

Regional Development Dichotomy – A Strategic Plan for a Balanced Development for Vagra-Dahej Sub Region, Bharuch, India

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Abstract

Gujarat is a leading industrial state in the Indian union with a long coastline dotted with 40 of the country's 142 ports. The state has been promised \$296.42 billion (USD) via 5,500 industrial memorandum, which has created economic growth of 7.7 percent in the last decade. Many of these investments are concentrated around the coast or large urban agglomerations. VagraDahej is a coastal sub region in Gujarat located near a high concentration corridor of industrial conglomeration. This subregion city has a population of 82,000 people living in its 68 villages that offer promising economic opportunities. However, is paradoxically experiencing natural resource degeneration and out-migration of the local people. VagraDahej contributes about \$3 billion USD annually through excise duty and taxes to the state and national income through its largest 'On-land' petroleum reserves in India. It has the only liquid cargo port and chemical terminal in the country, large-scale investments in petrochemical, metallurgical, and other port-based industrial investments ranging from \$.60 to \$900 million USD per unit. Agriculture, fishing, salt farming, and natural resource based activities are traditional sources of economy; where the most local population is engaged in the sub region. VagraDahej is under serious threats of salinity ingress, droughts, low agriculture productivity, declining traditional economy, and out migration attributed to weak land use planning, non-judicious use of water, compounded by unstable climatic conditions, topography, and poor soils with low permeability and inherent salinity. The sub region faces a serious development dichotomy with a ratio of annual average earnings of local people, to the total wealth generated from the available resources and investments in the sub region being abysmally low. These research findings are based on secondary data analysis, field surveys, and consultations with the stakeholders in field and sector experts. This paper assesses development potential and constraints in the sub region and attempts to prepare future development strategies to attain balanced regional development. This paper emphasizes natural resource regeneration (land, water and soil conservation) and thus attempts to create options for livelihood regeneration in the rapidly industrializing coastal region of Gujarat.

Context

Gujarat state, located in the western part of India, has progressed by leaps and bounds to become a leading industrial and progressive state in the Indian union, contributing 11 percent to the total industrial output. The share of primary, secondary, and tertiary sector has been 18.1, 41.5, and 40.4 percent respectively of the total Gross State Domestic product, GSDP (23 billion USD) from 1999 to 2000.

The state has a total population of 51 million, and over 37 percent reside in urban centers. The state has 25 districts, 226 blocks, 18,356 villages, and the longest coastline--1600 km--in the country. With improved economic opportunities in secondary and tertiary sector, the state is quickly transforming into a predominantly industrialized and urban state.

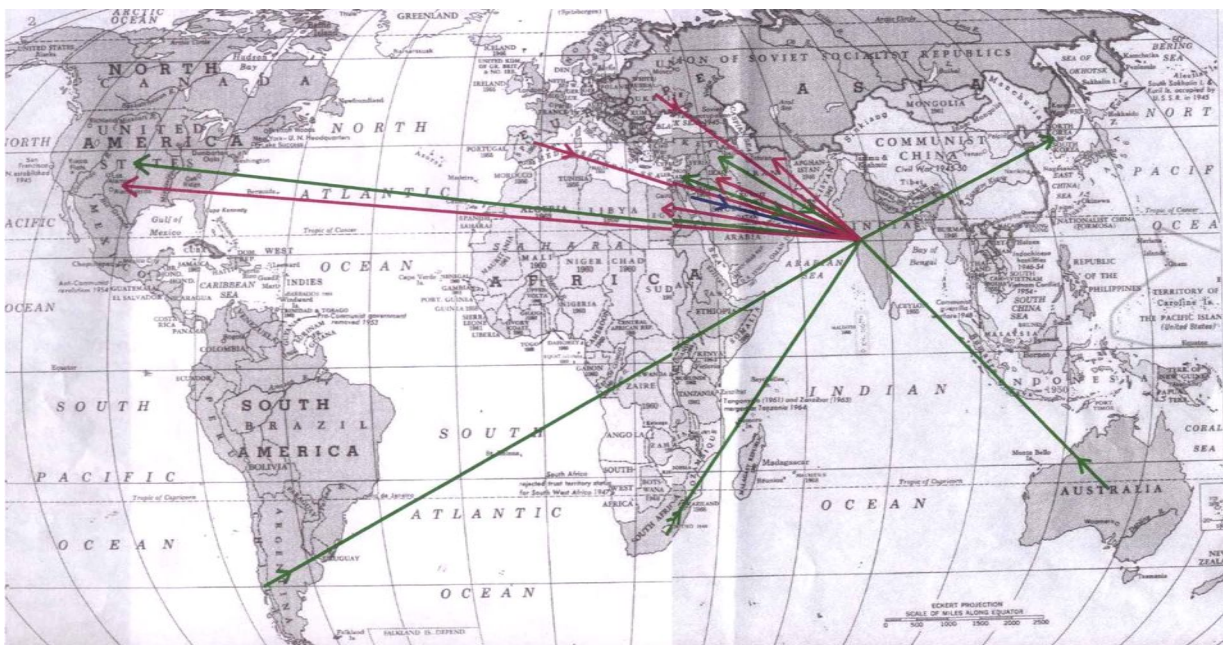
The industrial and service sector in Gujarat has experienced unsurpassed growth in the last decade and the state economy witnessed a growth rate of 7.7 percent, making it the second-largest industrial state.

Additionally, the state received acknowledgements of 5,539 industrial entrepreneurship memorandums, IEM (13.2% of the country) by March 2001, with estimated investments of nearly \$32 billion USD (16.5% of the country).

The industrial base has widened considerably from traditional textile to chemicals, petrochemicals, engineering, pharmaceuticals, dyes and dye intermediates, food processing, agro-processing, dairy, and edible oils etc. The impact of large-scale investment projects is felt over a larger geographical area. The legal mechanisms used to ensure organized development at regional level are still not in place, hence there is a fear the spatial growth pattern that would emerge could be haphazard and undesirable in the absence of planned growth. The south Gujarat region commonly referred to as the Golden Corridor is dotted with several industrial conglomerations. The Vagra-Dahejsub region falls along the coast in the south Gujarat region.

Gujarat is home to 40 of the 142 minor and intermediate ports in the country. The largest concentrations of on-land hydrocarbon reserves are located in the south Gujarat region around the Gandhar and Ankleshwar, which are within the Vagra-Dahejsub region area. Nearly the entire VDSR falls in the Narmada command area, an ambitious large-scale irrigation project of the Government of India.

This paper is based on a larger study carried out for a coastal region in Gujarat in 2002, which is named as Vagra - Dahej Sub region (VDSR).



