FINAL DRAFT

URBAN RESILIENCE ROADMAP

DUHABI MUNICIPALITY

KOSHI PRADESH, NEPAL

AUGUST 2023

Duhabi Municipality
Koshi Pradesh, Nepal

UNDP

Final Draft

Urban Resilience Roadmap
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FOREWORD

ACKNOWLEDGEMENT

Our sincerest appreciation and admiration go to the Hon. Mayor and Deputy Mayor of the Duhabi Municipality, who took proactive decisions to develop Urban Resilience Roadmap for Duhabi Municipality and supported the entire process with proactive interest, generosity, and concern.

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The Consultant group would also like to extend its sincerest thanks to UNDP/CDRMP team, for providing them this opportunity to work on the very challenging and evolving concept of Resilience Building, particularly in urban local governments in Nepal. The team always encourages them to think innovatively and apply new knowledge and ideas in the development of this roadmap. Their comments and remarks on the draft report were very practical and insightful.

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PREFACE

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 Resilience 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	National 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 Program
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. Likewise, the effects of climate change can be seen manifesting in exacerbated intensity of disastrous events and increased loss of lives and investments. Disaster preparation and management have garnered worldwide attention because of programs 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- its land is highly susceptible to flooding, and landslides. Its geological location between the Eurasian plates makes it highly prone to earthquakes. In such a 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 literally means 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 that is exposed to various natural and manmade hazards like flooding, earthquake, and fire. With strong agricultural and industrial base and growth as an annex to Biratnagar- the capital of Koshi province, Duhabi can grow resiliently 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 the Municipality of Duhabi. 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 action plans 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 situation, and climate change implications, disaster scenario, conditions of urban infrastructure and services, and status of urban governance, budgeting, and investments in the municipality. A total of 4 major components, 12 sub-components, and 78 indicators have been used to pave the road towards resilience of Duhabi. 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 Investments

The data and information collected using the indicators were systematically compiled and analyzed to explain the situation of the municipality with respect to the status of resilience. Stakeholders' engagement included interactions with personnels from different tiers of government at various departments and sections of various agencies and offices. In order to strengthen the knowledge about resilience building and enhance capacities for implementation of the roadmap, relevant municipal staff and other stakeholders were engaged in data collection and formulation of the roadmap. Training sessions on educating the municipal staff as well as other relevant stakeholders about the concept of resilience, its objectives and usefulness of the roadmap to address various risks and issues of the municipality were carried out to ensure that the relevant stakeholders actively participate in the roadmap preparation. Implementation strategy has also been developed to guide the relevant institutions and stakeholders to effectively implement the roadmap for a resilient Duhabi.

This resilient strategy is aimed to holistically address the key disaster and climate risk issues and challenges of the municipality and 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, and partners to achieve the milestones and a tentative budget. The action plans proposed in this document are contextual and achievable.

The roadmap 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 building code compliance, increased climate change risks and flooding, expanding responsibilities of the Forest, Environment, and Disaster Risk Reduction (DRR) sector, underutilized partnerships, and slow integration of disaster considerations into local development efforts are among the challenges. To address environmental, climate, and disaster 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, expanded Disaster Fund, multi-sector collaboration, and integrated risk reduction into development planning.

Noncompliance 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, dwindling 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, green integration, water management, maintenance protocols, community participation, and private sector collaborations.

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

The Duhabi Municipality's Urban Resilience Roadmap is a significant step towards a more sustainable urban future, developed via thoughtful planning and stakeholders' engagements. It addresses urbanization, environmental, and climate issues while emphasizing inclusive socioeconomic 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 and partners such as the provincial government and NGOs. It's implementation requires approval in the municipal council, the formation of multi-sectoral groups, and integration into routine functions. A successful implementation plan based on diverse financing sources is critical for encouraging sustainable and resilient urban development in Duhabi.

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1. INTRODUCTION

1.1. Introduction

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, an act to guide the provision of aid for people affected by natural disasters was enacted in 1982 named “National Disaster Relief Act”[2]. 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, a 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) headed by the prime minister. 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 risk are also prioritized.

The concept of ‘resilience’ has several definitions. The Rockefeller Foundation (2015) 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 when conditions require it. The Resilient Cities (2019) defines characteristics of a resilient city as reflective, resourceful, inclusive, integrated, robust,

[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 Kathmandu Valley Districts - 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 Wok, 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.

flexible, and redundancy. The World Bank Tools for Building Urban Resilience highlights the following key points for building urban resilience.

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

1.2. Rationale

The topography of Nepal[3], which ranges from high mountains to hills and plains (terai), poses a special difficulty for a building of resilient cities. Natural disasters such as landslides, flash floods, riverine floods, and earthquakes are different for each 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 should establish a culture of resilience in Nepalese cities.

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 socioeconomic 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

[3] 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.

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 IUDP, 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 creation of the Urban Resilience Roadmap will inspire additional initiatives in urban disaster risk reduction and foster the interest and practical expertise of relevant partners engaged in this work both in Nepal and overseas. The roadmap highlights the work and outlines useful insights from the field, serving as an excellent resource for professionals and practitioners in disaster risk reduction. While making our urban centers sustainable and resilient, the findings will also assist our national and foreign partners in accelerating and diversifying their interventions in urban disaster risk reduction.

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 stakeholders from diverse backgrounds matching the major themes of the study.

The initial phase involved review of literature and conceptualization of the framework. While the review of relevant literature and documents continued, 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 a draft report of urban resilience roadmap.

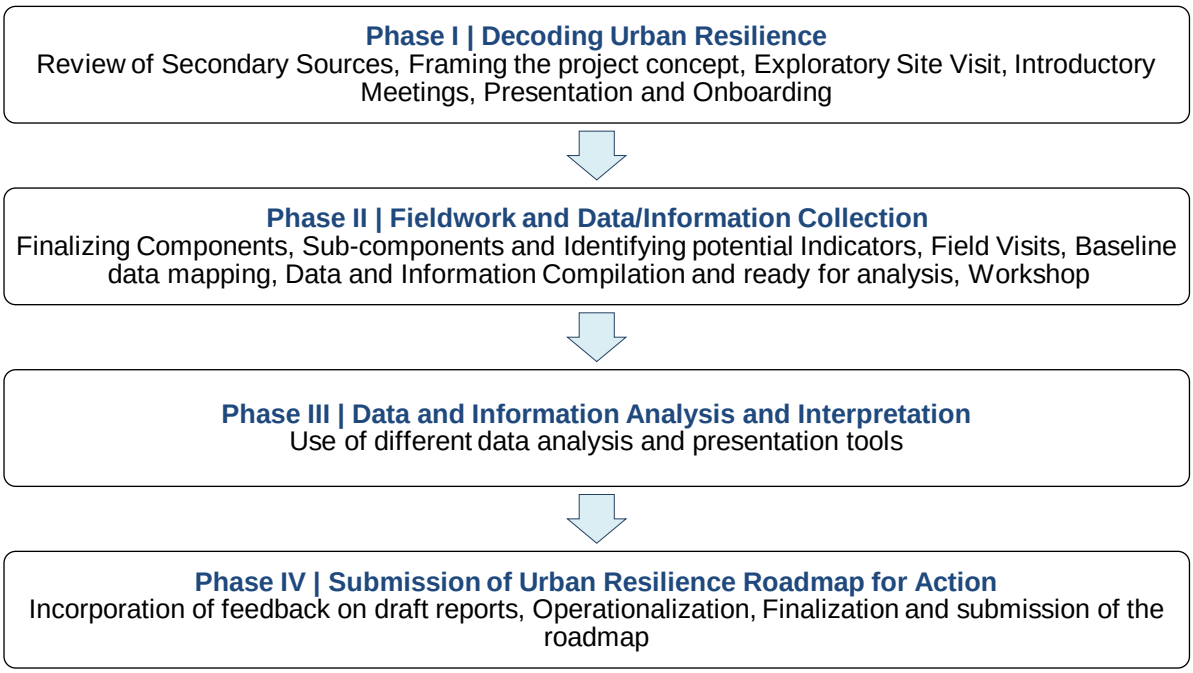

Figure 1-1 Overall process of urban resilience roadmap preparation

2. DUHABI PROFILE AND ANALYSIS

Duhabi Municipality located in Sunsari district, Koshi Province has total population of 67,051 (2021 census) and annual urban growth rate of 1.78% and geographic area of 76.64 square km. Duhabi was designated as municipality during the state restructuring after combining the surrounding VDCs ie Baluwa, Purva Kushaha, Sonapur, Duhabi, Simariya and Tanamuna. Strategically located along Sunsari-Morang industrial corridor and at the intersection of Biratnagar-Dharan and Biratnagar-Inaruwa sections of Koshi Highway, Duhabi Municipality has high economic potential with rise in settlement growth and industrial activities. Its strategic location in between the two major cities Biratnagar and Itahari along with the connectivity to the national highway and Indian border has created immense opportunities for development of housing, trade, and industry.

