PUNJAB VISION DOCUMENT 2047

GOVERNMENT OF PUNJAB, DEPARTMENT OF PLANNING

VIT-TE-YOJNA BHAWAN, SECTOR-33-A, CHANDIGARH

website: www.pbplanning.punjab.gov.in

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ਭਗਵੰਤ ਮਾਨ

ਮੁੱਖ ਮੰਤਰੀ, ਪੰਜਾਬ

Bhagwant Mann

Chief Minister, Punjab

Government of Punjab with its massive electoral mandate endeavors to take governance to people's doorsteps, and improve the well-being and prosperity of the people of Punjab. With this purpose in mind, it gives me immense pleasure to share with you "Vision 2047" - a vision of Punjab for the next 25 years.

Vision 2047-presents a roadmap that envisages a developed Punjab by 2047, i.e., the hundredth year of India's independence. This document is a vital part of our Government's sincere efforts to take Punjab to new heights of development and to create a prosperous Punjab. The document aims at converging efforts of different administrative departments and agencies to achieve sectoral goals. The challenges articulated in this document would lead to greater synergies of action at every level of governance.

I take pride in informing the people of Punjab that our government is working tirelessly to set targets for simplified, fast, effective and pro-people development in the State. We will further devote ourselves more rigorously to inclusive and accelerated growth of the State to achieve the targets identified in this document.

The efforts made by our senior officers from different administrative departments in preparing this document are praiseworthy. I appreciate the time spent in detailed and meticulous deliberations by all the stakeholders.

I acknowledge the efforts put in by the Department of Planning, fine work done by the Institute for Development and Communication (IDC), Chandigarh .

I dedicate "Vision 2047" to the people of Punjab and hope that we will all collectively work together to achieve the goal of the vision of a developed and transformed Punjab by 2047.

(Bhagwant Mann)

message

ਹਰਪਾਲ ਸਿੰਘ ਚੀਮਾ

ਵਿੱਤ ਤੇ ਯੋਜਨਾ ਮੰਤਰੀ, ਪੰਜਾਬ

Harpal Singh Cheema
Finance and Planning Minister, Punjab

Punjab urgently needs to rejuvenate its economy. Keeping this in view 'Vision 2047' document has been prepared in which strategies to build an integrated model with strong backward and forward linkages among different sectors have been proposed and also the strategy to synergise academia-government-industry (AGI) linkages has been worked out.

Vision 2047 is a comprehensive document that carefully highlights the current status, sector-wise challenges, short and long-term targets, and strategies to meet the identified targets. This document will be useful in understanding the current and projected trade-offs for making pro-people policies for the overall welfare of the people and sustainable development of the State.

The vision document has redefined quality parameters and processes for people's well-being. Along with this, strategies have been formulated to improve quality of education, health, sanitation, safe drinking water and electricity. The gaps between the castes, gender and geographical divides in terms of access to gains of development, health, education, social security and safety nets have been identified and policies have been suggested to bridge these disparities to build a socially just society. These identified issues have been interwoven into growth processes to bring about human and economic welfare. This detailed document will usher in an era of hope to bring Punjab back to its glory. I hope that this 'Vision 2047' document will act as a guiding document for successive governments and bureaucracy to focus their efforts and policies in right direction.

I congratulate all the officials involved in preparing the Vision 2047 document. I acknowledge the efforts the Department of Planning and its Principal Secretary, Shri Vikas Pratap, IAS, have put in. I also acknowledge the significant contribution made by Prof Pramod Kumar, Director, Institute for Development and Communication (IDC) Chandigarh, and his team for preparing this voluminous document.

I dedicate 'Vision-2047' document to the people of Punjab.

(Harpal Singh Cheema)

message

Vikas Pratap, IAS
Principal Secretary, Planning Punjab

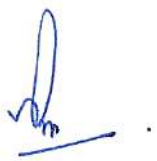
Vision 2047 document is a blueprint for the future of the State of Punjab in the 100th year of independence of the country. The document presents the targets to be achieved and strategies to follow to make our State "future ready".

The next 25 years are an opportunity to take the State to the next level of economic growth and to reclaim its prominent position, vis-a-vis other States, that Punjab once enjoyed.

As we all know a key challenge for the State is to ensure that the growth and development targeted to be achieved in the future are sustainable, with no further harm done to the State's natural resources. To achieve the objectives set out in the Vision-2047 document, Punjab has to manage its finances well, especially the revenue generation.

I appreciate the efforts the Department of Planning has put in, particularly by Sh. Rakesh Kumar, Joint Secretary Planning, Sh. Sumit Chopra, Director Planning, and Ms. Rajni Bala, Deputy Director for their assistance in completing the 2047 Vision document. I am also thankful to the Nodal officers from various departments for sharing their respective departments' visions and strategies. It would not have reached fruition without the active involvement of Prof Pramod Kumar and his team.They have weaved various competing themes within a holistic framework.

I am confident that together we shall pave the way for rebuilding the State and bring it back to the numero uno position.



(Vikas Pratap)

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Introduction

Punjab represents peculiar development paradoxes. On one hand, its performance on the well-being indicators is competitive with other States, while on the other hand, its trajectory of development is riddled with stagnation. It has been unable to carve out its path in a globalized neoliberal economy. Undoubtedly, the State's economy, in the initial years since the 1960s, has been growing (with few exceptions) at an annual rate in the vicinity of 5 percent. To illustrate, Punjab has low per capita income, but consumption in equalities and incidence of poverty are below the national average. Compared with States with higher growth trajectories and high per capita income (like Gujarat, Kerala, Maharashtra and Tamil Nadu), Punjab has performed relatively better on the citizens' well-being indicators.

The development process in Punjab has been much more inclusive. For instance, the rural-urban gap in the ownership and use of consumer durables and living facilities is lower in Punjab compared to other high-income States like Maharashtra and Gujarat. Similarly, the proportion of rural Scheduled Caste households owning various consumer durable goods and living facilities is higher in Punjab than in Maharashtra, Gujarat and Tamil Nadu.

Among the general population, poverty reduction has mainly been attributed to the development of agriculture and the trickling down of its benefits across rural and urban societies through forward and backward linkages. However, now the agricultural sector growth is under stress and can no longer be relied upon to remove poverty, especially among socially and economically disadvantageous groups like, women, scheduled castes and the migrant labour. There is a need for structural transformation of the economy to create employment opportunities for the poor in sectors other than agriculture. For the productive engagement of youth, the strategy should be to formulate and implement a market-friendly skill development policy as a part of the flagship programme of Skill India.

A comprehensive and focused strategy has to be formulated with a potential for higher growth rate. Direct poverty alleviation programmes alone are insufficient to eliminate poverty from the State, especially from amongst the socially handicapped groups, mainly because the productive resource base of these communities is fragile. In the long run, poverty can be alleviated by improving direct access of the poor to economic resources, particularly ownership of land and other productive resources, access to basic services,

natural resources, technology, and financial services, including microfinance and building the resilience of the poor for coping with climate-related shocks and disasters. Social indicators, however, do not complement the State's economic performance and leave much to be desired in translating economic gains intosocial outcomes for its people, especially keeping in mind the impact that improvementin social indicators has on the well-being of its people.

Given this perspective, the approach followed in the Vision 2047 document aims to take precedence over the future issues of a technology-driven, rapidly transforming society, such as prioritising goals concerning department-specific limitations, overcoming the constraints of segmented and compartmentalised administrative set- up or contemporary citizen-centric issue-based targets and strategies by focusing on the non-rigid and holistic policy prescriptions.

Punjab Vision 2047 Document consists of nine departmentalised sections and sixteen socio-economic indicator-based sub-sections focusing on the major challenges that the State is struggling with and envisages short-term and long-term strategies to overcome these challenges. The main challenges identified for the citizens' well-being are dignified living which includes ***Poverty*** (removal of poverty, especially among the socially and economically disadvantageous groups like women, scheduled castes and the migrant labour); ***Hunger*** (it is the poor who go hungry despite being at the lowest place at Hunger Index, the State's large number of women are suffering from anemia);***Livelihood*** (citizens' shorter engagement with livelihood opportunities, the lowest participation rate among women in the context of livelihood); and ***Shelter*** (poor housing amenities and facilities like, no facility of drinking water in the house, Katcha roof type house, and no drainage arrangement in the house etc.). The institutional factors for improving access to quality ***Education*** (inadequacy of separate Anganwari and Pre-School system, non-availability of digital infrastructure, e-learning platform, digital content; teachers not fully equipped with digital training and an alarming supply-side constraint concerning the number of teachers in primary and upper primary schools); ***Health*** (infrastructure, workforce, access, and financing issues); ***Sanitation*** (inadequacies of sewerage network, sewerage treatment plants, storm water drainage solid waste management and safe drinking water); and, ***Electricity*** (maintaining an uninterrupted power supply and taking care of the increasing power demand). The issues arising out of ***Caste*** (deprived in terms of access to land, education and health as compared to the non-scheduled castes); ***Gender*** (socially burdened biased expectations, roles and norms,

restrictions while accessing resources, facilities and responsibilities based on gender identity and social exclusion); and, ***Geographical Divides*** (regional disparities in terms of access to gains of development, social security and safety nets).