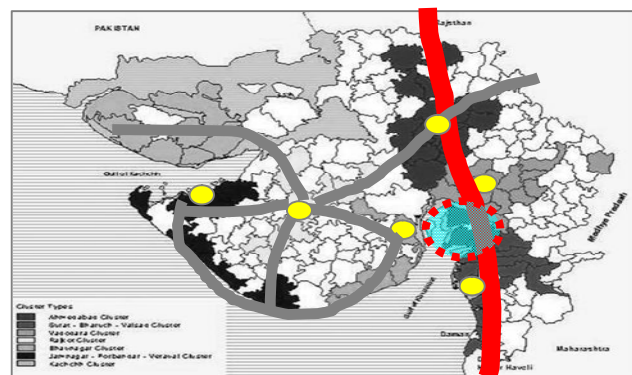
General Overview and VDSR

A recent study of Gujarat State concluded that 64 talukas (blocks) in the state (as shown in the figure) account for-

- a. 80 percent of the state’s urban population
- b. 82 percent of industrial employment (1996)
- c. 88 percent of new industrial investments made
- d. in Gujarat since 1991

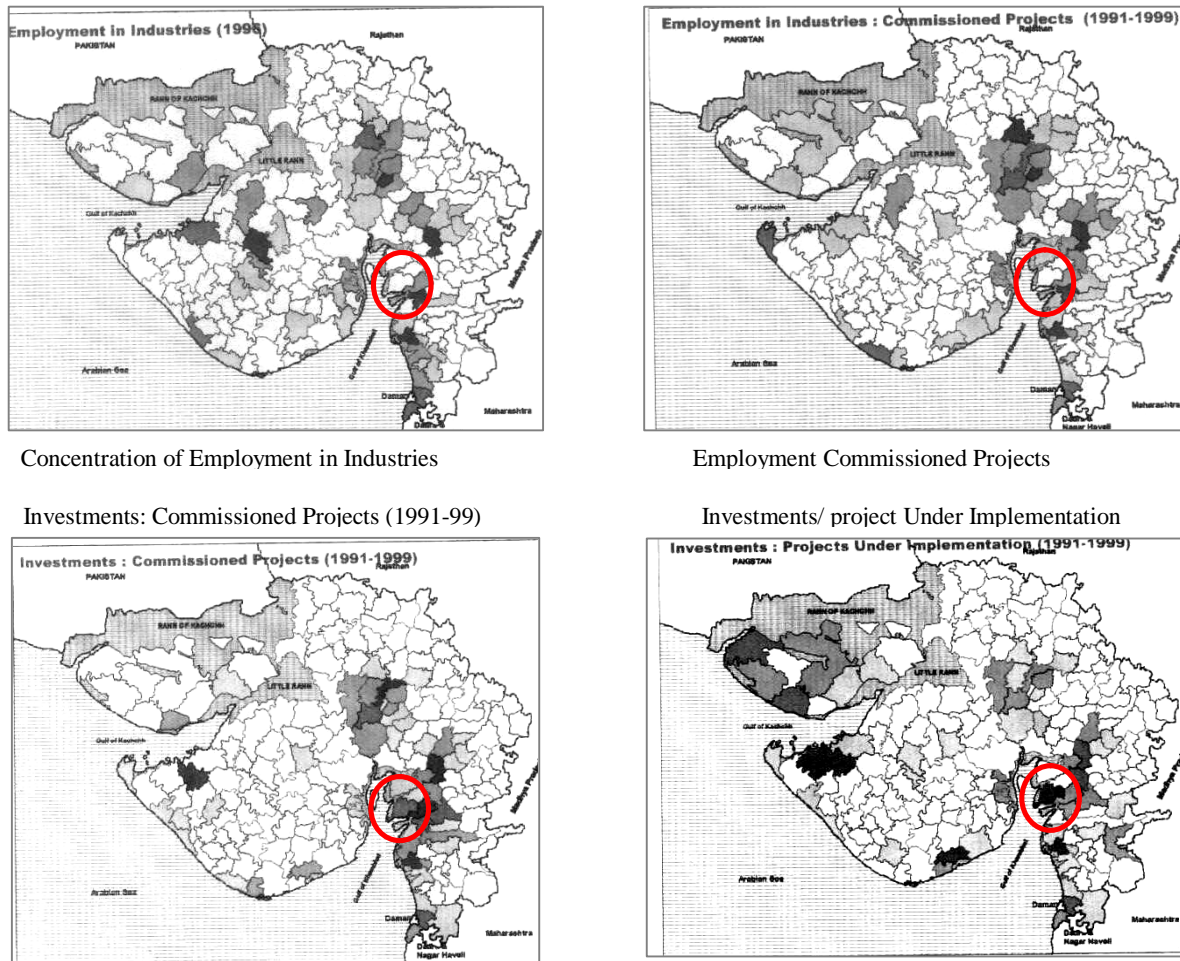
These make upright linked clusters, of which, six are located around the six Municipal corporation cities and two of them are in Kacchch and Veraval-Porbandhar due to availability of coast.

In the figure, yellow dots represent the urban large centers with one million-plus population. The different shades of grey in the map show geographical concentration of economic activities (a, b and c). The blue dot represents is the Vagra – Dahejsub region.



Spatial Patterns of Industrial Concentration

Figure 2 :Courtesy: SP, CEPT, Ahmedabad India



Source : State Environmental Action Program (Urbanization Process)

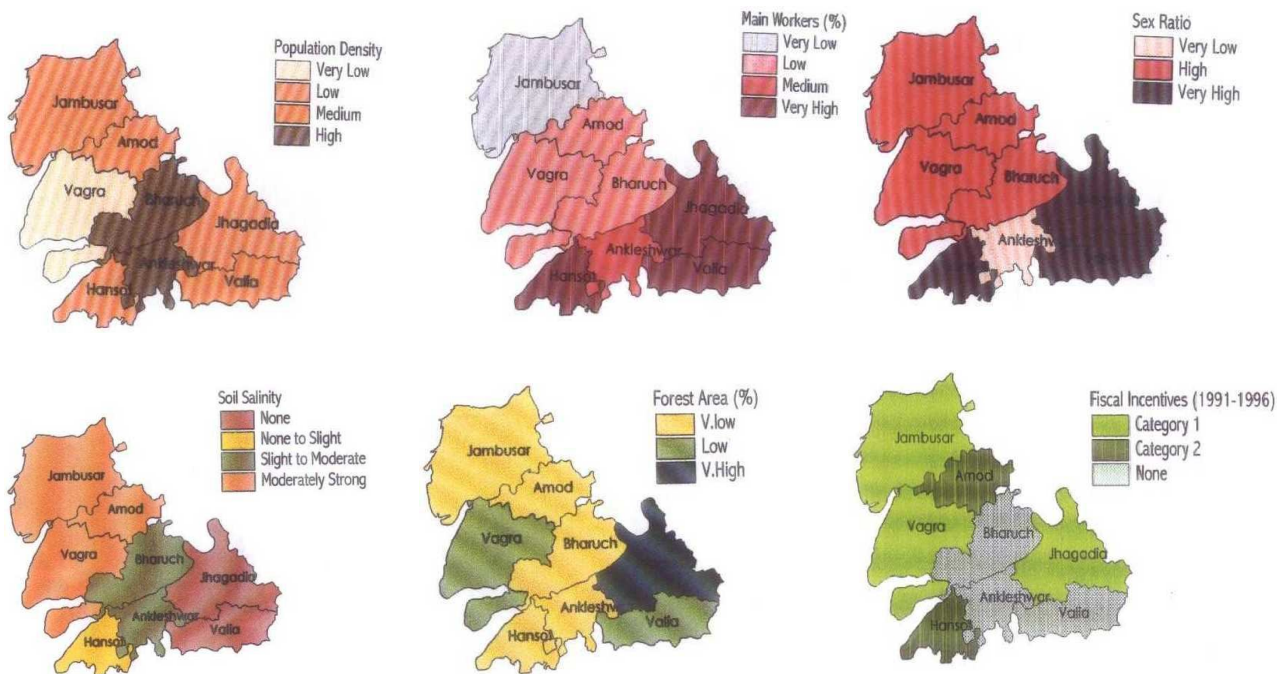
Delineation of VagraDahej Sub Region

The administrative boundary of all the blocks of Bharuch district were taken as larger region for the purpose of delineation of sub regional boundary. The VDSR is a contiguous area with largely homogeneous development characteristics including demographic, economic activities, occupational pattern, physiographic features, and natural resource base among others.