However, inadequate access to 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 increased flooding events due to encroachment and growing climate change impacts.

Besides the Budhi Ganga on the eastern side of the municipality, other rivers include Tengra, Manushna and other local streams. During the monsoon the river originating from foothills/chure become wild with huge quantity of water discharge resulting in outflanking of rivers causing flood to the entire city. The eastern corridor study of MOUD (details explained below) has outlined the need for regional efforts in flood management of the Budhiganga as it affects numerous municipalities and VDCs in the sub region including Itahair 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 stress 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

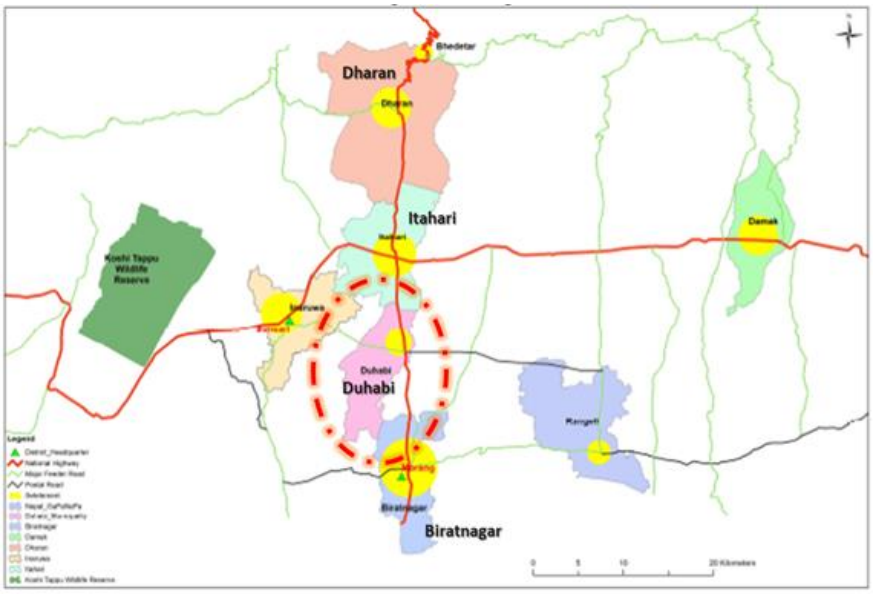

Figure 2-1 Strategic Location of Duhabi Municipality

with Koshi Highway, that provides access to Inurwa in the west and Damak in the east. Major feeder roads allow access of Duhabi to other centers of growth like Rangeli.

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.

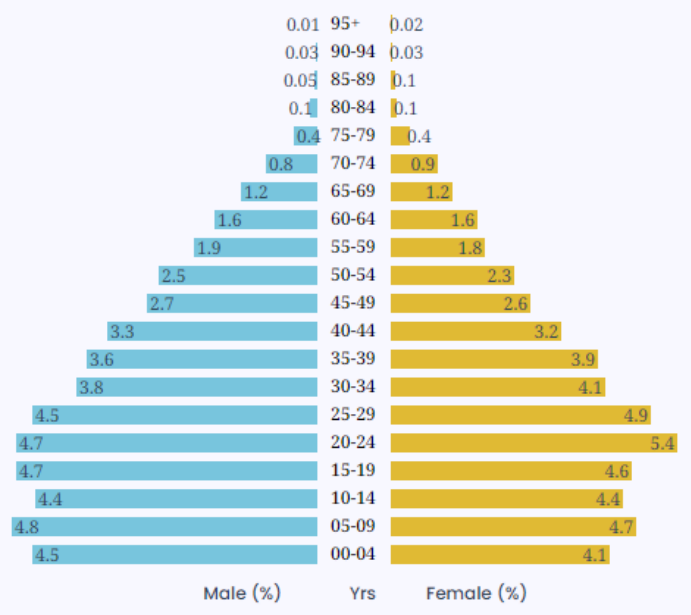

Figure 2-2 Population by 5-year age group and sex (National Population and Housing Census, 2021)

According to the census report of 2021[4], 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.

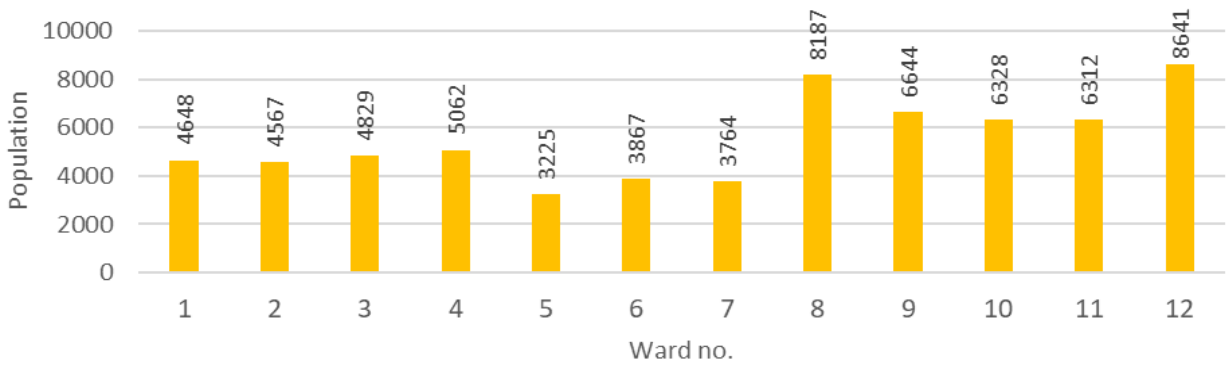

Figure 2-3 Ward-Wise Population Distribution (National Population and Housing Census, 2021)

2.2. Socio-Economic Characteristic

Duhabi is home to many ethnic groups following many religions. The majority of the population are from Tharu, Musalman and Musahar[5] ethnicity. Hinduism is the major religion, followed by Islam.

[4] National Population and Housing Census 2021 published by the National Statistics Office (NSO)
[5] Tharu, Musalman, and Musahar are considered to be marginalized communities in the country.

Table 2-1 Population in numbers - ethnic groups of Duhabi Municipality (NSO, 2021)

ETHNIC GROUP	POPULATION
Tharu	14702
Musalman	12709
Musahar	6317
Uraunwa/Kudukh	4288
Brahman - Hill	2810
Chhetree	2607
Other Minorities[6]	90

Due to 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[7].

Since Duhabi is an industrial city, many of the rural workers are employed in industries. Unfortunately, the daily life of the marginalized class (tribal/tribal/dalit) is based on subsistence farming system and daily wages in factories. The municipality has 65.6% economically active population (NSO, 2021). About 45% of the population aged 10 and above are involved in agriculture, 13.9% in manufacturing, 7.5% in construction and 16.1% in wholesale and retail trade, repair of vehicles.

2.3. Urbanism, Urban Growth, and Urban Development

A total of two Integrated Urban Development Plans (IUDP)[8] have been prepared for Duhabi till the year 2023. Many projects recommended by IUDP 2018 of the municipality have been implemented. The management of the market area, facility for wastewater management, and management of open spaces are some of the prominent examples of the projects that have been implemented with priority. Duhabi Municipality can be taken as an example of success stories of IUDP in Nepal. The IUDPs of Duhabi Municipality have suggested several activities that have potential to strengthen resilience of

> The IUDP of 2020 identifies 9.57% of total land area as built up, 1.07% covered by roads, 6.99% covered by tree cluster and 4.40% covered by water bodies. Cultivation covered a maximum land area of 52.75 sq km which was 77.8% of the total land area in 2020. Other land use identified were barren land, bushes, grassland, and open spaces. The IUDP of 2018 identified 89.08% of total land as agricultural, only 0.02% as forest, 1.69% as roads, 2.22% land area as industrial, 3.47% as residential and 0.66% as commercial. Water bodies cover 1.64% as per the IUDP of 2018. While there are differences in the land use percentages provided by the IUDPs, it is clear that a majority of land is agricultural and there is a high potential for agricultural development.