These identified issues have been interwoven into growth processes. Given the, precarious fiscal conditions and poor employability, the Vision Document has envisaged achieving rapid economic development with a major thrust on the secondary and tertiary sectors, strengthening inter-sectoral linkages, improving the fiscal health of the State, employment generation by expanding the industrial and service sectors through diversification and innovation and establishing a harmonious relationship between growth and environmental resources. For the agriculture sector, Vision 2047 emphasises diversification and developing a new higher-yielding variety of seeds and low reliance on chemical inputs. Another focus is to reduce the rural-urban gap further to the minimum in terms of standard of living, rural infrastructural and public amenities and facilities.

For industry, the focus is to incentivise essential industries, such as, bicycles, X-ray machines, ventilators, food and organic farming, sanitary equipment, etc., the revenue- generating industries, such as, hospitality, tourism, etc., shall be encouraged and incentivised. The document also proposes to encourage the Cotton Industry as the textile sector has huge employment potential and provides massive returns that would spur the liquidity in Punjab and would lead to a higher economic growth trajectory for the economy.

A services-led growth strategy focusing on health, education, IT, logistics, bulk courier services, knowledge-based and non-polluting services, sports etc., has been designed for implementation in right earnestness. For new ventures in the services sector, easy availability of loans and simplification of the regulatory processes have been envisaged. The document emphasises need to implement the strategies to build capacity and develop skills in consonance with the market demands. Similarly, improving health facilities based on the principle of an all-inclusive, sustainable and multi-stakeholder approach, with a focus on the people and their demands to meet the various health challenges regarding infrastructure, workforce, access, and financing issues, have been envisaged. For uplifting the socially marginalised sections i.e. women, third-gender and the scheduled castes, the State shall have to adopt a strategyaddressing the diverse need of the women through gender centres, such as, gender hubs and women cooperatives, and evolving innovative modes to make the scheduled castes a part of the socio-economic and political mainstream, to improve the

adverse sex ratio, focusing on nutrition, quality education, employment and ensuring a safe environment, especially against the sexual predators.

The strategies to meet the crisis in natural resources (involving water budgeting, niche crops), energy (set up renewable energy programs, reducing energy consumption), and climate change (sustainable transportation like, switching to electric vehicles, cutting down emissions, installing renewable sources of energy and waste-to- energy projects to target additional power generation and solid waste management) has been made integral to the growth process.

There is a need to provide digital platforms to the people living on the margins for rights-based governance and to make the systems more accountable in terms of costs, conduct and performance. Similarly, safety, security and equitable access to public services are the prerequisites for any functional democracy, and for generating wealth, eradicating poverty and social exclusion.

Given this, the Vision 2047 Document suggests a composite strategy by focusing on building income redistribution into the growth strategy itself. For instance, it has been visualised that by 2030, the income of the small farmers is to be doubled through technology upgradation, improvement in the soil quality, integrated water uses and provision of quality seeds, etc. It has been proposed to improve the land quality by restoring bio-diversity through deploying crop varieties in the fields, enrichment of a natural ecosystem and gene banks. A long-term strategy for diversification of the economy has been proposed by giving impetus to the modern small-scale industries and transforming the structure of employment from farm to non-farm through skill development and by building robust infrastructure. A dedicated rail freight traffic corridor, the creation of dry ports, a sustainable energy system linking rural areas with urban centres, and accessible and modern agricultural markets have been factored in to achieve double-digit growth. A special focus has been given to developing competitive human resources by improving the quality of education and skill development. The underlying thrust of the Vision Document is to create conditions for the vulnerable sections to avail of these opportunities in an equitable manner. There is also a sufficient emphasis on building institutional and citizen capacities and formulating a strategy to converge engaged governance with e-governance for trust-building, efficient and accountable delivery of services.

Pramod Kumar, Director, IDC

SECTION I

FINANCE AND ECONOMY

I. Economy

II. Finances

III. Employment

I
ECONOMY

Punjab's economy excelled almost for three decades starting from the mid-1960s, both on account of the rate of growth and per-capita income. During the post-economic liberalization period, the economy, however, started slowing down on many fronts. It is trailing behind in indicators like rate of growth, per capita income, industrial development, employment, investment and fiscal health. The persistent agrarian crisis has further compounded the economic distress of the State.

The present-day crises of the economy have their roots in the existing model of development led by agriculture. For dissipating the crisis, the State, must adopt new model of development rather than relying on the existing model. For rejuvenating the State's economy, the strategy is to develop an integrated model with strong backward and forward linkages among sectors.

Current Status

The status of the economy has been examined on the basis of the temporal behaviour of growth parameters: state income and per capita income; structural transformations in the economy; drivers of growth; agriculture-centric model of development; investment; fiscal health of the State; unemployment; and the relationship between growth and environmental resources.

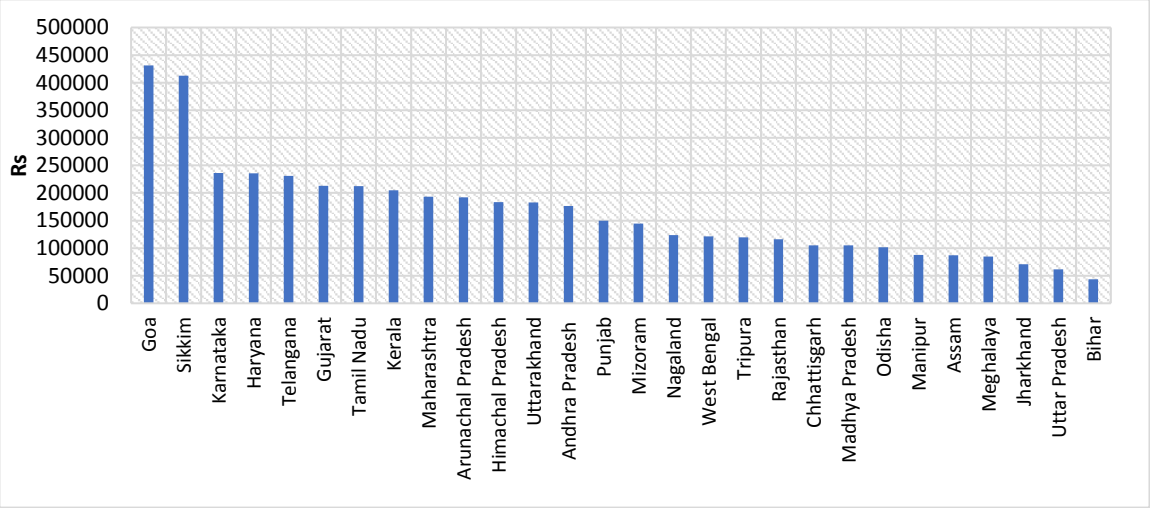
1. Temporal Behaviour of Growth Parameters: State Income and Per Capita Income

Punjab enjoyed economic supremacy among Indian states both on account of the rate of growth of the economy and per capita income. The State's GSDP experienced a growth rate of 5.0 per cent from 1970-71 to 1993-94 at constant 2004-05 prices. Punjab, in the mid-1960s, also occupied the first rank by replacing Maharashtra in the field of per capita income. In 1965-66, the per capita NSDP of Punjab was Rs 559, and that of Maharashtra was Rs 534 at current prices (Statistical Abstract of Punjab, 1975). The major driver of growth during this period was the commercialized agriculture sector.

After economic liberalization, the rate of growth of the economy, however, started decelerating. Economic supremacy in terms of per capita income among states also started oscillating from 1995-96 onwards and was finally replaced by other states. In 2020-21, the per capita NSDP of Punjab was Rs 1,49,894 at current prices, and the State occupied the fourteenth position among states (see Figure 1 and Table 1 in Annexure).