Vagra-Dahej sub region is a coastal taluka (block) comprised of 68 villages in Bharuch district of Gujarat state. It had a total population base of about 80,000 in 2001 and the sub region offers sweeping economic opportunities due to its location in proximity to the industrial agglomeration, hydrocarbon reserves, and ports. The VDSR contributes significantly to the state and national income, however, has very little impact on improving the local traditional economy base, which is predominantly farming based. The VDSR has the largest on-land petroleum reserves in India at Gandhar and the only liquid cargo port and chemical terminal in the country. Additionally, it is home to other large and mega scale investments in the petrochemical, metallurgical, and other port based industries with an investment to the tune of \$60 million to nearly \$900 million USD per unit.

This paper is based on the regional plan exercise carried out for the area with an aim to provide comprehensive development strategies in VDSR through exploiting its under-utilised potential, overcoming constraints, and proposing growth guidelines for economic, social and environment improvement. It endeavours to attain balanced development in the VDSR by strengthening the traditional economic sector through natural resource regeneration, improving economic opportunities and quality of life to the natives.

Figure 3 : Shows Few Parameters Used in The Regional Delineation Process on a Larger Region to Identify VDSR



Source : September 2002, Summary and Final Report, Vagra-Dahej Sub Region Plan

Methodology

Study findings are based on the analysis of secondary information and primary information gathered from the field. The methodology included preparation of comprehensive village level base map collated from various sources of spatial information including satellite imagery and ground verifications. The study includes spatial analysis, status review of demographic profile, socio economic profile, and natural resources of the sub region, status of infrastructure and linkages with larger region, review of sector-specific government policies and programs in the context of VDSR. Several rapid assessment surveys coupled with stakeholders' consultations were organized in the field and inputs were sought from the sector experts.

The study critically assesses the development potential and constraints across different issues and development parameters in VDSR. It enquires into each development sector separately after evaluating its status, contribution in the VDSR growth and prepares strategies for future. The sectors studied include

- Natural Resources in the Region
- Livelihood Regeneration in the Region
- Water Resource Development in the Region
- Economic Activities in the Region
- Economic Infrastructure
- Land Capability and Land Suitability for Land Management in the Region
- Environmental Concerns in the Region
- Physical Infrastructure in the Region
- Social Infrastructure in the Region

Inter sectoral and interdependent regional issues across different development sectors have been analysed to frame a comprehensive strategy and proposals were formulated for the overall development of the VDSR.

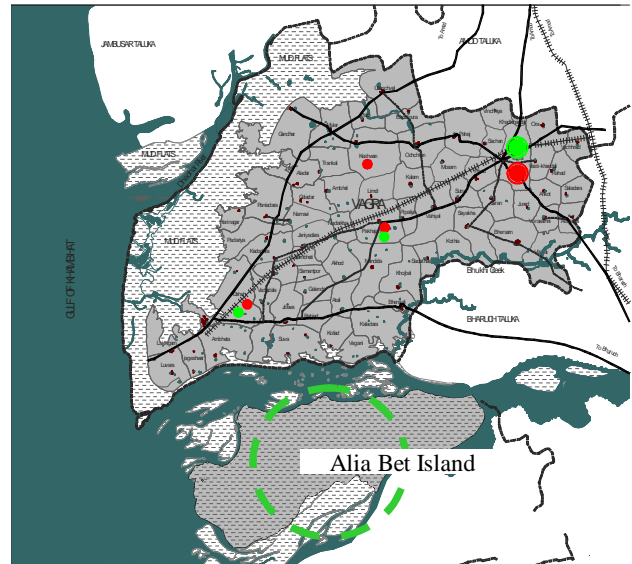
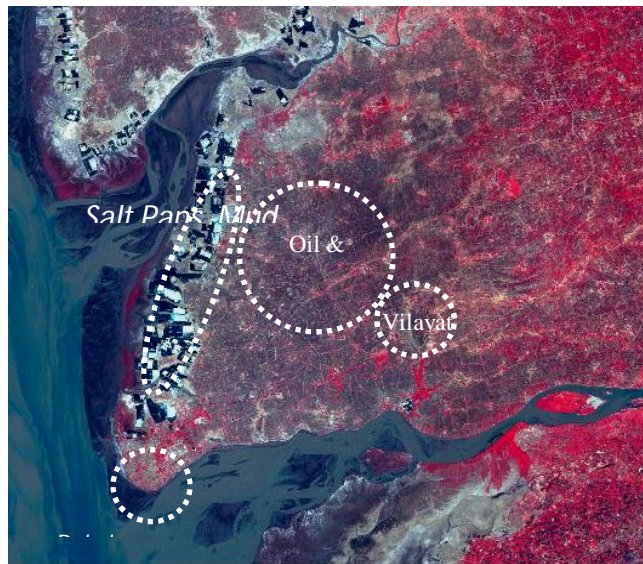


Figure 4 : IRS-1D LISS-III Satellite imagery of VDSR Boundaries **Figure 5: Map of VDSR with Roads & Village Boundaries**

Issues and Concerns in the Sub region

1. Declining Traditional Economy of the VDSR

The traditional sources of economy for the natives in VDSR are agriculture, fishing, salt farming, and other natural resource-based activities. The VDSR falls in the water-scarce, drought-prone area of the country where the inherent characteristic of the soil is saline, which leads to subsistence agriculture. Natural resources are degenerating as evident by expanding tracks of saline wasteland, degrading soil and water resources, erosion of vegetative cover, and depleting mangroves among other factors. Combined, this leads to low productivity in agricultural activities, which has resulted in people moving out of the VDSR in search of improved economic opportunities.

The VDSR faces a development dichotomy. While rich in hydrocarbon reserves, resulting in rich natural wealth and large-scale industrial investments, the natives of the area are poor. The ratio of total annual earnings of the local people to the total wealth generated from the VDSR from the available resources and investment is abysmally low.

Over a time, land degradation has occurred due to a weak land use planning system, non-judicious use of water, and uncontrolled release of waste, which is often compounded by unstable climatic conditions, topography, and soils with low permeability and inherent salinity. The salt-affected soils change the natural vegetation and agriculture of the area.

The soils in the study area had low permeability with constricted drainage, which will aggravate the problem after the implementation of Narmada Canal, as water logging would be inevitable. Primitive irrigation practices, seepage losses from irrigation network, lack of drainage facility and sometimes improper alignment of the irrigation network, which obstructs the natural drainage, are the potential threats for water logging in the VDSR.

Vegetation in the VDSR is salt-affected, very poor, and comprises of stunted and scattered growth. The natural vegetation includes salt marshes and depleting mangroves. The Bharuch District has nearly 14.7 sq.km of mangroves and the VDSR has about 5.39 sq km. Mangroves act as natural coast guards, provide protection against encroachments of sea, tides and hurricanes, help maintain estuarine water quality, and increase biodiversity. Additionally they provide numerous economic benefits. The mangroves here grow on inter-tidal mudflats in a very stunted and sparse form on Aliabet Island and near Paniyadra and Dahej villages. Mangroves are rapidly vanishing and their existence is being threatened by coast side development, over exploitation, land reclamation, over harvesting of wood and other materials, salinity, dumping of waste, and pollution due to chemicals and pesticides. Mangrove areas are also threatened by free grazing camels, which trample the seedlings, and local communities that overexploit seeds and twigs.