[6] The minority population belongs to people of Sunuwar, Loharung, Satar/Santhal, Khawas, Bahing, Kumhar, and Sampang ethnicity
[7] Page 30, IDUP of Duhabi Municipality, 2020.
[8] The first IUDP was prepared in 2018 by the National Institute of Urban and Regional Studies with the technical and financial support of The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The second IUDP was prepared in 2020 under the Ministry of Urban Development by CEMECA- BEAM-RIDEC JV.

both local communities and Duhabi Municipality at large. The plans adopt a comprehensive strategy by taking into account urban resilience in its physical, social, economic, environmental, and institutional dimensions. Likewise, the plans encourage 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 guarantees 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 main Koshi highway transects the city while major commercial and trading activities also occur along this route. The Budhi River restricts large scale development in the east. The highest density of housing can be seen in wards 5 and 6 which consist of the entry area to Duhabi from the commercial hub of Biratnagar side. There is no definite urban road network pattern, most of the city is developing organically, 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[9].

Mega City Region[10] in context of Nepal has been defined as a polycentric urban agglomeration with population more than 1 M with population density of 20 ppha 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. The report identifies Duhabi as a residential and recreational zone along with the Industrial Hub. The report proposes various plans and programs that can be viewed from the perspective of urban resilience. River training and river front development, development of industrial village and development of Haat Bazaar are some important plans and programs that help to build flood disaster as well as socio-economic resilience of Duhabi. The report also contains data and analysis of the urban infrastructures present in the Mega city region which includes Duhabi.

Similarly, the Eastern Urbanizing Corridor Plan 2019[11] 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 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 headings. 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.

[9] Land use map of the Municipality is present in the annex.

[10] 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

[11] 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”.

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. 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 it into perennial nature. These river systems are highly polluted and cause disasters during monsoon due to 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 and are losing their relevance and are being encroached in todays' context. Further new trend is emerging for developing a fishpond in private lands.

Figure 2-4 Budi River

Figure 2-5 Solid Waste Management facility at Duhabi Municipality

The municipality, with the help of development partners, has set up a solid waste management facility that helps to recycle inorganic waste. The facilities 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 this municipal area. Especially during the rainy season, this disaster is causing land erosion and loss of people's wealth. Apart from this, it also damages the local livelihood, livestock and industrial production.

According to the DRR portal[12] 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[13] of the government mentions a total of 8 incidents between 2013 and 2023 of which all are recorded as fire incidents with 3 fires in ward 10 alone. An estimated loss of 23 million NPR has been incurred. With the changing climate and shift in weather patterns, losses due to intense rainfall and untimely rainfall on agriculture has been noted.

[12] http://drrportal.gov.np/

[13] https://bipadportal.gov.np/damage-and-loss/

2.5. Governance and Budgeting

One of the main hurdles in governance of disaster risk management with respect to Duhabi can be seen in lack of coordination between the provincial and the local government. The coordination of with other relevant stakeholders including industries and neighboring municipalities is also weak. Disaster related information is not being shared and discussed adequately between the two tiers of government and also other partners and stakeholders of this field. Another area of concern within the governance involves the influence of social and political pressures exerted by diverse stakeholders upon government officials managing water and irrigation services. This influence has been shown to lead to the development of unresolved vulnerabilities, de-prioritization of risks, and potential realignment of focus.

Separate Disaster Funds are present, both in the municipality and the Koshi province[14]. Whenever any household is affected by disaster and reconstruction is required, there used to be provision of technical assistance from the government[15]. In order to carry out the reconstruction work, 50-60% of the financial contribution is provided from the federal government, 30% from the provincial and 10-15% from the local government. The total budget allocated by Duhabi municipality for environment and disaster risk reduction in the year 2078 was 1cr 28 lacs. 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. There are no specific procedures to deal with climate change related disasters. Early warning systems have not been developed. The linkage between industries and disaster has not been studied while municipality engages with industries from this perspective is also weak.

3. CONCEPTUAL FRAMEWORK

3.1. Conceptual Framework and Operational Structure

The urban resilience of Duhabi municipality has been decoded[16] 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 exhaustive brainstorming sessions with experts, city officials, and stakeholders at the local level.

Diverse and inclusive socio-economic opportunities, effective institutions supporting investments, and environment, climate change and disaster responsive infrastructure development are the main conceptual themes identified for the project. These conceptual themes have been translated and operationalized into four major components and twelve sub-components to study, collect data,

[14] 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 8 crore NPR has been allocated for it. For the facility, 1 crore has been designated for DPR, 1 crore for search and rescue equipment, 50 lacs for awareness and around 60 lacs for disaster drills.

[15] National Reconstruction Authority used to provide technical assistance for the reconstruction process. Now DUDBC and NDRRMA offer technical assistance.

[16] 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.

analyze, and recommend actions for building urban resilience of Duhabi. Likewise, around 78 indicators were also identified to help collect data for building roadmap to urban resilience.

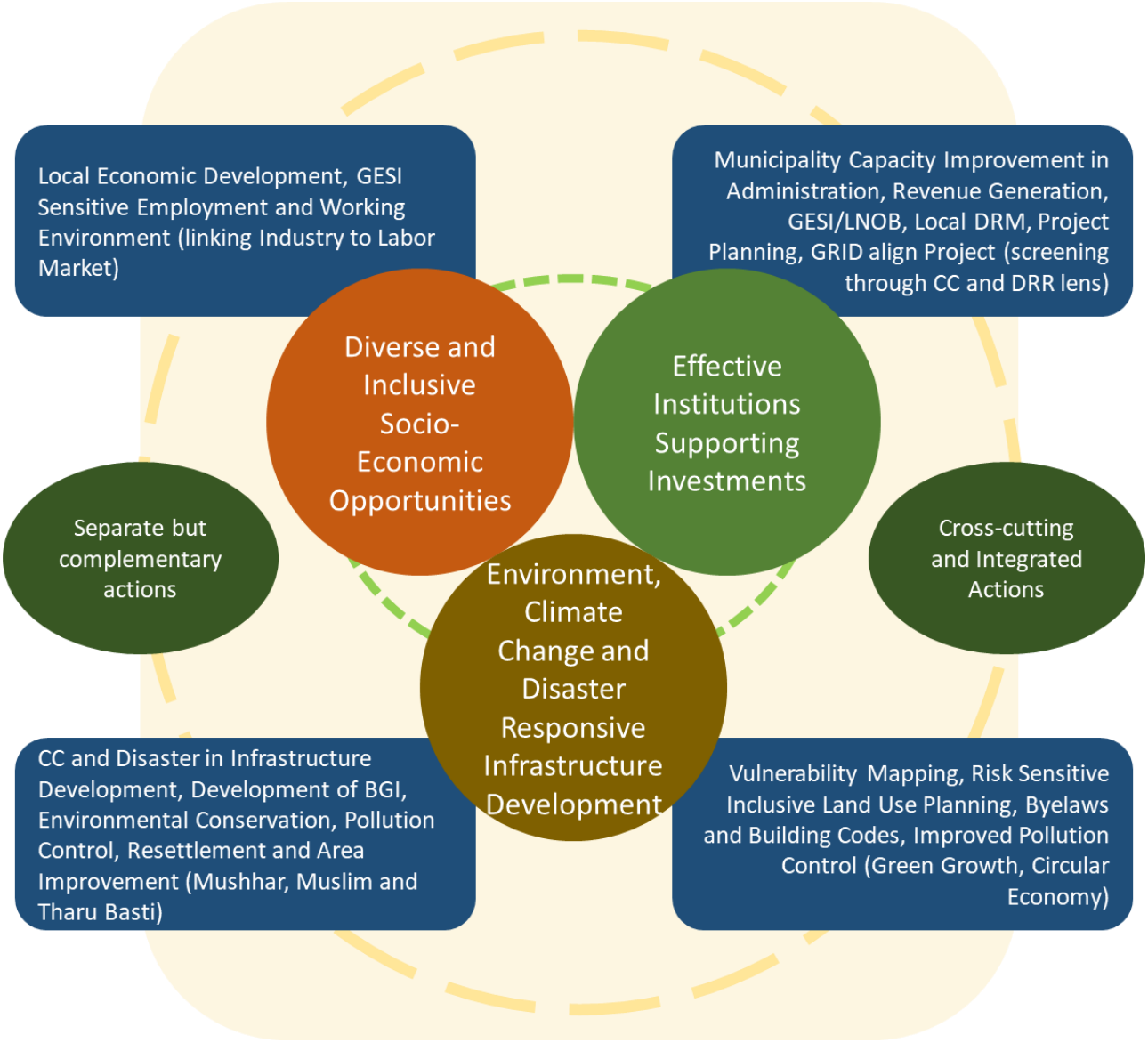

Figure 3-1 Conceptual framework of the study

One of the major operational components of the roadmap is diverse and inclusive economic opportunities. With over 80% land currently used for agriculture, and the placement of Duhabi in the sub-regional industrial corridor, the economy of Duhabi is dominated by 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 IDUPs, 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 been identified as the fourth component of the roadmap.