Industry, capital, service sectors and international trade are the epicentres of economic liberalization and globalization. The agriculture sector, unfortunately, was not the central focus of the economic reforms. Punjab being an agrarian state hence could not reap the benefits of the new economic policy and lost its economic supremacy in the process.

Figure 1: Per Capita Net State Domestic Product at Current Prices For 2020-21



Source: Ministry of Statistics and Programme Implementations, Government of India

During the recent decade, the temporal behaviour of state income (GSDP) reveals that from 2011-12 to 2020-21, Punjab experienced a growth rate of 4.6 per cent (at constant 2011-12 prices). In the case of per capita NSDP at constant prices, Punjab recorded a 3.0 per cent growth rate during the same period.

2. Structural Transformations in the Economy

The structural transformation in the economy of Punjab has been studied over time and in comparison, to five states, namely, Gujarat, Haryana, Karnataka, Maharashtra, and Tamil Nadu.

The empirical evidence suggests that the economy of Punjab has undergone structural transformations over time. At the beginning of economic reforms, the share of the primary sector was 46.1 per cent of the State's income (1993-94), the highest among selected states. The percentage of secondary and tertiary sectors in state income was 21.8 per cent and 32.1 per cent, respectively, suggesting the predominance of agriculture and allied sectors in the economy (see Table 2 in Annexure).

In the year 2011-12, the predominance of the primary sector was replaced by the tertiary sector. The share of the tertiary sector was 43.8 per cent, followed by the share of the primary sector (30.8 per cent). The share of the secondary sector was 25.4 per cent of state income. Though the tertiary Sector's share has increased in Punjab, however, it was the lowest among selected states except that of Gujarat (see Table 3 in Annexure).

The predominance of the tertiary sector was further strengthened in the year 2020-21. The tertiary sector contributed 45.9 per cent to the State's income- almost the same share that the primary sector contributed in the year 1993-94. In 2020-21, the share of the primary sector was 30.7 per cent and remained the highest among the selected states. The secondary sector contributed 23.3 per cent share to the State's income (see Table 4 in Annexure).

The foregoing analysis reveals that though the economy of Punjab witnessed structural transformations, however, the pace of structural transformations was lower than that of the selected states.

3. Drivers of Growth

In Punjab, during the initial period, agriculture and allied sectors were drivers of growth, followed by tertiary and secondary sectors. Gradually the tertiary sector took the lead as the driver of growth, followed by the primary and secondary sectors, which are closely competing with each other.

4. Agriculture-Centric Model of Development

The much-celebrated and acclaimed growth model of Punjab was essentially a single-sector project. Its thrust was on a national programme of agricultural development for

making the country self-sufficient in food grains and ensuring food security. Punjab at present has a sectoral combination comprising stagnating and crisis-ridden agricultural sector; a weakening industrial sector, and a slow-growing service sector. The agriculture and industry in Punjab are not developed in an integrated manner. Similarly, the non-farm activities in rural Punjab have not been developed through a well-designed policy package. Wheat, paddy and cotton are the three principal crops. In Punjab, a large share of the production of these crops is exported to other states. In 2020-21, about 99.56 per cent and 99.44 per cent of the marketed surplus of wheat and rice respectively was contributed to the Central Pool. The case of cotton is in no way different. The State exports the maximum of its food grains without value addition and imports most of the industrial products used as inputs in the agriculture sector from other states.

5. Investment

Punjab has suffered on account of investment, particularly after the mid-1990s. For example, the investment-GSDP ratio in Punjab was highest (32.27 per cent) in the year 1995-96. It came down to 13.4 per cent in the year 2011-12, and it improved slightly to 16.4 per cent in the year 2019-20, which was almost half of the 1995-96 investment-GSDP ratio. Since the post-liberalization phase, Punjab has not been attracting adequate fresh capital, especially foreign capital. The flow of foreign direct investment in Punjab is abysmally low. It was around 1.2 per cent of total foreign direct investment in the country in the year 2021. The major stumbling blocks in the way of fresh industrial capital are: (i) Locational disadvantages of the State from the national market, (ii) Poor natural resource base, (iii) Cumbersome, time-consuming and non-transparent procedure for clearing industrial projects, (iv) Expensive land, (v) Tax holidays to the neighbouring hill states in the past and (vi) Sensitive international border.

6. Fiscal Health of the State

The fiscal health of the economy is in a precarious condition. The fiscal parameters like mounting public debt, growing committed expenditure, low capital expenditure, increasing fiscal deficit, and lack of additional resource mobilization are the sources of serious concern in the State. The Fiscal health of the economy of the state is elaborated in the chapter II of section 1.

For keeping fiscal health in good condition, it is essential to get doses of additional resources on regular basis.

7. Unemployment

Punjab has a very interesting case of growth, creating jobs for the migrants and joblessness for the locals. This phenomenon is also undergoing a change because of the intensive mechanization of farm operations and hence suggesting job losses to the migrant labour as well. In Punjab, one finds negative employment elasticity of the agriculture growth. The existing industries barring a few also do not hold bright prospects of decent jobs for the local youth. The service sector, though, is offering around 40 per cent of jobs, but most of the jobs are not as per the aspirations of Punjabi youth.

According to the Periodic Labour Force Survey, in Punjab unemployment rate was 7.4 per cent, higher than the all-India rate of 5.8 per cent for the year 2018-19. Centre for Monitoring Indian Economy data reveals that the unemployment rate has increased to 8.5 per cent in June 2022, which was again higher than the all-India rate of 7.8 per cent. According to one estimate, at present, Punjab has around 25 lakh persons who are unemployed.

8. Relationship between Growth and Environmental Resources

The growth-centric development model in Punjab has recklessly exploited and polluted environmental resources. This model did help the country to attain self-sufficiency in food grains and the State to emerge supreme in economic prosperity. Industrial development in the State has also emerged as a culprit from an environmental sustainability perspective. It is pertinent to mention that in Punjab, around 57 per cent of industries fall in the red category, which highly pollute the environment.

Challenges

The Punjab economy at present is at a critical juncture and is facing several challenges:

KEY CHALLENGES

- Achieving faster and more inclusive development to restore the economic supremacy of State.
- Diversification of rural economy.
- Rapid industrialization led by smart technologies and making it complementary to agricultural development.
- Strengthening inter-sectoral linkages.
- Attracting both domestic and foreign capital.
- Developing quality infrastructure on a fast track.
- Improving fiscal health of the State.
- Generation of gainful employment.
- Developing a harmonious relationship between growth and environmental resources.

Vision

The State vehemently needs a paradigm shift in development strategy, postulating a long-term vision for 25 years, ensuring:

- High growth;
- Equitable Economy; and
- Environmentally sustainable development.

Punjab grew at a rate of 4.6 per cent p.a. (at constant 2011-12 prices) during the last decade (from 2011-12 to 2020-21). With a view to take the Punjab economy on a higher growth trajectory, two alternative rates of growth, one for the short run (2030) and the other for the long run (2047), have been worked out. Under the first alternative in the short-run (2030), the postulated rate of growth of the economy is 7.5 per cent, while for the long-run (2047), the postulated rate of growth is 10.0 per cent. These higher rates of growth are considered on the basis of economic strengths of Punjab, like well-developed infrastructure, industrial peace, high bank deposits, and demographic dividends, modernized agriculture equipped with state-of-the-art technology, sizeable Punjabi Diaspora and adequate markets.

The structure of the economy in the short-run (2030) has been projected, keeping in view the moderately developed industrial states. While for 2047, it has been postulated on the basis of the structure of the economy of the highly developed industrial states.

SHORT-TERM TARGETS AND STRATEGIES: 2030

Targets:

- Rate of Growth of the Economy: 7.5 per cent per annum.
- Structure of the Economy (per cent of major sectors in state income) as under: Primary Sector (22 per cent), secondary sector (28 per cent) and tertiary sector (50 per cent).