Bharuch is the sixth largest salt-producing center in India and VDSR's production is about 53.83 percent of that of total comes from Bharuch (530,929 tons). There are more than 50 production units spread over 7696 ha (8.7% of the entire Taluka area) and a huge potential to promote salt production and to other salt-based industries. The industry is suffering from technological backwardness and employs traditional methods for salt farming. There is a need for technological improvement with the help of Central Salt and Marine Research Institute (CSMRI).

2. Industrialization Scenario in VDSR

Industrial development has been below expectations; as against 77 IEM issued promising \$60 billion USD (11.47 percent of the state), only six projects have been commissioned and four are under implementation. Of the total planned investment, only 20 percent has come.

The VDSR has two large-scale industrial estates at Dahej (near the coast) and Vilayat (nearly 25 km away); the pace of industrialisation in general has been lower than expected. A few petrochemical mega-industries and large industrial corporations are located in Dahej including giants such as Indian Petrochemicals Limited (IPCL), Indo-Gulf Birla Copper, Gujarat Chemical Port & Terminal Company Limited (GCPTCL), LNG Petronet, BASF, GACL and Welspun. However, 40 percent of the Dahej industrial estate is still vacant while Vilayat estate is fully vacant.

The investments in Dahej are mega scale ranging from \$60 million to \$900 million USD per industry. The industries in the Dahej estate have found the availability of coast (the opportunity to build captive jetties), proximity to salt and Gandhar oil fields (for the feed stock), and various tax concessions and other incentives offered by the state as a few attraction factors to invest here. The Dahej also has an advantage of a major liquid cargo port with chemical terminal storage, which could be used by industrial units around.

Despite of all this, the slow industrial growth is largely owing to following reasons:

- Global economic recession in the petroleum sector, leading to low pace of investments
- Seven other GIDC estates within 60 kms, all largely chemical, petrochemical-posing competition
- Lack of comprehensive packages for industries, and missing infrastructure gaps
- Lack of proactive measures, single window clearances, and industry-friendly policies

3. Economic and Physical Infrastructure Gaps in VDSR

Roads

The VDSR is connected with Bharuch city through State Highway. Its condition is deplorable and traffic intensity has increased considerably due to the development of a port complex and other mega-industries at Dahej. The traffic is bound to further intensify as the specialised port and upcoming multipurpose solid cargo would soon be catering to the larger areas.

Railways

The VDSR is connected with the nearest broad gauge railhead of Bharuch by a 64 km long narrow gauge line. Dahej has business linkages with central, northern, and western India and Maharashtra state, which could be strengthened if a railway connection is established.

Rapid industrial development demands conversion of the present narrow to broad gauge railways, to link the VDSR with the nationwide railway network. Western Railway has formulated a plan to strengthen its broad gauge trunk route by providing a third line in addition to the existing double line between Virar and Ahmedabad, which would link Dahej with Bharuch and Vadodara. A techno-economic feasibility study to examine viability of conversion of the Bharuch - Sammi - Dahej line could determine the technical and financial commitment for the conversion. This could also be taken up through private sector participation where the benefiting industries could form consortia along with the railway authorities to develop the rail line.

Waterways

The Roll-on-Roll-off (Ro-Ro) ferry from Dahej to Ghogha, which is located in Bhavnagar on the other side of the Gulf of Cambay, could reduce the travel times from eight hours by road to one-and-a-half hours by waterways. This project began with a project cost of \$700,000 USD was later abandoned due to higher operating cost. With the induced economic activities in the VDSR, traffic on this route is likely to grow as the sea route takes one-fourth the time in reaching Bhavnagar.

In addition, Ro-Ro also provides the facility of loading vehicles and general cargo. This project would be financially viable in near future. Because of this, the Gujarat Maritime Board is re-evaluating techno-economic feasibility aspect of waterways.

Industrial Effluent Conveyance System

Because of the many chemical industries, the sub region generates hazardous waste, which must be disposed safely without adversely affecting environment and ecology. The large-scale units in Dahej, have laid captive waste treatment, disposal, and conveyance systems that take treated waste a few miles out in the ocean, complying with pollution and waste disposal norms. A common effluent conveyance system is absent in both the estates at Dahej and Vilayat and is the prime reason for slow industrialization. Initially, several expressions of interests were received by the industries department from both small and medium sized industries. However, in the absence of conveyance system these industries declined. Such systems involve huge capital and operational costs and it is economically unviable for small and mediums scale industries to implement these systems. On completion of this system Dahej is likely to attract more industrial investments.

4. Lack of Social Facilities in VDSR

Housing

The natives of the VDSR are generally farmers and involved in traditional activities leading them to settle near farms or at the Block headquarter. The typology includes various materials used in the houses, which ranges from temporary, semi temporary (thatched roof and mud walls) and few permanent types of houses. Due to lack of social infrastructure such as good schools, hospitals, recreation facilities, and markets among other things, a large number of employed families prefer staying close to the nearest urban center like Bharuch city. The industrial employees in Dahej largely commute from Bharuch nearly 45 km from Dahej. A few industries have provided housing at Bharuch and provide transport facilities for their employee's commutation, but there are few that have their own housing colonies in the industrial campus equipped with basic amenities.

Drinking water and Sanitation

Quality water is a scarce commodity and the domestic needs of natives are met largely by village tanks, wells, and the treated piped water supply of the state. Industries also supply water to a few villages and also conduct some local community development programs on education, health, and hygiene.

Education

In the VDSR, the number of primary level educational institutions is reasonably high, whereas the secondary and higher secondary schools are relatively fewer. Bharuch city has one College and one Industrial Training Institute (ITI) whereas despite requirements from the local industries, VDSR does not have such a program. It is proposed that an ITI or Advance Training Institute (ATI) should be established to impart training to local population based on industry requirements near Dahej.

Health

In the VDSR, villages having higher order medical facilities--hospitals and maternity homes--are relatively low with only three primary health centers. Villages having medium order facilities--primary health centres and dispensaries--are more common.

5. Environmental and Safety Concerns in VDSR

Due to hazardous industries in the VDSR, oil and gas exploration activities are vulnerable to environmental adversities and attract attention. Oil and gas exploration and crude oil processing poses multiple safety concerns of the people here. The task of processing wastes involves contaminated wastewater, tank bottom sludge and crude pipelines routinely cleaned by pigging operations, which can lead to spills and generation of sludge containing heavy metals. The process of cleaning and de-ballasting tankers on a daily basis and the possibility of accidental oil spills pose a threat to marine animals, mangroves, and coral reefs. Effluents from Oil & Natural

Gas Corporation (ONGC) installations such as exploratory drills, Central Processing Facility (CPF), and flaring of low-pressure gas also generate various pollutants.

Waste Management by the Dahej Industries

There are six functional mega industrial units in Dahej dealing in chemicals, petrochemicals, and metallurgical. The industries in have their own collection and disposal systems. The observed wastes include ETP wastes, waste oils, slag, and other process wastes. These have intermediate storage yards for appropriate storage of wastes. The industries carry out pre-treatment through solar drying and incineration within premises and plants have captive ETP's and wastewater is disposed into the sea through marine outfalls. In some cases, there are secured landfills within the units. The treated waste disposed in the sea is hazardous for the aquatic life in long run, which invites attention.