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 stakeholders' engagements, key informant interviews, focused group discussions, and workshops[17]. 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.

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

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*

Figure 3-2 [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

[17] Details of the key notes and discussions in Key Informant Interviews, Focused Group Discussions, Stakeholders' engagement, and Workshops have been shared in the annex.

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

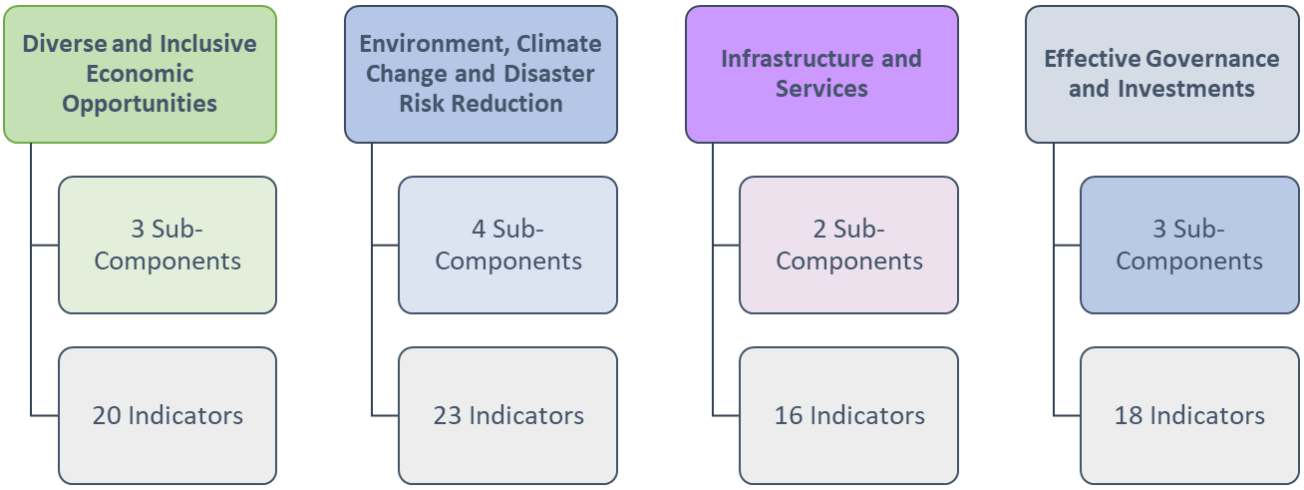

Figure 3-4 Number of indicators under each component

4. DATA ANALYSIS AND INTERPRETATION

4.1. Diverse and Inclusive Socio-Economic Opportunities

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 while agriculture provide employment to about 50 percent followed by service and informal sector 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). Around 20 percent of the economically active populations are employed simultaneously in both industries and agriculture. 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 economic opportunity till recently was not very open and wide. With exceptions, bulk of people employed by the industries are working as daily labors while professional and technical positions are often filled by the Indian citizens. It seems that the local authorities missed the opportunity here. The need of industries should have been better linked with the skill development programme of the local bodies. However, this des not seem to be happening at the required pace because the working relation between the industries and the local municipality is still very weak and ordinary. The 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.

However, some positive changes have been noted recently and the economic opportunities are slowly expanding and deepening. 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 improve seeds, fertilizers and equipment at subsidized rate; research, training and skill development; access to market and cold storage; introduction of new cash crops, decentralization of budget and so on. The 'Agriculture Market Development Project' is a landmark initiative, which is expected to add new feathers to this sector in the short run[18]. 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. In spite agriculture 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

[18] The 'Agriculture Market Development Project' is 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'* as envisioned.

by males. The engagement of women in *'haat bazar'* is more prevalent in *'Tharu'* community having rich culture and are also the aboriginal of this region.

The recent focus of municipality in agriculture has allowed this sector to grow both horizontally and vertically. Addition of crops like maize, wheat (increase in land coverage), 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.

Internal roads need to be broadened and strengthened, for easing the transportation of agriculture produces to the city market or on highway. 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[19]. 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[20]. 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[21]. The Swiss government supported enterprise development programme (Step-up) is instrumental in promoting a culture of entrepreneurship and new enterprises in the agrarian society[22].

[19] 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.

[20] 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.

[21] 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.

[22] 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 partner 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

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 provisioned in any of the above opportunities for people with disabilities. The municipality is building a dedicated program for Musahar populations in Wards 8 to 12, whereby they will be provided skill development training as well as financial assistance to open new enterprises and improve their livelihood prospects. In addition, the 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.

The Duhabi municipality is successful in offering a wide range of economic opportunities, however they are yet little loose, scattered and risk ignorant and hence demand further consolidation and in many cases upscaling at the city level and beyond. Industries, which is the key source of economic employment, must be protected from all kinds of climate and disaster risk prevalent in the region. Entrepreneurs need to be risk literate while their enterprises need to be risk mainstreamed. The Business Continuity Plan (BCP) of the new enterprises must assess and adhere to climate risk 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

Being an industrial city situated along the highway, the environment is a principal concern of local authorities and people of this city. The environmentally vulnerable areas identified by the IUDP 2020 are not getting any special considerations 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. The industries located in Duhabi municipality are not operating from within any industrial zone, while they are spread all over the places including along the highway and surrounded by both high and medium density residential settlements. In many places, industries are causing the development of slums like settlements, which are mainly housed by laborers and their families who are primarily working in those close by industries. This trend may encourage the emergence of similar slum settlements in other areas of the city.

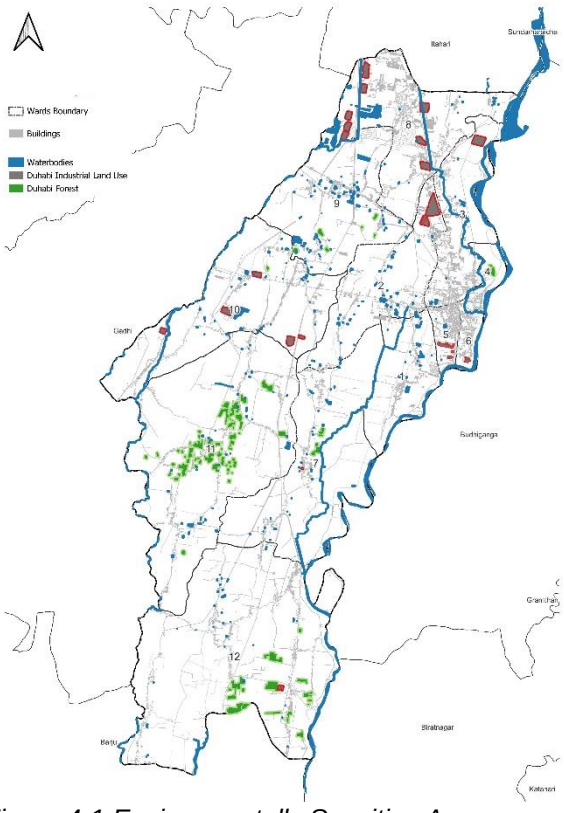

Figure 4-1 Environmentally Sensitive Areas

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 both-sides, in the benefit of the larger society[23]. The environmental concerns caused by the industries are both internal and external to the industries. In the absence of '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 risk, 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 ground.