Drivers of Growth and Strategy

- Robust growth drivers by optimizing the traditional drivers, namely tertiary sector, secondary and primary sector and new sources of growth like knowledge and digital technology have been identified.
- Prudent fiscal management measures comprise resource mobilization, reducing public debt (40.0 percent of GSDP), limiting committed expenditure to 75 per cent of revenue receipts by rationalizing subsidies, increasing capital expenditure to 12.5 per cent of total expenditure from the present level of 6.3 per cent and bringing fiscal deficit within the prescribed limit of 3.0 per cent of GSDP as per FRBM Act, Punjab (2003) and extension in GST compensation for five years by the Union Government is considered. Improving fiscal efficiency by adopting outcome-based budgeting.
- The development strategy is to develop an integrated model with strong backward and forward linkages among sectors and diversification of the rural economy to promote high growth.
- Generating decent jobs by boosting investment in all sectors and building a synergy between industry and educational institutions to improve employability and startup ecosystems.
- Rapid industrialization led by knowledge and digital technologies.
- Making development equitable with new policy initiatives targeting lower strata of society.
- Promoting environmental sustainability, white and green industries, organic farming, judicial use of chemical inputs within prescribed limits and renewable energy.

LONG-TERM TARGETS AND STRATEGIES: 2047

Targets:

- Rate of Growth of the Economy: 10 per cent per annum
- Structure of the Economy (per cent of major sectors in state income) as under: Primary Sector (16 per cent), secondary sector (30 per cent) and tertiary sector (54 per cent).

Drivers of Growth and Strategy

- Robust growth drivers include tertiary sector, secondary and primary sector and also new sunrise sources of growth, like knowledge and digital technology.
- For improving the fiscal health of the economy on a sustained basis, the strategy is to mobilize additional resources and bring fiscal deficit to 3.0 per cent of GSDP as prescribed in the FRBM Act, Punjab (2003) and public debt to be reduced to 30 per cent of GSDP. Reducing committed expenditure to 60 per cent of revenue receipts by rationalizing subsidies, increasing capital expenditure by 20 per cent of the total expenditure, and eliminating wasteful expenditure by adopting zero-based budgeting (ZBB). Improving fiscal efficiency by adopting best practices introduced by Central and 11 State Governments in the field of outcome-based budgeting.

Annexure

Table 1:
State-wise Per Capita NSDP at Current Prices for 2020-21 (Rs) As on 01.08.2022

S. No.	State	2020-21	S. No.	State	2020-21
1	Goa	431351	15	Mizoram	144394
2	Sikkim	412754	16	Nagaland	123385
3	Karnataka	236451	17	West Bengal	121267
4	Haryana	235707	18	Tripura	119789
5	Telangana	231103	19	Rajasthan	115933
6	Gujarat	212821	20	Chhattisgarh	104943
7	Tamil Nadu	212174	21	Madhya Pradesh	104894
8	Kerala	205067	22	Odisha	101501
9	Maharashtra	193121	23	Manipur	87832
10	Arunachal Pradesh	192360	24	Assam	86857
11	Himachal Pradesh	183333	25	Meghalaya	84638
12	Uttarakhand	182698	26	Jharkhand	71071
13	Andhra Pradesh	176707	27	Uttar Pradesh	61666
14	Punjab	149894	28	Bihar	43605

Source: Ministry of Statistics and Programme Implementation, Government of India

Table 2:
Sectoral Distribution of State Income: 1993-94 (at Current Prices, Base: 1993-94) (%)

	Primary	Secondary	Tertiary
Gujarat	25.5	35.8	38.8
Haryana	42.4	26.2	31.3
Karnataka	36.3	25.4	38.3
Maharashtra	20.2	32.8	47.1
Punjab	46.1	21.8	32.1
Tamil Nadu	24.8	33.7	41.5

Source: Ministry of Statistics and Programme Implementations, Government of India

Table 3:
Sectoral Distribution of State Income: 2011-12 (at Current Prices, Base: 2011-12) (%)

	Primary	Secondary	Tertiary
Gujarat	22.8	40.5	36.7
Haryana	23.6	31.6	44.9
Karnataka	14.5	28.7	56.8
Maharashtra	18.0	30.9	51.1
Punjab	30.8	25.4	43.8
Tamil Nadu	13.1	36.4	50.5

Source: Ministry of Statistics and Programme Implementation, Government of India

Table 4:
Sectoral Distribution of State Income: 2020-21 (at Current Prices, Base: 2011-12) (%)

	Primary	Secondary	Tertiary
Gujarat	19.8	42.9	37.3
Haryana	20.0	31.1	48.9
Karnataka	15.0	18.7	66.3
Maharashtra	15.6	24.4	60.1
Punjab	30.7	23.3	45.9
Tamil Nadu	12.9	32.7	54.3

Source: Ministry of Statistics and Programme Implementation, Government of India

PUNJAB ECONOMY: VISION 2047
TARGETS, SHORT AND LONG-TERM STRATEGIES

Indicator	Current Status/Baseline		Target/s 2030		Target/s 2047		Strategies
RATE OF GROWTH OF THE ECONOMY	4.6% per annum (GSDP) (From 2011-12 to 2020-21 at Constant 2011-12 Prices)		7.5% p.a.		10.0% p.a.		• The development strategy comprises the optimization of the traditional drivers of growth, namely the primary, secondary and tertiary sectors and new sources of growth like knowledge and digital technology. • Making development equitable with new policy initiatives targeting lower strata of society. • Based on development experience, the strategy would be to steer the economic structure of the economy in favour of the non-agriculture sector, particularly the manufacturing sector.
STRUCTURE OF THE ECONOMY	Share of the major sector in state income as (%) (2020-21)		Share of the major sector in state income as (%)		Share of the major sector in state income as (%)		
	Primary sector	30.7	Primary sector	22.0	Primary sector	16.0	
	Secondary sector	23.3	Secondary sector	28.0	Secondary sector	30.0	
	Tertiary sector	45.9	Tertiary sector	50.0	Tertiary sector	54.0	
AGRICULTURE	Agriculture is the major driver of growth in Punjab. The phenomenal increase in the yield of wheat and paddy proved a boon for the State. The yields of both crops, however, have reached a plateau. This, coupled with the decline in public investment, terms of trade against agriculture, etc., has resulted in an agrarian crisis.		Diversification of agriculture and rural economy.		Diversification of agriculture and rural economy.		With a view to mitigate the agrarian crisis, the considered strategy is to diversify agriculture and the rural economy particularly by promoting non-farm activities including rural industrialization.
INDUSTRY	• The share of the manufacturing sector is 13.6% of State Income, suggesting a moderate industrial base (2020-21). • State's industrial structure is dominated by small-scale units characterized by (i) outdated technology, (ii) high cost and (iii) low-quality goods. • Industrial development is uneven across districts. Three districts namely, Ludhiana, Jalandhar and Amritsar, constitute almost half (47.84 per cent) of the total industries in the State.		Share of the manufacturing sector in state income: 20.0%		Share of the manufacturing sector in state income: 25.0%		• Three types of industries need to be incentivized to make Punjab an industrial hub: i. High-tech agro-based industries making them farmer's centric; ii. Footloose industries and; iii. Advanced digital technology and knowledge-driven industries. • Upgradation and modernization of existing industrial units.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
SERVICE SECTOR	The service sector is the backbone of Punjab's economy. It is contributing the maximum (46 per cent) to the state income. Service sectors, barring a few sub-sectors, are using traditional technologies.	Consolidating the service sector by developing sunrise services and making it a trusted engine of growth.	Consolidating the service sector by developing sunrise services and making it a trusted engine of growth	The strategy for making the service sector a reliable engine of growth is to develop sunrise services like information technology-enabled services (ITES), including BPO, online education, social media and entertainment; cyber security; environmental services; Fintech (Financial technology business) services; quaternary/knowledge services like scientific research, bio-technology, education, consultancy, IPRs; quinary services delivered by top decision-makers relating to new ideas/policies, data interpretation, and application, evaluation of new technologies. The application of digital technologies in the service sector will also be incentivized.
INTER-SECTORAL LINKAGES	Punjab's Economy has relatively weak sectoral linkages.	Strengthening inter-sectoral linkages.	Strengthening inter-sectoral linkages.	For promoting high growth, the strategy is to develop an integrated model with strong backward and forward linkages among sectors (triple-engine of development).
QUALITY INFRASTRUCTURE	Punjab has a well-developed infrastructure and is among top ranking states.	Improving the quality of existing infrastructure, and promoting the penetration of digital infrastructure.	Improving the quality of existing infrastructure, and promoting the penetration of digital infrastructure.	With a view to harness the full potential of infrastructure, the strategy is to improve the quality of existing infrastructure and promote the penetration of digital infrastructure.
INVESTMENT	• Punjab has suffered on account of investment, particularly after the mid-1990s. • The investment-GSDP ratio in Punjab was highest (32.27%) in the year 1995-96. • Investment-GSDP ratio came down to almost half (16.4%) in 2019-20 much below the national average (32.0%) and selected states.	The investment-GSDP ratio: 25.0%	Restoring the investment-GSDP ratio of Punjab (1995-96)/national average (2019-20): 32.0%	For attracting both domestic and foreign capital, an aggressive strategy in the form of improving the investment climate in the State and initiating economic governance reforms like the adoption of the decentralized and digital technology-centric governance model for time-bound and corruption-free clearance of industrial projects.