Impact of Ports

Dahej is developing as a large port complex with operational Dahej Old Port, captive jetties of IPCL, Indo-Gulf and chemical port, and the terminal of GCPTCL. Further, the LNG Terminal is also under implementation and there is a proposal for a Solid Cargo Port of LNG Petronet, a captive jetty for Welspun, and a GMB jetty for Ro-Ro traffic. Construction of ports and jetties involve dredging, which disturbs the benthic ecosystem. Discharge of waste and unnoticed toxic chemical discharge through ships in the near shore waters may have direct impact on marine bio-diversity. Port operations may provide sewage, bilge wastes, and oil discharge and cause leakage of harmful materials both from shore and ships. Pollution by crude oil/petroleum products could arise from tanker collisions, grounding, leakage, tank washing, and deballasting.

Handling of Chemicals

The feedstock and the chemicals produced in the VDSR are transported through tankers by road and by sea route. These chemicals are extremely hazardous in nature. There is a need to provide adequate training to the employees and transportation

Hazard Zones

Large areas in the VDSR have an underground network of pipelines carrying inflammable and hazardous chemical, crude, and gases. Significantly, a large area of the VDSR is under ONGC's oil and gas exploration and mining lease because of several process installations in the area. Dahej handles hazardous chemicals through process industries and ports here. Apart from these, the VDSR falls under certain natural hazards such as a moderate risk zone of cyclone hazard and flood prone coastal area. The VDSR would prove to be extremely vulnerable to disasters, hence the a need for a comprehensive multiple disaster management plan.



Figure 6: Jetties and Chemical Storage Tanks at Dahej

6. Status of Water Resources in VDSR

The VDSR is surrounded by water from three directions; paradoxically, there is a scarcity of quality water. Salt ingression in the ground and backwater salinity intrusion in the Narmada and Bhukhi River water are other serious threats. There are 68 small and medium sized village ponds that have limited storage capacity and are used for fishery and domestic water consumption and a few of these are also used for irrigation. There are no irrigation projects except for a few government sponsored Panchayat irrigation and District Rural Development Agency (DRDA) sponsored check dams/ percolation wells.

As per the physiography of the VDSR, large scale irrigation structures are non-viable, instead a large number of water harvesting structures can be planned and constructed on first and second order streams, and field bund both for conserving rainwater for irrigation and domestic uses.

The VDSR falls in the Narmada basin and its command area; hence benefits from the Sardar Sarovar Narmada irrigation project would accrue to this region also. Though there are few areas that have high potential for water logging once Narmada water comes, conjunctive use of ground and surface water would be preferred here. The Narmada River also meets the water needs of industries. From the river, water is brought through dedicated pipe lines serving these industries at astronomical price.

7. Alia Bet Island in the VDSR

Alia Bet is an island on the south of the VDSR separated by the River Narmada. This island is accessible by boat from the VDSR and could also be accessed through mudflats during non-monsoon season from Hansol block. A large portion of this island gets submerged during monsoons and also during high tides. Alia Bet is now inhabited by nearly 50 nomadic families who survive on livestock, fishery, and fodder.

This island is at the mouth of the Narmada River and has expanding mud flats and mangroves. The island lacks in civic services such as roads, power, water, telecom, and sanitation. Nonetheless, Alia Bet has the potential for eco-tourism due to its scenic beauty.

Development Constraints and Potentials in the VDSR

1. Development Constraints in the VDSR

□ Limited Area Available for Physical Development

Owing to hydrocarbon exploration activities, a very large area in the VDSR is under ONGC Mining Lease (ML) resulting very little room for the development of the supportive functions. ONGC clearances are needed to develop in the lease area.

□ Depleting Natural Resources

VDSR is exposed to degradation of soil, water, vegetation, mangroves, and other natural resources. The natives engaged in the traditional economic sector were adversely affected by the low productivity of crops and vegetation. Because of low productivity in agriculture there has been a significant out migration. Hopefully, implementation of the Narmada irrigation system will result in higher participation rates in agriculture.

□ Missing Balanced Approach

Despite the push of industrial investments in the VDSR, there has been very limited contribution on the local economic development. The local resources in the VDSR include its hydrocarbon reserves, industrial investments, natural resources, and the people; the traditional economy base needs to be strengthened and rejuvenated. This will improve local economy and would ensure balanced development.

□ Lack of Local Sources for Domestic and Irrigation Water

The VDSR has a serious scarcity of water; the drinking water needs of almost all the villages are barely being met by the Gujarat Water supply and Sewerage Board (GWSSB), which pumps water from 30 km away from Palej. With a rising population, drinking water needs and industrial water needs would exacerbate.

□ Dependence on Narmada Water for Industrial Purposes

In the absence of local source of water, state industrial authorities and individual large-scale units, which require bulk water, have laid dedicated water pipelines from intake wells on the Narmada River nearly 30 km. away. When the Sardar Sarovar Narmada irrigation project is fully operational, the storage in the Dam upstream of river Narmada may affect the availability of water. Also, the Saurashtra water supply project and the new industrial estate of Jhagadia on the south bank are also expected to develop their own intake wells in the same region. This concentration at the water source does need to be investigated in-depth or matched with the Narmada water allocation plan.

□ Limited Skilled Human Resources and basic Amenities

The VDSR has suffered from a flight of human resources over the last few decades. The region has specialized industrial activities that require at least some basic technical skills for employment. The local sub region has a dearth of qualified human resource that industry can employ. In the absence of the local people, the industries employ supervisors, technical, and managerial staff from distant locations and provide temporary arrangements for their social needs such as housing, transport and other basic amenities such as schools, dispensaries, and other infrastructure.

□ **Absence of basic Infrastructure to Attract Investments**

Industrial investments prioritize their locations based on the maximum location advantage in terms of procuring raw material, labor, good infrastructure to run the industry, ease of clearances, and proximity to the markets. Dahej and Vilayat industrial estates both lack in connectivity (rail and road) and unavailability of effluent conveyance system posing serious constraint in the desired industrial development.

□ **Absence of a physical Planning, Monitoring and Regulatory Authority**

There is no regional authority in place today. If the required administrative structures are not in place, it will be difficult to coordinate and manage a balanced development approach in the VDSR.

2. Development Potentials in the VDSR

□ **Policy Support**

As per the industrial policy of the Gujarat state to promote economically and socially backward areas, various incentive mechanisms were launched to attract industrial investments. Dahej, having the advantage of being located away from the densely populated areas and the availability of the port, was developed as mega chemical zone by the state industries department.

□ **Proximity to the South-Gujarat Industrial Corridor**

The 500 km long corridor, joined by railways and the National Highway (NH8) from Mumbai to Ahmedabad, is dotted with various industrial concentrations of medium and large scale. The corridor was also known as Golden corridor. The NH8 and the Mumbai-Ahmedabad railways are only 45 kilometres from the farthest point of the VDSR. The possibility of a connection with the national transportation system would be an asset for the VDSR.

□ **Availability of Energy**

The hydrocarbon reserves in the VDSR also are used as feedstock for few energy intensive industries that have captive power plants. The National Thermal Power Corporation (NTPC) has a gas-based power station in the neighboring sub regions at Jhanor.

□ **Availability of Salt**

There are about 50 salt manufacturing units in the VDSR, which offers tremendous potential for salt-based industries.

□ **Narmada Command Area**

The entire VDSR, with the exception of Alia-Bet Island, is under the Narmada canal command area, which upon implementation would improve agriculture and allied activities in the VDSR.