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), 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. However, this will only materialize if the municipality takes the lead and coordinates the whole process of bringing different parties together and on the same page. 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[24], operational in Dharan-Biratnagar industrial corridor during 2002 to 2011. Both cement and a few other industries are the major source of air pollution, which is hazardous to the health of the local citizens. Even industries which are not within the boundary of the Duhabi municipality, are continuously causing air pollution to the city. In such cases, transboundary (inter-city) partnership and collaboration is indispensable to find solutions acceptable to all. The issue related to occupational health safety (OHS) of industrial labor and other staff is generally managed and settled inside the industries, and municipality rarely receives any complains on that front. All municipal staffs are insured while a special programme is launched by the municipality to insure families of marginalized communities under subsidized rate[25]. 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

[23] 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.

[24] Strengthening Environmental Administration and Management in Nepal (SEAM-N) project was funded by Finish Government and was implement in Biratnagar-Dharan Industrial Corridor area in the year 2002 to 2011. Three municipalities (Biratnagar, Ithari and Dharan) and 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

[25] 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.

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 grossly missing. 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 going down at a rapid pace and it is more prevalent in the market areas of the city. Besides, 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[26].

The Duhabi municipality is highly prone and vulnerable to multiple climate risks and the most disastrous is flooding followed by urban and industrial fire, cold and heat wave, drought and also common health hazards. It is important to understand the overall river system of the municipality starting from where they originate and where they end. 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. Unfortunately, there is no EWS installed in any of the above rivers, to inform local citizens in advance and minimize both human and economic losses in town. This situation here demands inter-municipality and inter-district discussions and negotiations including exchange of information, to better manage the outfalls and find win-to-win solutions for all.

Riverbeds are narrowing due to rampant encroachment and weak compliance of land and infrastructure development norms in the city. Though the hazard maps of the municipality is 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 blocked and are used more as garbage bin) even with the mild rain, around 30 percent of the municipal areas (wards- 2,3,10,11,12) get inundated. Even the construction of new drains is not considering the climate data (provided by DHM) and are still using PDSP design manual[27], which now demands revision and needful integration of climate risk and variables of CC impacts. Similarly, soil erosion as a result of severe flooding has become an urgent threat, which is 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 now asking 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 compels them to discontinue their operation and services, sometimes for an extended period. The frequency and

[26] 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.

[27] PDSP is a design manual used frequently for irrigation projects in Nepal. This was developed way back in 1990 and hence it does not capture climate change concerns and need of change in design specifications accordingly.

severity of flooding has significantly increased in recent time due to high intensity and extended rain and other impacts of climate change. Besides flooding, the Duhabi municipality is also facing droughts, which is directly impacting the agriculture yields, in spite 80 percent of the agriculture land is accessed to irrigation facility, they do not receive water since the available irrigation system demands urgent repairs and maintenance. The drought is also affecting the water table, which is continuously going down in recent time.

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.....

Both industrial and urban fires are on the rise, and it is happening in almost all months of the year. This is mainly because of electric short-circuit due to use of poor cable and low-quality wiring and high fluctuation in electricity supplied by the NEA. Like in other towns, the practice of using fire alarming system and fire extinguishers at the individual property level is very rare 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 is also not fully equipped and nor does it have suitable training and exposures required to better manage the fire incidents. It is often very taxing for a small municipality like Duhabi to maintain the full-fledged team of fire brigade on its own. Once again it is advisable to partner with other nearby municipalities and operate such a facility on a cost sharing basis.

The Duhabi municipality has made some targeted progress to deliver improved climate and disaster risk reduction and management support in town. 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 exist, while LDCRP is also developed with the support of external consultant, which is unfortunately not found in action[28]. The municipality has also constituted DRRM fund, however the total amount allocated to this fund is minimal (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 is very important in view of coordinating with local agents and sharing alert

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 itself are not strong and may not provide all essential facilities to cater the increased no of families housed during the emergency.....A project proposal of NRs 40 million to develop *'emergency shelters'* is submitted to MOFAGA while the decision is yet awaited. 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.....

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.....

[28] Although LDCRP 2022 is a revised version, however, it does not look like that it is prepared following a consultative and participatory approach. Many people are unaware of this report while the consultant was also unable get hold of this report.

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[29]. As reported by DEOC, their linkage with LEOC including other municipalities is very weak and ordinary. The municipality yet to have a stockpiling facility for emergency response[30].

> The DEOC is a unified communication hub led by the APF, who 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, however in practice, this is not the case. The DEOC is found operating under several constraints and limitations. 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 is not in favor of local government towards building more proactive relationship and holding industries accountable to their wrong deeds (poor management of industrial waste). In the present context, the partnership between the Duhabi 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. On the other hand, the municipality does 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.

The present efforts of Duhabi municipality in areas of environment, DRR and CCA need to be further consolidated, harmonized, and strengthened. The loss and damage of properties and infrastructures in recent disasters is too huge to ignore. It is therefore important to prioritize building of resilient infrastructure which can better withstand the disaster impact and cause minimal loss to individuals and national economy. To achieve this, mainstreaming disaster and climate risk into development is indispensable. This will ensure that the overall development of Duhabi municipality is risk informed, sustainable and resilient. Now that sectoral responsibilities are transferred to the municipalities, integration of disaster risk into sectoral development initiatives can be comparatively easier than before. 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. Some positive symptoms are already visible with the increased budget and targeted activities in some sectors like agriculture, health, education, and others. The efforts, however, need to be institutionalized and backed up with appropriate systems and authorities in place.

[29] 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 even utilizing local FM stations and social media for communicating with local communities during emergency response.

[30] 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.

4.3. Infrastructure and Services

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 the planned development. The enforcement of the National Building Code is crucial in creating resilient societies 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 moderate success to create robust infrastructure and dependable services for the municipality's well-being and long-term development. The enforcement of the National Building Code plays a crucial role in ensuring the safety, structural integrity, and resilience of societies in the face of natural disasters and urbanization. With limited technical capacity in both private sector and the local government, the municipality is struggling to ensure code compliance despite its herculean efforts. The municipality is moving ahead to adopt eBPS, recognizing the need for efficiency and digitization of the building permit process[31].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 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. The municipality can ensure the safety, resilience, and sustainability of its built environment by encouraging compliance with laws and promoting a culture of responsible construction.

The fire brigade and competent human resources within the Duhabi municipality stand as stalwart sentinels, exhibiting their preparedness to combat potential fire outbreaks[32]. Nevertheless, the water supply infrastructure's inadequacies and the prevailing issues of accessibility within the compact settlements, particularly in the fringe wards and marginalized enclaves, cast a shadow of compromise upon their abilities. The exigencies of rapid response, coupled with the magnitude of potential fire outbreaks, necessitate a harmonized and coordinated approach among neighboring municipalities, bolstered by the identification and fortification of vital water infrastructure for emergency contingencies. The vulnerability of these communities is further exacerbated by the prevalent use of combustible construction materials such as bamboo, wood, and thatched roofs. Considering these circumstances, a concerted effort to reinforce the resilience of the vulnerable communities becomes a paramount imperative

[31] 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.

[32] Municipality has recently bought a fire brigade and provided trainings to its staff and are ready to move all the time, they are connected to DDRMC

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, preventing communities from the adverse effects. Network of ponds are prevalent in the municipality under use for social function, winter irrigation and fisheries. The community ponds are in dilapidated condition as people could not foresee their use in modern lifestyle. These ponds, the crucial infrastructure to combat scorching heat during summer, need conservation and redefine its use in modern times. During heat waves specially for school going children and senior citizens, the city lacks any information system, cooling centers[33], water ATM 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 lead by Budhi Khola, Keshaliya, Tengrakhola and few other local drains. The city core has limited drainage facilities without outfall structure. The Municipality is vulnerable to flood and therefore needs an integrated water management system in collaboration with municipalities in the North – South corridor. The implications of climate change need to be considered in the design of urban drainage systems[34].

Duhabi has fairly developed road network linking rural wards and urban core with 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. The city deprived of public transport, take refuge to private motor bike, e rickshaw and cycle. The city size, landform and the distance between work-home-market makes it perfect for developing it as cycle city if cool dedicated cycle lanes are designed and constructed. 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 Corona 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.