Indicator	Current Status/Baseline		Target/s 2030	Target/s 2047	Strategies
FISCAL HEALTH	The fiscal health of the economy is in a precarious condition.		Improving fiscal health of the State.	Improving fiscal health of the State.	By adopting a strategy of (i) introducing new progressive taxes; (ii) broadening the tax base of the existing taxes; (iii) improving tax compliance; (iv) implementing digital technology-driven tax reforms; (v) increasing user charges, (vi) improving the performance of public sector undertakings, disinvestment and asset monetization; (vii) rationalizing subsidies and reducing over-dependence on public debt; (viii) mobilizing additional resources from tax and non-tax revenue sources and containing expenditure. Reducing unproductive and wasteful expenditure by employing Zero-based budgeting (ZBB) system. Improving fiscal efficiency by adopting outcome-based budgeting.
	FISCAL DEFICIT	4.80% of GSDP	3.0% of GSDP	3.0% of GSDP on a sustained basis	
	COMMITTED EXPENDITURE	Above 90.0% of the total Revenue Receipts (including power subsidy)	75.0% of total Revenue Receipts (including Power Subsidy)	60.0% of total Revenue Receipts (including Power Subsidy)	
	CAPITAL EXPENDITURE	6.4% of total expenditure	12.5% of total Expenditure	20.0% of total Expenditure	
	OUTSTANDING DEBT	49.1% of GSDP	40.0% of GSDP	30.0% of GSDP	
UNEMPLOYMENT	The job profile of farm activities is not in consonance with the job preferences of educated Punjabi youth and hence the State is experiencing large-scale unemployment and out-migration of youth. The unemployment rate was 8.5 per cent in June 2022 (CMIE), higher than the all-India rate of 7.8 per cent.		Reducing the incidence of unemployment.	Reducing the incidence of unemployment.	Generating decent jobs by boosting investment in all sectors and building a synergy between industry and educational institutions to improve employability and startup ecosystems.
RELATIONSHIP BETWEEN GROWTH AND ENVIRONMENTAL RESOURCES	• The growth-centric development model in Punjab has recklessly exploited and polluted environmental resources. • The intensity of sickness of environmental resources has reached an alarming stage and started playing havoc with the lives of people.		Making development environment friendly.	Making development environment friendly.	For promoting environmental sustainability, white, green and orange industries, organic farming, judicial use of chemical inputs within prescribed limits and renewable energy needs to be incentivized.

II
FINANCES

Fiscal health depends upon the rate of growth of the economy which in turn depends upon economic stimuli provided in the budget. The fiscal health of the economy is in a precarious condition mainly due to mounting public debt and debt servicing, increasing fiscal deficit, growing committed expenditure, low capital expenditure and lack of additional resource mobilization. For improving the fiscal health of the economy, the suitable strategy is prudent fiscal management.

Current Status:

The fiscal health of the State has been examined on the basis of trends in revenue and capital receipts; trends in revenue, capital and other expenditure; public debt; deficit parameters; and additional resource mobilization.

1. TRENDS IN REVENUE RECEIPTS

Revenue receipts comprise the State's own tax revenue, State's own non-tax revenue, share of Central taxes and grants-in-aid from the Centre.

State's Own Tax and Non-Tax Revenue

The State's own tax revenue receipts show a declining trend. The share of own tax revenue was 50.3 per cent in the total revenue receipts in 2004-05, which declined to 47.7 per cent in 2021-22. Similarly, the share of the State's non-tax revenue has declined over time. Its share was 38.8 per cent in total revenue receipts in 2004-05, which declined drastically to 6.3 per cent in 2021-22 (see Table 1 in Annexure).

Central Transfers

The declining trends in the State's own tax revenue and non-tax revenue have resulted in increased dependence on the central transfers of funds (share in Central taxes + grants from the Centre). For example, in 2004-05, the share of central funds was 10.9 per cent which increased to as high as 46.0 per cent in total revenue receipts during the year 2021-22.

Rate of Growth of Revenue Receipts

The growth profile reveals that revenue receipts grew at a compound annual growth rate of 10.8 per cent during the financial year 2004-05 to 2021-22 in Punjab (see Table 1 in Annexure). The State's own tax revenue registered a compound annual growth rate of 10.4 per cent from 2004-05 to 2021-22. The State's own non-tax revenue experienced a negative compound annual growth rate of 0.5 per cent during the same period. Share of central taxes and grants from the Centre witnessed a growth rate of 18.1 per cent and 23.2 per cent per annum during 2004-05 to 2021-22, respectively (see Table 1 in Annexure).

Performance of Punjab's Own Tax Revenue vis-a-vis Other States

It's not only that the share of the State's own tax revenue is declining; Punjab's performance on account of (i) the State's own tax revenue as a percentage of GSDP and (ii) per-capita tax revenue in comparison to other states is also not satisfactory.

(i) State's own tax revenue as a percentage of GSDP

The State's own tax revenue as a percentage of GSDP measures the State's ability to generate tax revenue through its own efforts. In the case of Punjab, its own tax revenue-GSDP ratio works out to be 6.1 per cent during 2015-16 to 2020-21. Punjab is almost in the middle (13th rank) of all the states, revealing that Punjab has not harnessed the economy's full potential to generate tax revenue of its own (see Table 2 in Annexure).

(ii) Per-capita tax revenue

It's not only that Punjab's performance on account of the tax-GSDP ratio is low, Punjab's position in the case of per-capita tax revenue is also dismal. During 2019-20, Punjab with Rs 13,403 per-capita tax revenue, was ranked 22 among the Indian States (see Table 3 in Annexure).

2. TRENDS IN CAPITAL RECEIPTS

Capital receipts comprise (i) public debt excluding ways and means advances; (ii) ways and means advance and (iii) recovery of loans/non-debt receipts.

The share of public debt, excluding ways and means advances in capital receipts, has increased drastically over time (see Table 4 in Annexure). Its share in total capital receipts was 58.4 per cent in 2004-05, which increased to as high as 94.7 per cent in the year 2021-22, suggesting capital receipts' over-dependence on public debt. This phenomenon is not sustainable as the repayment of debt and its interest become a perennial fiscal problem.

The share of ways and means advances in total capital receipts decreased from 40.4 per cent in the year 2004-05 to 4.8 per cent during 2021-22.

The percentage share of non-debt receipts in the total capital receipts remained less than 1.0 per cent except for a few years. This is a serious fiscal problem as non-debt receipts are a very important facet of the fiscal health of the economy.

Rate of Growth of Capital Receipts

A perusal of the growth rate of capital receipts and its components reveal that capital receipts grew at a compound annual growth rate of 8.2 per cent from 2004-05 to 2021-22 (see Table 4 in Annexure). Public debt, excluding ways and means advances, experienced a growth rate of 11.3 per cent per annum during the same period. Ways and means advances registered a negative annual growth rate of 4.5 per cent from the financial year 2004-05 to 2021-22. Non-debt receipts grew at a compound annual growth rate of 2.6 per cent between 2004-05 and 2021-22.

3. TRENDS IN TOTAL RECEIPTS

The share of revenue receipts in the total receipts increased from 55.98 per cent in 2004-05 to 65.44 per cent in 2021-22. On the other hand, the share of capital receipts in total receipts declined from 44.02 per cent to 34.56 per cent during the same period.

4. TRENDS IN REVENUE EXPENDITURE

Revenue expenditure of the State comprises salaries and wages (including grant-in-aid salary), pensions and retirement benefits, interest payments and other revenue expenditures.

Table 5 in Annexure shows that the share of salaries and wages in total revenue

expenditure decreased from 34.6 per cent in the year 2004-05 to 28.8 per cent during 2021-22. The share of pension and retirement benefits in total revenue expenditure increased from 8.8 per cent in the year 2004-05 to 15.3 per cent during 2021-22. The share of interest payments in total revenue expenditure decreased from 23.2 per cent in the financial year 2004-05 to 19.6 per cent in 2021-22. The share of other revenue expenditure in total revenue expenditure was 33.4 per cent in the year 2004-05, which increased to 36.3 per cent in the year 2021-22.