□ **Presence of Mega Industries**

The mega industries in Dahej, such as IPCL, GACL, Indo-Gulf, BASF, LNG Petronet, etc, could attract other downstream industries, which could use the product of the local industries as raw material. (Concept of Backward and Forward linkage)

Proximity to Coast / potential to build captive jetty/ Presence of Liquid Chemical Port and Terminal The VDSR is a coastal region. It provides opportunities to build captive jetty for specific industry needs. the only one of a kind, liquid chemical port and terminal with specialized storage facilities for hazardous chemical in the country is located here. Therefore, this port has a large catchment for all export and.

□ **Possibility of all-purpose Solid Cargo Port**

The Gujarat maritime Board (GMB) is negotiating to establish a solid cargo port. Having an all-purpose port in the area could attract more investments in near future.

Development Perspective of VDSR

Population growth in any region is generally dependent on the economic opportunities that region offers. The VDSR witnessed low population growth from 1971 to 1991, subsequently it increased to 20 percent during 1991 to 2001, which could be attributed to the industrial activities and resultant in-migration. VDSR has had consistent pattern of population growth; hence, trend based population projections would be imprecise.

The population projections in this study have been carried out on the basis of proposed future economic activity based scenarios. These scenarios could be attributed to two likely activities, which would induce economic improvement of the VDSR:

- Improved agriculture practices after Narmada Irrigation project
- Induced Industrial development after filling infrastructure gaps

The effect of the above activities would be spatially concentrated in specific areas, the VDSR has been divided into four homogenous activity zones and the population has been projected in each of these zones separately. These zones are:

Dahej Industrial Zone includes the Dahej industrial estate and five immediate neighboring villages, which registered high conversions of land from agriculture to non-agriculture.

Vilayat Industrial Zone includes the Vilayat industrial estate and three immediate neighboring villages.

Vagra-Urban Zone includes Vagra village, which is also the Block's administrative headquarter, and three immediate neighbouring villages. Vagra, having administrative offices, markets, and other relatively higher order facilities, has potential to graduate to an urban area in future.

Vagra-Rural Zone includes the remaining 50 villages including Alia Bet Island. In order to arrive at the total projected population in VDSR, the population figures for the two activities based scenarios – Agriculture Improvement and Industrial Development -- were added up.

□ Effects of improved agriculture on population in the VDSR

The entire VDSR, excluding the Alia Bet Island, is covered under Narmada Command area. As per the phasing schedule of Narmada project, the Bharuch district will be covered by the year 2005. The nature and level of farming activity in the VDSR would get transformed dramatically with improved irrigation facilities, leading to higher employment potential in the agriculture sector. This could reduce out-migration considerably, in the first stage and subsequently in-migration may take place depending on farm potential.

This study borrows parameters for the likely population growth from the earlier study of "Road Development Plan for Karjan Command Area." This study was based on the Ukai-Kakrapad command area, which envisioned that the region with a base decadal growth rate of 11 percent would increase to 24 percent and 31 percent in subsequent decades. It is assumed that after the implementation of Luvara Branch Canal in 2005 in the VDSR, the growth pattern would follow similar trend as in the case of Karjan Command Area.

Thus, until 2006, it has been assumed that the growth would follow the natural trend and, subsequently, growth as in the case of Karjan Command Area. After the projections, the forecasted population has been apportioned to the four population zones based on activities. For projections, the ratio method was used, which takes into account the shifts in proportions in the zones. The resultant population thus obtained is as below:

Population Zone	Area	Year			
	(In ha)	2006	2011	2016	2021
Dahej Zone	16,953	16,872	19,023	22,430	25,869
Vagra Urban Zone	3,287	10,667	12,100	14,661	16,909
Vilayat Zone	4,313	7,477	8,308	9,191	10,600
Vagra Rural Zone	63,790	45,831	50,452	53,649	61,875
Total Sub region	88,343	80,847	89,883	99,931	115,253

▪ Effects of Induced Industrial Development on Population in the VDSR

Industrial growth in VDSR has not been very encouraging, however, in the future growth proposal, three scenarios have been suggested:

- **Scenario-I:** Low Growth Scenario or Minimal Interventions approach
- **Scenario-II:** Medium Growth Scenario, which envisages major infrastructure improvements to attract investments so that the existing serviced industrial plots are occupied.
- **Scenario-III:** High Growth Scenario, which looks at the possibility of creating a Special Economic Zone (SEZ) and focuses on changing the approach totally to become a global market oriented estate.

The population projection was done for all three scenarios assuming varying growth rates. The additional population attributed to industrial development is anticipated to be direct employment generated by new industries, the multiplier effects in the form of service sectors employment and dependants on these workers.

The above three scenarios assume different levels of industrial development where Scenario I assumes 70 percent of Dahej Industrial area and 50 percent of Vilayat industrial area to be occupied by year 2021. Scenario II assumes the entire industrial area to be occupied by the target year and Scenario III proposes an increase in the present industrial area by around 1.5 times. Scenario III is a high growth scenario and envisages additional area requirements for the creation of a SEZ and provision of necessary infrastructure. Based on the current Employment – Area ratio in the Dahej GIDC, the total direct industrial employment has been worked out for different scenarios, which are presented below:

Estimated Employment and area Under Industries

Industrial Areas	Present Area in ha	Presently occupied Area	Area under industries (in ha)			Employment in industries		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
Dahej	4400	1530	3080	4400	7700	10959	15656	27399
Vilayat	985	0	492.5	985	985	3900	7800	7800
Total	5335	1530	3547.5	5335	8635	14859	23456	35199

Taking a cue from other industrial estates in Gujarat where this rate ranges from 1-2 service employment per industrial worker, for projecting the likely service employments, a multiplier rate of 1.5 was assumed.

Estimated Employment in Industrial Zones

Industrial Zones/ Population	Scenario I	Scenario II	Scenario III
Dahej Zone	70,454	100,648	176,135
Vilayat Zone	25,071	50,143	50,143
Total	95,525	150,791	226,277

Most Likely Industrial Scenario (Scenario-II)

Scenario II, wherein the Dahej zone is developed as Mega Chemical Zone has been chosen as most likely scenario. Phasing for this scenario has been done for the years 2006, 2011, 2016, and 2021. The total projected population in Dahej and Vilayat is envisioned to increase in the ratio of 30:60:80:100 and 15:35:75:100 over these years as shown in the table below

Phasing for the most likely scenario (Scenario-II)

Year	Dahej		Vilayat		Total
	% Share !	Population	% Share!	Population	Population
2006	30	30,194	15	7,521	37,716
2011	60	60,389	35	17,550	77,939
2016	80	80,519	75	37,607	118,126
2021	100	100,648	100	50,143	150,791

Total Projected Population for the Sub Region

In order to arrive at the total projected population in the VDSR, the population figures for the two activity based scenarios – Agriculture Improvement and Industrial Development -- were added.

Zones (Likely predominant activity)	Area (ha)	Population year wise			
		2006	2011	2016	2021
Dahej Zone	16,953	47,066	79,412	102,949	126,517
Vagra Urban Zone	3,287	10,667	12,100	14,661	16,909
Vilayat Zone	4,313	14,998	25,858	46,798	60,743
Vagra Rural Zone	63,790	45,831	50,452	53,649	61,875
Sub Region Total	88,343	118,563	167,822	218,057	266,044

The VDSR would have 260,000 people in the target year 2021. Of the total population, the highest concentration would be in Dahej Zone, which is proposed to be developed as a conglomeration of mega-industries. Substantial growth is also envisioned in agricultural activities due to better irrigation facilities and improved cultivation practices.