[33] 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

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

Housing is emerging as a vital infrastructure specially for marginalized community, The population of Duhabi is dominated by marginalized communities like Mushhar, 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.The increasing population in core area demand service land parcel for commercial and residential uses. The project and programs designed and implemented in silos may not reduce the risk that the city citizen specially marginalized communities are exposed to. While there have been some initiatives from the municipality to support such 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 noble 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 Mushhar and Muslims living in the city core along the riverbanks. 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 Municiaplity has prepared a budget of 837.76 M for 2080/81which is marginally less that than 896.3M for 2079/80. However, the internal revenue has increased from 210.8M to248.4M in 2080/81. The trend shows that internal revenue has been increasing. The major contributor in the budget is the grant (tied/untied) and supports (fiscal equalization grant, revenue distribution, 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 while only 36 percent to the capital expenditure. The municipality has exhibited remarkable spending capacity with about 90 percent of the capital expenditure 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. Property tax, business tax and contribution from Industries are meager and need rethinking in taxing. The businesses in the municipality are informal in nature and are out of tax gambit. The tax regime needs to be reviewed and properly strategized.. The municipality receives about 275M, 33.2% of total budget as conditional grant from federal government, mainly used in social security and other recurrent expenditures (30.2%). Only 302M is spent as capital investment which is not even sufficient to create 5 km of good quality road. However, through community mobilization , the municipality has been creating necessary infrastructure in the core as well as fringe wards. The municipality has been allocating about 2M in disaster fund and GESI budget each. However, during the flood the expenditure goes to 100-150M depending upon the severity of the situation. 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 170M 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.

4.4.2. Institutions and Management

The municipality has well developed organization structure with 7 well defined divisions and subdivisions. Well-articulated TOR for each division. 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 can be a plus point in case of main power failure during disasters. The meeting time and reminders and information are shared to municipality officers via SMS notifications.

The LISA[35] 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. The resilience of Duhabi is tied with the development of Mushahar, Muslim, Uraw and other Dalit community and their access to services and participation in decision making. Municipality has initiated some programs like skill development, housing for Mushhar community, scholarship to girl students and students from marginalized.

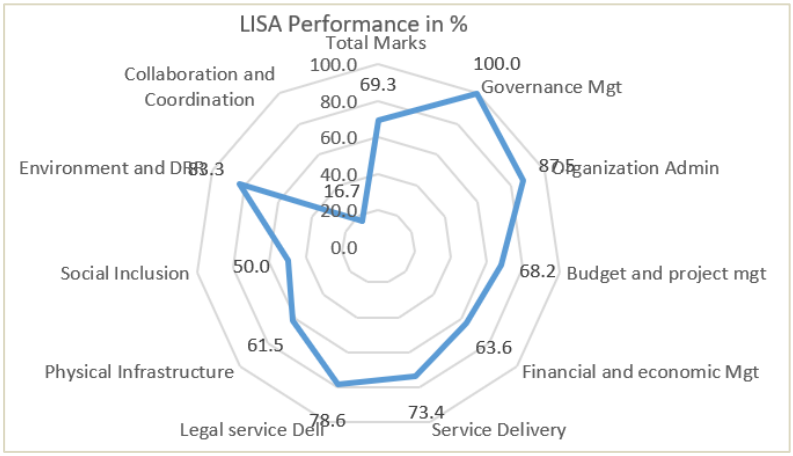

Figure 4-2 Lisa Performance of Duhabi Municipality

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 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 to participate in general meetings and community discussions. Efforts to bring the industrialists and FNCCI on board for partnership and cocreating opportunities for deprived communities are under discussion and have very limited impacts. The municipality, provincial government, and local NGO 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. The partnership further working with local cooperatives and saving – credit groups for promoting entrepreneurship and business environment for marginalized communities. The mayor's housing

[35] Local Government Institutional Capacity Self-Assessment (LISA) is carried out annually too assess capacity of LGs in different aspects

scheme for Mushahar communities is another example of partnership in the municipality. By fostering a culture of cooperation and openness, Duhabi can achieve the SDG goals.

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 for any notice and information regarding the disasters. The office Facebook account of the municipality has 5000 friends (+1750 followers) and the official Facebook page has over 3000 reach. The municipality has been using this social network to connect with people and provide useful information. This helps to strengthen e-governance and transparency. Despite herculean efforts of one man IT department, not all the information, study reports, meeting minutes are updated in time

5. 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 a city'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 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 share a vision of city for all, referring to the equal use and enjoyment of cities and human settlements, seeking to promote inclusivity and ensure that all inhabitants, of present and future generations, without discrimination of any kind, are able to inhabit and produce just, safe, healthy, accessible, affordable, resilient, and sustainable cities and human settlements, to foster prosperity and quality of life for all[36].

The overarching goal of the Resilience Road Map is to Make Duhabi inclusive, safe, thriving, and smart with adequate descent jobs, housing, infrastructure and services to its citizens leaving no one behind[37].

The prominent strategies for making Duhabi a resilient city involve a combination of proactive planning, infrastructure improvements, 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 NDC 2, This may include flood defenses, green roofs, permeable pavements, e-vehicle, 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.

[36] Adopted from Habitat III.
[37] Outcome of the discussion during workshop, FGDs and discussion with municipal authorities

4. Infrastructure Resilience: Identification of critical infrastructure to withstand shocks and stresses. Strengthen 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 take ownership of their neighborhoods and contribute to 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. 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 enforce building codes, land-use regulations, building bye laws, planning norms and standards, universal design codes.
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

- Industries based economic opportunities are not diversified enough to make them inclusive.
- Present trend of subsistence agriculture is not significantly contributing to improvement in the living standard of the local populations.
- Growing climate change impact has not been appropriately integrated in the prevalent agriculture practices.
- Untargeted employment and skill development opportunities do not promote entrepreneurs and enterprise creation.
- Absence of targeted opportunities is a major deterrent to economic freedom of women and marginalized communities.

B. Thematic Strategies

1. Strengthen municipality working relation with industries to better protect the economic interests of its populations.
2. Provide skill development training that is consistent with the requirements of human resources by industries.
3. Educate and support local farmers to practice climate smart marketable agriculture.

4. Consolidate and organize skill development and enterprise creation efforts aiming to expand and diversify the local economy base.
5. 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, available to all **strata of populations** in Duhabi municipality, by building on its wide-ranging efforts and expanding its economic base to allow them to have increased and sustained income.

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

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline (Term)	Partners and Stakeholders	Budget (M)/Source
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 meet on regular interval.	Coordination Platform, Training Course, OJT	short to medium	Industries, Training and Academic institutes (TAC),	7
		Ensure municipal skill development efforts correspond to the human resource needs of the industries.				
		Provide targeted skill development training to marginalized communities to improve their access to employment in industries				
2	Living standard of the local communities improved with the promotion of marketable agriculture	Encourage and facilitate local farmers to practice community farming (CF) by forming community groups	Training, Knowledge Building (KB), CF Guidelines,	short to medium	Cooperatives, Agriculture Research Center (ATC), MDC, Agri-Business Group (ABG)	10
		Provide necessary tools, technology, credit and information to promote community farming leading to marketable agriculture.				
		Ensure better income by supporting the marketing of improved production at increased price.				
3	Improved knowledge of local farmers on climate change impact in agriculture sector	Study climate change impact on agriculture and disseminate the findings and suggestion to farmers and other stakeholders.	Study and Research, Training, KB, CCA tools,	medium to long-term	CC Expert, NARC, TAC, ATC, ABG, Banks, Cooperatives	15
		Provide farmers 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.				
4	Employment and skill development opportunities are integrated and harmonized	Bring Skill Development Training School (SDTS) into operation and promote one-door system to SDT activities.	Training Course, OJT, Exchange Programme, Policy	short to medium	TAC, Industries	40
		Focus SDTS activities towards creation of new entrepreneurs and new enterprises				
		Ensure SDT opportunities include OJT option and also offer exchange program with other training institutions.				

		Provide subsidy and/or reservation to marginalized communities to better access SDT opportunities				
5	Women and marginalized communities' skills and income improved	Conduct socio-economic study of the poor and marginalized communities with regard to their skills, employment and income opportunities.	KB, Training	short to medium	Research Institutions, MDC, Cooperatives	30
		Implement targeted activities to expand access of women and marginalized groups to wider employment market resulting in improved income and financial autonomy.				