Rate of Growth of Revenue Expenditure

The overall revenue expenditure registered an annual growth rate of 10.7 per cent during the financial year 2004-05 to 2021-22. Salaries and wages grew at a compound annual growth rate of 9.5 per cent during the same period. However, pension and retirement benefits experienced a higher rate of growth (14.3 per cent) during 2004-05 to 2021-22. Interest payments grew at a compound annual growth rate of 9.6 per cent during the same period. The growth rate of other revenue expenditure during the period 2004-05 to 2021-22 was 11.2 per cent.

Trends in Committed Expenditure

Salaries and wages, pension and retirement benefits and interest payments comprise committed expenditure, which government must meet. Committed expenditure constitutes a major share of the revenue receipts. The percentage share of committed expenditure in total revenue receipts was 82.9 per cent and 78.4 percent during 2004-05 and 2021-22 respectively. In case power subsidy is considered a component of committed expenditure, then the share of committed expenditure exceeds 90.0 per cent of the total revenue receipts. The higher consumption of revenue receipts by the committed expenditure leaves meagre resources for social services like education, health and economic services, including primary, secondary and tertiary sector activities.

Committed expenditure grew at a compound annual growth rate of 10.4 per cent during the financial year 2004-05 to 2021-22.

5. TRENDS IN CAPITAL AND OTHER EXPENDITURES

Capital expenditure

Capital expenditure is incurred upon the creation of productive assets, which play a pivotal role in stimulating growth in the economy. In Punjab, capital expenditure was Rs 761 crores in the year 2004-05, and it increased to Rs 8,010 crores in the year 2021-22; thus, it registered an annual growth rate of 14.9 per cent.

Other expenditures

In Punjab, repayment of public debt was Rs 3,017 crores in the year 2004-05 which increased (five-fold) to Rs 17,273 crores in the year 2021-22. The manifold increase in the repayment of public debt leaves lesser funds at the command of the government to spend on development projects.

Repayment of ways and means advances was Rs 4,555 crores in 2004-05 and declined to Rs 2,006 crores in 2021-22. Advances of loans were Rs 97 crores in 2004-05, which increased to Rs 1,576 crores in 2021-22.

Rate of Growth of Capital Expenditure

Capital expenditure grew at a compound annual growth rate of 14.9 per cent from 2004-05 to 2021-22. Repayment of public debt (excluding ways and means advances) experienced an annual growth rate of 10.8 per cent per annum during the same period. Repayment of ways and means advance registered a negative annual rate of growth of 4.7 per cent from 2004-05 to 2021-22. Advances of loans grew at a rate of 17.8 per cent during the same period (see Table 6 in Annexure).

6. TRENDS IN TOTAL EXPENDITURE

Total expenditure comprises revenue expenditure, capital expenditure, repayment of public debt excluding ways and means advances, repayment of ways and means advances and advances of loans.

In the financial year 2004-05, revenue expenditure was 67.11 per cent, while capital expenditure constituted 2.97 per cent of the total expenditure. The remaining share (29.92) was that of other components. The respective share in the financial year 2021-

22 was 76.97 per cent, 6.39 per cent and 16.64 per cent (see Table 6 in Annexure).

Total expenditure grew at a rate of 9.8 per cent during the financial year 2004-05 to 2021-22.

7. OUTSTANDING PUBLIC DEBT

The government resorts to borrowing to meet the difference between expenditure and receipts. The expenditure of the State, including committed expenditure, is growing exponentially. The contribution of non-tax revenue, particularly due to loss-making public enterprises, is also meagre. In this backdrop, most states, including Punjab, have resorted to borrowing routes to meet their expenditure. In Punjab, public debt, however, has gone out of proportion. Outstanding debt was Rs 47,548 crores in 2004-05. Table 7 in Annexure shows that the outstanding debt increased to Rs 2,81,444 crores (2021- 22) and constituted 49.1 per cent of the state income, which is the highest among states. The 15th Finance Commission has recommended a limit of 32.5 per cent of GSDP for all states in aggregate by the financial year 2025-26.

The Effective Outstanding Debt (2021-22) stood at Rs 2,60,953 crores (45.48 per cent of GSDP at current prices). The Effective Outstanding Debt is arrived at after excluding Back-to-Back loans received from the Government of India in lieu of GST Compensation: Rs 20,491 crores from total outstanding debt.

Outstanding debt grew at a rate of 11.0 per cent during the financial year 2004-05 to 2021-22.

The over-dependence on public borrowing in the long run adversely affects the economy as the servicing of the debt becomes a perennial liability. For repayment of outstanding debt, the government resort to another higher dose of public borrowing, and subsequently, the economy is trapped in the vicious circle of public debt. Punjab has entered this stage. In this situation, a substantial proportion of the public debt is used towards repayment of the old debt and interest payments, and finally, the development/capital projects in the economy suffer.

8. DEFICIT PARAMETERS

The fiscal position of Punjab is examined on the basis of three key deficit indicators: revenue deficit, fiscal deficit and quality of fiscal deficit.

(i) Revenue Deficit

Revenue Deficit is the difference between revenue expenditure and revenue receipts. According to the Fiscal Responsibility and Budget Management (FRBM) Act, 2003, states should aim for a revenue-neutral or surplus budget. Table 8 in Annexure reveals that Punjab has a revenue deficit throughout the period. It has oscillated between 1.14 per cent and 3.50 per cent of GSDP during 2004-05 to 2021-22.

The effective revenue deficit as a percentage of GSDP was 1.69 per cent and 1.05 per cent during the year 2020-21 and 2021-22, respectively. The effective revenue deficit is arrived at after considering Back-to-Back loans received from the Government of India in lieu of GST Compensation as part of Revenue Receipts of Rs 8,359 crores (2020-21) and Rs 12,132 crores (2021-22). It has never achieved the norm of the FRBM Act, 2003 and suggests serious fiscal concern.

(ii) Fiscal Deficit

The fiscal deficit shows the excess of expenditure over receipts. In Punjab, it has increased over time. It was Rs 4,115 crores in 2004-05 and increased almost seven-fold to Rs 27,519 crores in 2021-22. The fiscal deficit as a percentage of GSDP has oscillated between 2.44 per cent to 12.18 per cent. In the year 2021-22, the fiscal deficit was 4.8 per cent of GSDP.

The effective fiscal deficit as a percentage of GSDP was 2.69 per cent and 2.68 per cent during the year 2020-21 and 2021-22, respectively. The Effective Fiscal Deficit is arrived at after considering Back-to-Back loans received from the Government of India in lieu of GST Compensation as part of Revenue Receipts of Rs 8,359 crores (2020-21) and Rs 12,132 crores (2021-22).

(iii) Quality of Fiscal Deficit

The quality of fiscal deficit is measured by the ratio of revenue deficit to fiscal deficit

suggesting the extent of borrowing used for consumption/current expenditure. The percentage of revenue deficit to fiscal deficit has remained high over the years and was as high as 65.92 per cent in 2021-22, indicating that the quality of fiscal deficit has deteriorated in the State (see Table 8 in Annexure). The percentage of effective revenue deficit to the effective fiscal deficit in 2021-22 was 39.04 per cent.

9. ADDITIONAL RESOURCE MOBILIZATION

The budget document reveals no additional resource mobilization. For keeping fiscal health in good condition, it is essential to get doses of additional resources on regular basis.

Challenges

In light of the above discussion the key challenges faced by state finances are listed below:

KEY CHALLENGES

- Mobilization of additional resources.
- Improving tax compliance.
- Pruning committed expenditure.
- Mitigating unproductive and wasteful expenditure.
- Increasing capital expenditure.
- Reducing dependence on public debt.
- Bringing fiscal deficit within prescribed limits.
- Achieving zero norm in case of revenue deficit.
- Improving the efficiency of financial resources.

Vision

Improving the fiscal health of the economy by envisioning prudent fiscal management comprising sufficient resource mobilization, reducing dependence on public debt, containing committed expenditure, eliminating wasteful expenditure, ramping up capital expenditure, bringing revenue and fiscal deficits within prescribed limits and improving the efficiency of fiscal resources.