Development Strategies for Balanced Growth in VDSR

Based on the development constraints and potential growth, strategies across various sectors have been framed to achieve a balanced regional development in the Vagra-Dahej Sub region. These strategies are as follows:

1. Strategies for Natural Resource Regeneration

Soil Conservation and Regeneration of Soil Fertility

Introduce field drainage systems for waterlogged areas or potential waterlogged areas through an artificial field-drainage-grid linking fields

Promote conjunctive use of ground and surface waters

Prevent excessive soil wetting in the irrigation process to control the rise in the underground water level

Undertake water intensive cropping pattern in these excessively wet areas

Improve the coastal and inland problem of soil through soil amendments using organic fertilizers, gypsum treatment, and leaching

Improve crop management practices and introduce watershed management and rainwater harvesting

Promote Eco-Tourism in Alia – Bet

Alia Bet is virtually a no-man's land largely owned by the state and lying vacant. It has potential for eco tourism and related activities. Also, exploration of potential agriculture activities and mangroves regeneration in Alia Bet with the help of industries has been suggested.

Provide connection through floating crafts to Alia Bet Island

Prepare a tourism development master plan for Alia Bet and market Alia Bet as a destination for eco-tourism, invite private agencies to invest in tourism and recreation-based revenue-generating activities

2. Strategies for Livelihood Regeneration

To address the twin issues of economic development focusing on the needs of the local people and degeneration of natural resources, the focus is on revitalization of natural resources through organization of the rural poor and marginalized and the creation of necessary support infrastructure to facilitate their economic. Three major areas of intervention emerge: creating a physical and green barrier between sea and landmass, regeneration of wastelands through intensive land and water development activities, promotion of an integrated fisheries development program, and setting up infrastructure to promote primary sector activities

Develop enterprise development activities including Training Cum Production Centre (TCP) and Activity Centres (AC) covering a cluster of 15 villages each

Forestry

Forestry Development Species conducive to such environment could be promoted, including medicinal plants (potential for exports), oil producing plants (for soap industry), horticulture (citrus fruits), fodder (for livestock development), and fuel (first level of sowing in wastelands)

Wasteland Regeneration

The total area of wasteland is 8,334 Ha; the largest wastelands are in Gandhar and Dahej

Promote salt-loving plants with the help from CSMCRI, Bhavnagar.

Promote projects in which parcels of land can be given on long-term lease to the CBOs for regeneration and land and water development activities combined with vegetative development activities for economic benefits

Promote NGOs to facilitate provision and linking of support with finance, technical know-how, and institution management

Fisheries Development

Promote inland fishing in the estuary of the Narmada as well as fish cultivation in village ponds

Create infrastructure and support systems, to facilitate promotion of fisheries activities by village level organizations.

Repair, and deepen village tanks and provide inlet and outlets for fresh water and lease these tanks for ten years period to local CBOs

Establish Fish Farmer Development Agency (FFDA) that would provide technology inputs, training, and guidance to village level institutions; proposed TCPs will compliment their efforts

The proposed program visualizes creating complete product line, i.e. from hatchery to processing and marketing

Agriculture Efficiency and Yield

Introduce improved irrigation methods and farm techniques; also, explore methods for saline land farming, drip irrigation, and other water conserving methods for irrigation

Follow different cropping patterns before and after Narmada that are compatible to low and high water conditions

Establish experimentation and demonstration farms and set up research and development units, promoting horticulture activities

Facilitate land development and credit support

Prepare an estate asset management plan (inventory) for government-owned revenue land, formulate cooperatives, and transfer large sums of revenue land to these cooperative societies (landless laborers)

3. Strategies for promoting Industrial Development

Three scenarios for future development are envisioned for the industrial development in the VDSR:

Scenario I: (minimal interventions)

Allowing industrial growth to take its own course with minimal interventions implies bridging infrastructure gaps (Effluent Conveyance facility, Bharuch-Dahej Road to be upgraded, develop an Integrated Freight Complex, Emergency Response Centers as safety measures, and a ports related service center with specialized facilities like repairing of cranes, dredgers, ships to be provided) Policy level changes (single window clearance, comprehensive investment policies for ports, industries, and others; proactive approach for marketing; local benefits, like industrial training centers for local populace to suit the demand of industries)

Scenario II: (most-likely scenario):

The creation of a Mega Chemical Zone having a conglomeration of various segments of industry proposes proactive measures to boost industrial development and targets improving infrastructure, identifying prospective industries, and conducting excessive marketing campaigns to attract investors. The availability of salt in the Taluka can be capitalized upon for attracting salt-based industries; prospective industries include petro-chemical, chemical (including salt based) and electrical and engineering. This strategy would involve the provision of high quality infrastructure and industry friendly regulations. Additionally it would provide adequate social infrastructure, ensure that benefits percolate to the local populace, identify prospective industries, bring about policy modifications, and a need for common consent between stake-holding government agencies.

Scenario III: (Special Economic Zone)

This scenario includes exploring the possibility of developing a Special Economic Zone (SEZ)/ Export Promotion Zone (EPZ) as a self-contained area having world-class infrastructure oriented toward export production. In India, 12 SEZs have been approved, three of which are in Gujarat- Positra near Okha, Kandla, Surat, and two have converted from EPZs to SEZ. The strategy proposed for Dahej is to explore possibility of creation of a Special Economic Zone, which would provide investors with a favorable environment for export production. This implies a basic change in the approach and policies, and some major proactive actions.

4. Strategies for Ports Development

Identify new locations for major and intermediate ports in the Dahej area. Facilitate the use of excessive capacity of existing ports such as GCPTCL, LNG Petronet, and Birla Copper jetties for liquid and dry cargo for export and import by other users. GMB and customs to provide necessary arrangements for export from existing jetties, and carry out demand estimation and facilitate port based activities accordingly.

Establish manufacturing and repairing facilities for cranes, dredgers and other floating crafts, and ship-repairing activities. Provide for warehousing and bulk cargo terminus, parking for industrial units and proposed RO - RO ferry to network Dahej – Gogha (covering gulf of Cambay)

5. Strategies for Traffic and Cargo Management

Railways

After carrying out a detailed feasibility study, establish link from Dahej to Vilayat and Bharuch through a broad gauge railway link for bulk cargo, freight & passenger traffic. This could be developed through a consortium of operating industries with Indian Railway and other major rail users by forming a Special Purpose Vehicle (SPV).

Warehousing and Bulk Cargo Terminus

Develop a bulk cargo terminus, warehousing, and specialized go-downs in near vicinity of ports, jetties, liquid chemical and products to be brought through pipelines to storage depots.

Small and medium units could rent the storage areas for hazardous and non-hazardous import and export based items; provide dedicated railways siding to loading and unloading of goods on demand in larger units

Road Improvement

Upgrade existing State Highway linking Dahej and Bharuch to four-lane divided carriageway road

Connect Vilayat industrial estate to NH and Dahej, linkage starts at Nabipur on NH-8

Few roads within the industrial estate are state highways; the need to be transferred under the jurisdiction of industrial authority for easier maintenance upgradation

Promote hotels, motels, and other transport-related activities along the Bharuch Dahej highway this will also support financial viability of road strengthening

The goods carriers plying from and to the Dahej industrial estate carry hazardous material, hence there should be mandatory training of vehicle drivers and staff on handling issues of hazardous products and raw materials

Designated parking areas are required for the carriers, hence, there is a need to provide adequate truck parking space, identify parking area and lease out to industries or their management association.