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

5.2.2.Environment, Climate Change and Disaster Risk Reduction

A. Key Issues

- Industrial Waste and Environmental Pollution
- Limited compliance of NBC and Building by-laws
- Growing Risk of Climate Change and Frequent Flooding
- Mounting role and scope of Forest, Environment and DRR Section and Disaster Fund
- Under-practiced Partnership and Collaborative Approach
- Slow pace of Mainstreaming Disaster and Climate Change Concerns into Local Development

B. Thematic Strategies

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

C. Objectives and Action Plans

To promote participatory and collaborative approach to city based environmental protection and disaster risk reduction leading to **integration of climate and disaster risk into sectoral development**, ultimately roping to risk mainstreamed 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 (M)/Source
1	Improved management of Industrial waste and environmental challenges	Make policy decision towards making industries responsible and accountable for industrial waste and different form of pollution (air, water, noise) caused by those wastes.	Policy, Strategy, Coordination, Sharing, Monitoring System, Insurance Scheme, Subsidy	Short - Medium term	Industries, Department of Industries, Department of Health	10
		Coordinate with industries and facilitate the establishment of common waste treatment plants shared by multiple industries.				
		Develop and implement Joint Monitoring System/Strategy and implement effectively in active participation of industries and other key stakeholders.				
		Promote health insurance of local communities (living around industries) on subsidized rate in partnership of industries.				
2	Building and infrastructures are more compliant to NBC and BBLs	Strengthen Infrastructure Development and Environment Management Section/Engineering Section by providing necessary tools and training supported by authority and incentives to improve NBC and BBL compliance.	Training, Compliance, Monitoring System, Automation and GIS	Short - Medium term	Consulting firm, Department of Building Const.	10
		Establish an effective Compliance Monitoring System (CMS) supported by a dedicated and skilled team of technical staff.				
		Automate building and infrastructure related information (both old and new construction) using GIS and other relevant tools.				
3	Improved flood management by better adapting to climate change impact	Study the changing river system in view of growing urbanization and CC impact and provide suitable solutions to prevent flooding in town.	Study and KB, Preparedness Measures, D/L, Relocation Guideline	Short - Medium - Long term	Consulting firm, Insurance Company	15 (excluding cost of structural measure construction)
		Implement Priority Preparedness Measures (EWS, Evacuation Centers, Relocation Guideline, Strong house, Warehouse for stockpiling, Clean Drain, Forest Park, Risk Insurance and others...) that are instrumental in minimizing Damage and Loss caused by the regular flooding.				
		Develop Relocation guideline and relocate settlements existing along the rivers to any safer location as they are always at risk of flooding during monsoon season.				

		Design and construct structural measures for controlling flood in city area				
		Design and develop soft structure for flood control and management in suburb and peri urban area				
4	Forest, Environment and DRR Section strengthened while Disaster Fund increased	Strengthen Forest, Environment and DRR Section with able leadership, trained staff and more robust scope of work with focus on Risk Assessment, Preparedness and Mitigation.	Training, Scoping, Assessment, Preparedness, Fund, Local Plans, Participation, Consultation	Short - Medium term	DRR Expert, DPs, Academic Institutions	8
		Increase the size of the Disaster Fund and also make the scope of the Fund more comprehensive and robust.				
		Develop local level disaster plans (DPRP, LDCRP, Contingency Plan, Flood Response Plan) and implement following participatory and consultative method.				
		Practice WSA, WGA, LNOB, BBB, Resilience Building, Nothing About Us-Without Us while implementing DRRM activities.				
5	Partnership and collaboration aided improved disaster risk governance	Map-out all key partners and stakeholders of DRRM and CCA	Mapping, partnership, Collaboration, Cooperatives, MDC	Short - Medium term	DRR Partners and Stakeholders	3
		Develop partnership and collaboration with relevant stakeholders to improve disaster risk governance				
		Mobilize and engage local communities, cooperatives and market committees while implementing field level DRRM plan				
6.	Progress in Disaster Mainstreamed Local Development	Take policy/principal decision and make it compulsory to integrate disaster risk into local development.	Policy, Principal, Integration, Assessment, Mitigation	Short - Medium term		2
		Integrate DRR issues through municipal sectoral departments responsible for sectoral development.				
		Make Risk Assessment and Risk Mitigation as mandatory requirement of any development project beyond NRs 1 million				

EWS- Early Warning System, DPRP- Disaster Preparedness and Response Plan, LDCRP- Local Disaster and Climate Response Plan, WSA- Whole of a Society Approach, WGA- Whole of a Government Approach, LNOB- Leave No One Behind, BBB- Build Back Better

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

5.2.3.Infrastructure and Services

A. Key Issues

- Poor NBC and bye laws Compliance Building Construction
- Unplanned urbanization and extension of infrastructure
- Inadequate and Uneven distribution of Urban Open space
- Inadequate drainage system and encroachment on natural drainage system
- Poor Housing quality for marginalized community
- Muslims and Mushhar are living on marginalized land in the flood plains.
- Inadequate and poor accessibility in fringe wards for firefighting and ambulance movement
- Ineffective Segregation of waste at HH level, its safe transportation and disposal, 5R principle (Reuse, Reduce, Recycle, Refuge and Repurpose) not in practice in Solid Waste Management
- Depleting ponds and wetlands, Insufficient Clean Drinking Water

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 enhance resilience, mitigate floods, improve air quality etc,
5. Integrated Water Management: Develop resilient water supply and drainage systems to handle increased rainfall and drought conditions. Implement rainwater harvesting, stormwater management, and flood control measures to 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. Timely repairs and upgrades of drains and canals, fire brigade, electric systems.
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: Collaborate with the private sector to create new infrastructure and service resilience. Public-private partnerships can bring expertise, resources, and innovative solutions to the table.

C. Objective and Action Plans

To develop and enhance the Infrastructure and Service sector of our city, with a focus on fostering resilience and sustainability, to create a vibrant and adaptive urban environment that **meets the needs of present and future generations**.

Table 5-3 Action Plans for Infrastructure and Services

SN	Milestone	Interventions/Activities	Tools and Instruments	Timeline (Term)	Partners and Stakeholders	Budget (M)/Source
1	Critical Infrastructure are identified and strengthened	Mapping, vulnerability assessment and retrofitting of critical infrastructure (Hospital, School, Community Buildings	Mapping, Analysis, Plan,	Short Term	PG/FG/Dev Partner	3 (except construction cost)
		Development of DRR and Emergency Plan for hospital and orientation training to doctors and staff.	Assessment, DRR Plan, Orientation Training (OT)	Short Term	Mun, Dev Partner	1
		Development of emergency route plan for evacuation and safe travel to hospitals and evacuation centres (Development of Signage and installation)	Mapping, Signage Design, Installation	Short/Medium	Mun, Dev Partner	0.5
2	DRR and Climate Change Responsive Building bylaws in place and NBC enforced	Develop Climate Change and DRR responsive building bye laws for Duhabi	Consultation meeting, review	Short Term	Mun	1
		Develop guidelines for promoting green building technology in housing and other construction.	Review, Consultation, inventory of technology, Trainings to technical staff	Short/Medium term	Mun/Dev partners	2
		Create awareness and establish counselling center for NBC enforcement and adopt universal design for public buildings.	Counselling Model,	Short Term	Mun	2
3	Asset Management Data Base Created and Maintenance plan developed and implemented	Development of Asset inventory of the Municipality	Mapping, measurement, and assessment	Medium Term	Mun/ PG/ FG/ DP	3
		Development of Asset Management Plan of the local government	Orientation training, Data base creation, generation of O&M plan	Medium Term	Mun/DP	2
4	Protective Infrastructure planned and implemented	Preparation of Flood and Drainage Management Plan focusing on nature-based solution	Survey, mapping, assessment, planning	Medium/Long term	Mun/PG/FG/DP	2
5	Vulnerable communities/	Vulnerability assessment of communities exposed to disasters like flood.	Criteria, identify communities, assessment	Short term	Mun/FG/DP	3

	Settlements are strengthened or relocated	Development of Relocation Plan for communities located in hazard prone area and its implementation.	Identification of land, consultations, design costing and implementation	Long Term	Mun/DP	3
6	RISLUP Developed and Implemented	Preparation of RISLUP of Duhabi Municipality using multi criteria hazard/risk analysis	Vulnerability assessment, mapping, consultations, zoning, LU plan	Short/Medium Term	Mun/FG	10
		Enforcement of RISLUP linking it with Building Bye laws	Approval by Municipality and enforcement	Medium Term	Mun	1
7	Ecofriendly/Local/Renewable technology are promoted	Promotion of bio engineering and nature base solutions for flood management	Mapping of area, identification of plants, design and implementation	Short/Medium Term	Mun/DP	2
		Development of Guideline for enforcement of Green Building Technology	Mapping of local green technology, orientation training	Medium Term	Mun/DP	2
		Develop guideline for registering and regulating e rikshaw and promotion of eV city bus	Stakeholder consultation	Short /Medium Long Term	Mun/PG	2
		Develop guidelines for conservation and development of ponds and forest within the municipality.	Stakeholder consultation, mapping and adaptive use	Short/Medium Term	Mun/PG/DP	2
		Develop guidelines for conservation, operation, and maintenance of open spaces within the municipality.	Stakeholder consultation, mapping and adaptive use	Short Term	Mun/PG/DP	2