Short-Term Targets and Strategies: 2030

Improving fiscal health of the economy by learning from the experiences of better-performing states by mobilizing additional resources, controlling committed expenditure, mitigating unproductive expenditure, increasing capital expenditure and reducing the fiscal deficit and public debt based on the recommendations of the 15th National Finance Commission by adopting a combination of the following strategies:

(i) Improving tax revenue, particularly after the end of the GST compensation period on June 30, 2022. Tax revenue can be improved by bringing it at par with best-performing states. For example, Punjab's tax-GSDP ratio was 6.1 per cent during 2015-16 to 2020-21. The target is to improve it to 7.5 per cent, matching it with best-performing states. This target can be achieved by (i) introducing new progressive taxes, (ii) broadening the base of existing taxes, (iii) improving tax compliance and (iv) implementing digital technology-driven tax reforms.

(ii) It is recommended that an extension in GST compensation for five years may be considered by the Union Government.

(iii) The performance of the non-tax revenue of Punjab has deteriorated drastically. The State to increase the share of non-tax revenue to 15.0 per cent in total revenue receipts by 2030. The strategy for this is a combination of increasing user charges, improving the performance of public sector undertakings, disinvestment and asset monetization.

(iv) Committed expenditure (including Power Subsidy) to be reduced to 75.0 per cent of the revenue receipts by rationalizing subsidies and reducing over-dependence on public debt.

(v) The capital expenditure to be increased from the present level of 6.4 per cent to 12.5 per cent of the total expenditure by containing expenditure, particularly committed expenditure.

(vi) As per the recommendations of the 15th National Finance Commission, the fiscal deficit is to be reduced to 3.5 per cent in 2022-23, and further to 3.0 per cent during 2023-26 by increasing revenue and reducing expenditure.

(vii) For containing public debt, the State to reduce public debt as a percentage of state

income to 40 per cent by the year 2030. Though, the 15th Finance Commission has prescribed this limit of 32.5 per cent for all the states in aggregate by 2025-26. But given the highest proportion of public debt as a percentage of GSDP (49.1 per cent) in Punjab, it is difficult to achieve the target by 2025-26. The strategy to achieve this target is to mobilize additional resources from tax and non-tax revenue sources and control expenditure.

(viii) Reducing unproductive and wasteful expenditure by employing Zero-based budgeting (ZBB) system.

(ix) To improve fiscal efficiency, State to consider outcome-based budgeting. Already Central and 11 State Governments have adopted outcome-based budgeting.

Long-term Targets and Strategies: 2047

The vision is to make Punjab one of the most fiscally disciplined states by learning from the best practices of the Union Government and best-performing states. The fiscal discipline is to be achieved by increasing tax and non-tax revenue, reducing dependence on public debt, reducing committed expenditure, hiking capital expenditure and keeping the fiscal deficit within the prescribed limit of 3.0 per cent of GSDP on a sustained basis.

For keeping and sustaining good fiscal health of the economy following targets and strategies to be adopted:

(i) Improving tax revenue, particularly after the end of the GST compensation period on June 30, 2022. Tax revenue to be improved by increasing the Tax-GSDP ratio to 12.5 per cent. This target can be achieved by a strategy of (i) introducing new progressive taxes, (ii) broadening the base of existing taxes, (iii) improving tax compliance and (iv) implementing digital technology-driven tax reforms.

(ii) Increasing the share of non-tax revenue to 25.0 per cent in total revenue receipts by 2047. The strategy for this is a combination of increasing user charges, improving the performance of public sector undertakings, disinvestment and asset monetization.

(iii) Committed expenditure (including Power Subsidy) to be brought to the limit of 60.0 per cent of the revenue receipts by rationalizing subsidies and reducing over-dependence on public debt.

(iv) The capital expenditure to be increased from the present level of 6.4 per cent to 20.0 per cent of the total expenditure by containing expenditure, particularly committed expenditure.

(v) As per the recommendations of the FRBM Act, Punjab, the fiscal deficit is to be reduced to 3.0 per cent by the year 2047 on a sustained basis, by increasing revenue and reducing expenditure.

(vi) For reducing public debt, the State to reduce public debt as a percentage of state income to 30.0 per cent by the year 2047. The strategy for reducing public debt is to mobilize additional resources from tax and non-tax revenue sources and control expenditure.

(vii) Weeding out productive expenditure on obsolete programmes by employing Zero based budgeting (ZBB).

(viii) Improving fiscal efficiency by adopting best practices introduced by Central and 11 State Governments in the field of outcome-based budgeting.

Annexure

Table 1:
Composition of Revenue Receipts of Punjab FY 2004-05 to 2021-22

	Share in Total Revenue Receipts (per cent)				Total Revenue Receipts (Rs Crores)
	State's Own Tax Revenue	State's Own Non-Tax Revenue	Share in Central Taxes	Grants from the Centre	
2004-05	50.30	38.81	6.54	4.36	13807
2005-06	52.98	26.74	7.23	13.05	16966
2006-07	53.69	23.66	9.32	13.34	16795
2007-08	51.46	27.31	10.27	10.96	19238
2008-09	53.83	27.92	10.06	8.18	20713
2009-10	54.34	25.51	9.68	10.47	22157
2010-11	60.95	19.31	11.05	8.69	27608
2011-12	71.82	5.33	13.55	9.30	26234
2012-13	70.47	8.20	12.66	8.66	32051
2013-14	68.59	9.09	12.62	9.69	35104
2014-15	65.53	7.38	12.05	15.04	39023
2015-16	64.28	6.38	19.29	10.05	41523
2016-17	57.82	12.22	20.01	9.95	47985
2017-18	57.39	8.15	20.03	14.43	53010
2018-19	50.71	12.18	19.28	17.84	62269
2019-20	48.71	10.81	16.80	23.68	61575
2020-21	43.52	6.01	15.41	35.06	69048
2021-22	47.67	6.33	19.50	26.51	78343
CAGR (%)	10.4	-0.5	18.1	23.2	10.8

Source: Department of Finance, Government of Punjab and Punjab Budget at a Glance, Various Issues.

Table 2:
State-wise Tax-GSDP Ratio (2015-21)

	2015-21	Rank		2015-21	Rank
Chhattisgarh	7.4	1	**Bihar**	5.5	15
Telangana	7.4	2	**Jharkhand**	5.5	16
Uttar Pradesh	7.2	3	**West Bengal**	5.4	17
Maharashtra	6.8	4	**Assam**	5.3	18
Goa	6.7	5	**Gujarat**	5.3	19
Kerala	6.7	6	**Himachal Pradesh**	5.2	20
Tamil Nadu	6.5	7	**Meghalaya**	5.2	21
Andhra Pradesh	6.4	8	**Arunachal Pradesh**	5.0	22
Karnataka	6.4	9	**Uttarakhand**	5.0	23
Rajasthan	6.4	10	**Manipur**	3.8	24
Odisha	6.3	11	**Tripura**	3.7	25
Madhya Pradesh	6.2	12	**Sikkim**	3.1	26
Punjab	6.1	13	**Mizoram**	2.9	27
Haryana	5.9	14	**Nagaland**	2.8	28

Source: State of State Finances: 2020-21, PRS Legislative Research.

Table 3:
State-wise Per Capita Total Tax Revenue FY 2019-20

	Rs	Rank		Rs	Rank
Jharkhand	98491	1	**Himachal Pradesh**	16743	15
Arunachal Pradesh	67257	2	**Andhra Pradesh**	16350	16
Sikkim	48746	3	**Uttarakhand**	16340	17
Goa	47061	4	**Tripura**	15659	18
Mizoram	31136	5	**Chhattisgarh**	14540	19
Telangana	22305	6	**Gujarat**	14411	20
Karnataka	20096	7	**Odisha**	14314	21
Nagaland	19463	8	**Punjab**	13403	22
Kerala	18898	9	**Madhya Pradesh**	12635	23
Meghalaya	18744	10	**Rajasthan**	12175	24
Maharashtra	18262	11	**West Bengal**	11149	25
Tamil Nadu	17601	12	**Assam**	11033	26
Haryana	17174	13	**Uttar Pradesh**	10557	27
Manipur	16748	14	**Bihar**	7713	28

Source: Statistical Abstract of Punjab, 2021

Table 4:
Composition of Capital Receipts of Punjab FY 2004-05 to 2021-22

	Share in Total Capital Receipts (per cent)			Total Capital Receipts (Rs Crores)
	Public Debt excluding Ways and Means Advance	Ways & Means Advance	Recovery of Loans/Non-Debt Receipts	
2004-05	58.39	40.37	1.23	10856
2005-06	92.29	5.11	2.60	5267
2006-07	91.52	0.00	8.48	4671
2007-08	75.54	5.18	19.28	7495
2008-09	91.83	6.96	1.21	6511
2009-10	62.21	26.57	11.22	11385
2010-11	65.73	29.79	4.47	13361
2011-12	64.58	34.87	0.55	17239
2012-13	52.35	46.94	0.71	24484
2013-14	44.01	55.53	0.46	24253
2014-15	38.12	61.44	0.44	31361
2015-16	52.29	47.15	0.57	38646
2016-17	65.59	34.20	0.22	83808
2017-18	39.25	60.59	0.16	46073
2018-19	44.65	53.74	1.60	52947
2019-20	39.27	38.05	22.68	70847
2020-21	66.49	33.43	0.08	63745
2021-22	94.65	4.85	0.50	41382
CAGR (%)	11.3	-4.5	2.6	8.2

Source: Department of Finance, Government of Punjab and Punjab Budget at a Glance, Various Issues.