6. Strategies and recommendation for Social Infrastructure

After implementation of the Narmada irrigation canal project, with the induced development in agriculture and industrial sector, the different levels of infrastructure services demand would increase with the increase in population.

Appropriate housing provisions would have to be made and area would be allocated for residential near the industrial concentration at Atali (270 Ha) and also in the Vagra Urban zone (100 ha) for industrial employees.

Higher facilities like colleges and Industrial Training Institutes (ITI) to impart training to the natives are proposed in urban areas, and town level infrastructure like commercial areas and open spaces apart from educational and medical facilities have been proposed.

7. Strategies for Environmental and Safety Concerns

The future growth in the VDSR would have to be within the purview of environmental regulations of Ministry of Environment and Forests (MoEF). All the industries have to abide by environmental standards framed by statutory agencies. It is important that forest areas are preserved and the coastal area development is regulated under the Coastal Regulation Zone Notification.

Specific proposals include:

Control of Air Pollution

Reduction of evaporation of crude oil/gas products from storage tanks using floating roofs by using absorbers/diluters. Standardisation of the height of flare stacks

Pre-burning treatment to be introduced to various effluents before discharging to the atmosphere

Control of flare light by providing hood and canopy systems in the emission sources and monitoring of stack emissions and ambient air quality

Control of Water Pollution

As VDSR has a dearth of water, industrial wastewater should be segregated and recycled and reused as a water conservation method

Organic sludge from sewage treatment-cum-recycle plant to be used as organic manure for greenbelt development
Provide common effluent treatment plants for industries and sewage treatment plants for residential areas; industrial effluents to be discharged deep inside the sea through pipelines after primary treatment at the ETP's or CETP's. It is recommended that the discharge of wastewater in the sea should also be made strictly during low tide

For solid waste management, oily sludge must never be buried where it can be uncovered by tides; recovery of oil using bio surfactants can also be made.

A secured landfill is necessary for final disposal - by providing impervious liners to prevent any kind of soil contamination or chemical leakage.

Biological sludge can be used as organic manure in greenbelts

Control of Noise Pollution

Noise buffers in the form of walls around the units and tree plantation is recommended to further reduce noise levels

8. Strategies for Safety & Emergency Preparedness

As this industrial area deals with hazardous material, there is an urgent need for a disaster management center with the capability to deal with multiple disasters.

An individual on-site emergency plan is available to all the operational units in Dahej, a combined emergency plan for the industrial estate and surrounding areas should be prepared by Dahej Disaster Management Center.

Measures to be adopted in handling each product depending on the characteristics would need to be specified and Emergency Response Centers along roads need to be set up.

Develop a greenbelt around the Dahej industrial area, as plantation is the best investment an industrial estate can undertake to recurring and safeguarding its environment. Greenbelts help in the mitigation of fugitive gaseous emissions including the odor, arrests accidental releases, noise pollution control, wastewater reuse, ecological balance, prevent soil erosion, and improve the aesthetic environment.

9. Strategies for Water Management**Watershed management and artificial recharge:**

The VDSR has unfavourable physiographic characteristics, as it has a very high water table, salinity ingress, low rainfall, and constricted drains. Any large-scale irrigation project is unviable, hence VDSR has to wait for Narmada project to be implemented. However, a total of 50 structures are proposed in the VDSR, which include Nalabund, check-dams, percolation tanks and ravine reclamations. Recharge from rooftop rainwater harvesting is also considered, but would be too little due to very little roof top construction.

Suggested policy guidelines

Optimal use of water, formation of Water Users Associations (WUAs) after Narmada implementation

Resolve irrigation practices in some of the likely water logged areas through conjunctive use of surface and ground water

Introduce sustainable watershed programs with local participation and appropriate institutional development mechanisms

10. Strategic Approach to Land Management Plan

A Land Management Plan addresses Land Use Zoning, Development Control Regulations, and policy guidelines for management of the land, which involved following stages:

Land resource inventory analysing comprehensively physiographical, climatological features and land use activities to facilitate the decision-making process for future growth and land allocation.

Land capability analysis is based on soil characteristics - depth, texture, drainage, erosion, salinity, calcareousness, acidic/alkaline properties, particle size and gradients. For various soil units, cropping is suggested for both before and after Narmada implementation, to optimize the cropping yield

Land Suitability Analysis: prioritizes land use zoning based on relevant factors and appropriately reconciling with the present land use and includes two broad zones: Conservation Zones, delineated through the process of exclusion, and Development Zones Agriculture zone and Non-agriculture zones) delineated through the process of prioritization.

Land Use Zoning: primarily aimed at allocating land for facilitating and regulating economic activities and guiding future development in an organized and desired manner.

The Dahej Zone has an area of 16,953 ha, including Dahej industrial estate and five neighboring villages. A detailed Area Development Plan of the fast developing Dahej has been prepared. As per Scenario-II, population projections in the Dahej Zone have been considered. Five adjoining villages have registered high NA conversion of land and GIDC has 146 Ha. land in Atali village for township development.

As per Scenario-III, the total population in Dahej would be 176,000 and would require 7,700 ha land for the induced industrial development (SEZ). The land for various uses has been allocated as follows:

Area of Dahej Population Zone (16,953 Ha.), total area for industries (7,700 Ha.), existing estate area (4,400 Ha.), new industrial area (3,300 Ha.), residential area (270 Ha.), commercial and offices (130 Ha.), social infrastructure (0 Ha.), parks and gardens (50 Ha.), roads (150 Ha.), buffer zone (250 Ha.) and emergency Response Center (5 Ha.). Additionally, land has been allotted for transport terminus & godowns, gamtal area, water bodies, ravine reclamation, and other farm areas.

Implementation Strategy

Predominant economic activities in the VDSR are industries, ports, oil and natural gas exploration, salt production, and related support services. Although the area is abundantly endowed with natural and man-made resource potential, the pace of development has not been upto the expected levels. Given the development focus of the State, it becomes imperative that the State adopts a proactive role in developing areas to make them attractive for investment.

It is in this spirit that this study comprehensively attempts to provide a physical development framework with required development-friendly policies for making the VDSR attractive as an industrial investment destination. It is essential that an appropriate institutional structure is put in place for ensuring the implementation of the plan proposals and to undertake the proposed developmental activities. In addition to the industrial and infrastructure development related activities, proposals for development of natural resource regeneration and improvement strategies for agriculture and allied activities have also been made.

It is expected that the respective departments within the existing institutional framework would undertake the recommended strategies and action plans. The proposed institutional framework would mainly address the issues related to non-agricultural economic activities and the related infrastructure development to arrive at balanced development in the Vagra Dahej sub region.

The plan envisions proactive support from following departments for implementation of the proposed strategies and action plans to realize balanced development:

- Department of Agriculture & Cooperation
- Department of Revenue
- Department of Roads & Building

- Department of Mines & Industries
- Department of Railways
- Department of Environment & Forests
- Department of Ports and Fisheries
- Department of Energy & Petrochemicals
- Department of Narmada Water Resource and Water Supply
- Department of Health & Family Welfare
- Department of Urban Development and Urban Housing
- Department of Panchayats, Rural Housing, and Rural Development

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