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

5.2.4.Effective Governance and Investments

A. Key Issues

- Capacity and Human Resource Constraints: Lack of skilled and trained personnel to effectively mainstream DRR and climate change responsive activities in the municipal plan/project.
- Financial Resources and Revenue Generation: Duhabi has very weak own source revenue with possibilities for mobilizing alternative sources.
- Bureaucratic Instability: It disrupts development activities and service delivery.
- Limited Application of Information and Technology in governance: Lack of data-driven decision-making and e-governance solutions hinder responsive and accountable governance.
- Inadequate engagement with community in DRR and climate change adaptation:
- Absent Private Sector Engagement in infrastructure creating operation and management.
- Lack of coordination among 3 tiers of government
- Inadequate legal and institutional framework to deal with DRR and climate risk.

B. Thematic Strategy

Addressing the challenges requires a concerted effort from the federal and provincial government, local authorities, civil society, and citizens. Strengthening institutional capacities, promoting transparency and accountability, and prioritizing citizen engagement are crucial steps towards achieving effective governance and sustainable investment. The key strategies proposed include-

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. 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. Adopt E BPS, make more services digital.
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 3 tiers of government, NGOs, private sector and civil society and create platforms for joint planning, resource mobilization, and knowledge sharing on DRR and CCA.
6. Financial Mechanisms: Explore opportunities for public-private partnerships, 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 establish Duhabi a forward-looking local government that embraces smart technologies, promotes sustainable practices, and fosters resilience, ensuring an **inclusive governance system** that enhances the well-being of vulnerable and deprived communities, fostering **partnerships, transparency, and accountability** in decision-making processes.

Table 5-4 Action Plans for Effective Governance and Investments

SN	Milestone	Interventions	Tools and Instruments	Timeline (Term)	Partners and Stakeholders	Budget (M)/Source
1	Legal framework developed and resilience is internalized in development planning	Prepare local environment protection act with Regulations IEE/BES guideline	Community Consultation, review of federal and provincial acts and regulation	Short Term	Dev Partners	1
		Develop DRR and Climate change screening checklist as an integral part of IEE/BES guideline	Community Consultations	Short Term	Dev Partners	.5
		Orientation on DRR and Climate Change responsive MTEF and annual planning and budgeting	Consultation and KII with municipal officials	Short/Medium term	FG/DP	.5
		Orientation training IEE, BES and CC screening checklist	Training Modules	Short Term	FG/DP	1
2	Capacity of municipal staffs Developed	Capacity Need Assessment is carried out and plan prepared	Consultations and review of documents	Short/Medium term	FG/DP	.2
		Orientation training on DRR and CR assessment to technical staffs	Training Module	Short/Medium term	FG/DP	1
		Trainings on NBC compliance BPS, Orientation on Building Bye Laws, Training on bio engineering and nature-based solutions. Orientation Training on GRID approach of development	Consultations, review, Training modules	Short/Medium	FG/DP	5
3	Application of information technology in service delivery and DRR responses	E BPS developed and implemented	Model developed by UNDP	Short Term	DP	2
		Early Warning systems developed and implemented for flood	Existing models/technology	Short/Medium	FG/DP	5
		Electronic tax collection System promoted	Existing systems	Short Term	FG/DP	1
4	OSR will be strengthened, and other sources mobilized in critical	Tax policy revisited and amended to increase resource base.	Consultations	Short/Medium	MuN	.2
		Untapped resources are identified and taxed.		Short/Medium	FG/DP	.5
		PPP guidelines and acts are developed.	Consultation with private sector and other stakeholders, National and	Short	FG/DP	2

	infrastructure development		provincial acts and guidelines			
		Private sector or PPP model adopted in critical infrastructure development.	Consultation with private sector and other stakeholders	Medium to Long Term	FG/DP	.2
		Resources from FG and Development partners are mobilized.		Short/Medium Term	FG/DP	
		Community based insurance scheme against Disaster Risks will be developed and implemented	Community Consultation, Insurance Companies	Medium to Long Term	FG/DP, Insurance authority	.3
5	People's engagement is ensured at all levels	Development of a virtual platform to facilitate public engagement.		Medium to Long Term	FG/DP, Insurance authority	.5
		Constitute an institution for joint periodic monitoring with members from private section and civil society.		Short/Medium	FG/DP	.2

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

6. CONCLUSION

The formulation of the Urban Resilience Roadmap for 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 ever-increasing concerns of climate change and disasters.

The emphasis on diversified and inclusive socioeconomic opportunities is a critical component of this strategy. Recognizing the importance of equal access to economic growth and livelihood possibilities, the municipality of Duhabi 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, ensuring that they are active participants in local economy and the municipality's development at large. Duhabi can tap into the potential of its varied workforce by encouraging social cohesion and embracing diversity, leading the municipality toward long-term economic growth and prosperity.

Another critical component of the plan is environmental issues and the necessity of climate change adaptation. The roadmap developed measures to maintain and protect the natural environment by understanding the context with the help of transect walks and interacting with local stakeholders. Promotion of green infrastructure, sustainable behaviors, and climate-resilient communities help in incorporating disaster risk reduction measures to 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 the many components of the Urban Resilience Roadmap is effective governance and strategic investments. Involving stakeholders, including local communities, from the beginning of the project will create a sense of ownership and their commitment and support in implementing and completing the project on time. This participation 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 have brought many perspectives to the forefront. Transect walks have provided knowledge of the city's challenges and opportunities, anchoring the plan in the local context. Furthermore, a detailed literature review and secondary information analysis have reinforced the roadmap with global and regional best practices, allowing Duhabi to learn from the experiences of other cities and areas that have successfully undertaken resilience programs.

Implementation Strategies

Both the municipality and the municipal council are the prime users of the roadmap to urban resilience of Duhabi municipality. The roadmap can act as a guide for further research and new projects in the municipality to attract investments and perform sustainable developmental activities. Other stakeholders like the provincial government, district administration office and associated divisions can

use the roadmap to identify projects of importance as well as to make sure that the projects selected in the future do not undermine the resilience of the municipality.

Development partners and non-governmental organizations (NGOs) can use the "Roadmap to Resilience of Duhabi Municipality" as a framework to support urban resilience efforts. They can provide technical assistance, capacity building, and finance assistance, as well as facilitate community engagement and awareness. They can contribute in the execution of resilient infrastructure projects by collaborating with local stakeholders, monitoring progress, and ensuring the roadmap's alignment with community demands. Together, these efforts will help to strengthen resilience of Duhabi municipality by tackling growing concerns of hazards like flood and droughts and hence supporting regional sustainable development.

Before the roadmap can be implemented, it must first be thoroughly reviewed and approved by the Council of the Municipality of Duhabi. 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, considering the identification of risks and priorities within each sub-component. To guarantee successful implementation, decisions must be made on the incorporation of resilience building into the municipality's routine functions as well as the execution of specialized resilience measures on the ground. Furthermore, improving institutional capacity and individual’s knowledge and accountability are identified as critical requirements for the roadmap's successful execution.

The Resilience Roadmap is a comprehensive framework for encouraging sustainable and resilient urban development in the Municipality of Duhabi. However, to ensure proper implementation, the subsequent phase should be to create a detailed implementation strategy. This plan should include a detailed breakdown of activities, such as descriptions, deadlines, and financial requirements. The implementation strategy will provide a clear and coordinated approach to executing the roadmap's objectives by specifying these elements.

It is recommended that the municipality look into several financing sources to help with the financial element of implementation. This method will allow the municipality to use a variety of resources to fund various components of the roadmap. By diversifying funding sources, the municipality increases its chances of receiving the necessary financial support, ensuring the successful implementation of the roadmap's projects. Duhabi Municipality has to make considerable strides toward its goals of sustainable and resilient urban development by developing a clear implementation plan and actively pursuing various funding channels.

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