportunities. Furthermore, a detailed literature review and secondary information analysis have reinforced the roadmap with global and regional best practices.

Implementation Strategies

The roadmap can act as a guide for further research and new projects in the municipality to attract investments and perform sustainable development activities. Other stakeholders such as provincial government and development partners can use the roadmap as a framework to support urban resilience efforts.

Before the roadmap can be implemented, it must first be thoroughly reviewed and approved by the Municipal Council of Duhabi Municipality. Furthermore, the Council must demonstrate a commitment to providing the financial and human resources to execute the roadmap. It is strongly advised that a multi-sectoral Steering Committee be formed and approved by the Council to effectively oversee, assist, and monitor the implementation process. The committee's mandate should be clearly defined to ensure that it plays a decisive role in directing and coordinating the roadmap's execution. To guarantee successful implementation, decisions must be made on the incorporation of resilience building into the municipality's planning and budgeting as well as the execution of specialized resilience measures on the ground. Furthermore, improving institutional capacity and accountability are identified as critical requirements for the roadmap's successful execution.

The Urban Resilience Roadmap is a comprehensive framework for encouraging sustainable and resilient urban development in the Duhabi Municipality. However, to ensure proper implementation, the subsequent phase should be to create a detailed implementation plan which should include a breakdown of activities. The implementation plan will provide a clear and coordinated approach to executing the roadmap's objectives. The roadmap can support Duhabi Municipality in identifying prioritized activities to achieve its goals of sustainable and resilient urban development.

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