Table 5:
Composition of Revenue Expenditure of Punjab FY 2004-05 to 2021-22

	Share in Total Revenue Expenditure (per cent)					Total Revenue Expenditure (Rs Crores)
	Salaries and Wages	Pension and retirement benefits	Interest Payments	Other Revenue Expenditure	Committed Expenditure	
2004-05	34.61	8.80	23.15	33.43	66.57	17198
2005-06	35.82	9.10	20.40	34.68	65.32	18207
2006-07	39.58	10.27	22.39	27.76	72.24	18544
2007-08	32.31	10.55	19.63	37.51	62.49	23061
2008-09	32.48	11.52	19.95	36.05	63.95	24569
2009-10	34.96	12.25	18.28	34.50	65.50	27408
2010-11	35.23	17.94	17.02	29.80	70.20	32897
2011-12	43.55	18.62	19.00	18.83	81.17	33045
2012-13	43.14	16.41	17.31	23.15	76.85	39458
2013-14	34.81	15.07	18.78	31.33	68.67	41641
2014-15	35.04	15.55	19.22	30.18	69.82	46613
2015-16	34.96	15.64	19.53	29.87	70.13	50073
2016-17	39.30	15.87	21.05	23.78	76.22	55296
2017-18	37.16	16.34	24.55	21.95	78.05	62465
2018-19	32.26	13.38	21.62	32.74	67.26	75404
2019-20	32.54	13.57	23.16	30.73	69.27	75860
2020-21	29.61	15.84	21.02	33.52	66.48	86345
2021-22	28.83	15.27	19.60	36.30	63.70	96482
CAGR (%)	9.5	14.3	9.6	11.2	10.4	10.7

Source: Department of Finance, Government of Punjab and Punjab Budget at a Glance, Various Issues.

Table 6:
Composition of Total Expenditure of Punjab FY 2004-05 to 2021-22

	Share in Total Expenditure (per cent)					Total Expenditure (Rs Crores)
	Revenue Expenditure	Capital Expenditure	Repayment of Public Debt excluding Ways and Means Advances	Repayment of Ways & Means Advance	Advances of Loans	
	1	**2**	**3**	**4**	**5**	**(1+2+3+4+5)**
2004-05	67.11	2.97	11.77	17.77	0.38	25628
2005-06	84.99	7.08	5.19	2.58	0.15	21421
2006-07	69.34	9.67	19.33	0.00	1.66	26745
2007-08	84.18	8.00	6.27	1.42	0.13	27395
2008-09	82.53	9.60	6.16	1.52	0.18	29771
2009-10	78.51	6.20	6.54	8.66	0.08	34912
2010-11	77.11	5.59	8.67	8.47	0.16	42661
2011-12	75.50	3.65	6.11	14.33	0.40	43767
2012-13	69.61	3.38	6.48	20.18	0.35	56687
2013-14	68.61	3.63	6.01	21.47	0.27	60689
2014-15	63.79	4.27	4.40	27.18	0.37	73077
2015-16	61.70	3.77	4.72	22.45	7.35	81153
2016-17	41.44	3.26	3.04	21.28	31.00	133450
2017-18	62.13	2.34	7.45	27.33	0.76	100547
2018-19	64.48	2.06	7.36	24.93	1.16	116948
2019-20	56.59	13.30	9.41	20.11	0.58	134045
2020-21	68.36	3.47	10.55	16.87	0.76	126316
2021-22	76.97	6.39	13.78	1.60	1.26	125347
CAGR (%)	10.8	14.9	10.8	-4.7	17.8	9.8

Source: Department of Finance, Government of Punjab and Punjab Budget at a Glance, Various Issues.

Table 7:
Outstanding Debt and Debt Servicing of Punjab

	Outstanding Debt	Interest Payments	Repayment of Debt excluding Ways & Means Advances	Outstanding Debt/ GSDP	Interest Payments/ GSDP	Repayment of Debt excluding Ways & Means Advances/GSDP
	Rs Crores			Per cent		
2014-15	112366	8960	3214	30.5	2.4	0.9
2015-16	129441	9782	3830	33.1	2.5	1.0
2016-17	182526	11642	4050	42.1	2.7	0.9
2017-18	195152	15334	7487	41.5	3.3	1.6
2018-19	211917	16306	8611	40.6	3.1	1.7
2019-20	229354	17567	12618	39.9	3.1	2.2
2020-21	258032	18153	13325	48.7	3.4	2.5
2021-22	281444	18909	17273	49.1	3.3	3.0
2021-22#	260953	18909	17273	45.48	3.3	3.0

Source: Budget at a Glance, Department of Finance, Government of Punjab, Various Issues. #The Effective Outstanding Debt for the year 2021-22 is arrived at after considering Back-to-Back loans received from the Government of India in lieu of GST Compensation as part of Revenue Receipts of Rs 20,491 crores (2021-22).

Table 8:
Trends in the Deficit of Punjab

	Revenue Deficit (RD)	Fiscal Deficit (FD)	Revenue Deficit/GSDP	Fiscal Deficit/GDSP	Percentage of RD to FD
2004-05	3391	4115	3.50	4.25	82.41
2005-06	1240	2654	1.14	2.44	46.72
2006-07	1749	4384	1.38	3.45	39.90
2007-08	3823	4604	2.51	3.02	83.04
2008-09	3856	6690	2.22	3.84	57.64
2009-10	5251	6170	2.66	3.12	85.11
2010-11	5289	7143	2.35	3.18	74.04
2011-12	6811	8491	2.63	3.28	80.21
2012-13	7407	9346	2.60	3.28	79.25
2013-14	6537	8791	2.06	2.77	74.37
2014-15	7591	10842	2.06	2.95	70.01
2015-16	8550	17359	2.18	4.43	49.25
2016-17	7311	52840	1.69	12.18	13.84
2017-18	9455	12494	2.01	2.66	75.68
2018-19	13135	16059	2.52	3.08	81.79
2019-20	14285	16826	2.49	2.93	84.90
2020-21	17296	22584	3.27	4.26	76.59
2021-22	18140	27519	3.16	4.80	65.92
2020-21#	8937	14225	1.69	2.69	62.83
2021-22#	6007	15386	1.05	2.68	39.04

Source: Budget at a Glance, Department of Finance, Government of Punjab, Various Issues. #The Effective Revenue Deficit and Effective Fiscal deficit for the years 2020-21 and 2021-22 are arrived at after considering Back-to-Back loans received from GoI in lieu of GST Compensation as part of Revenue Receipts of Rs 8,359 crore (2020-21) and Rs 12,132 crores (2021-22)

PUNJAB FINANCES: VISION 2047
TARGETS, SHORT AND LONG-TERM STRATEGIES

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
TAX REVENUE: Own-Tax Revenue-GSDP Ratio	Own-Tax Revenue-GSDP ratio: 6.1% (2015-16 to 2020-21)	Own-Tax Revenue-GSDP ratio: 7.5% matching best-performing State	Own-Tax Revenue-GSDP ratio: 12.5%	Improving tax revenue by adopting a strategy of (i) introducing new progressive taxes, (ii) broadening the base of existing taxes, (iii) improving tax compliance and (iv) implementing digital technology-driven tax reforms.
NON-TAX REVENUE	6.3% of total Revenue Receipts (2021-22)	15.0% of total Revenue Receipts	25.0% of total Revenue Receipts	Increasing user charges, improving the performance of public sector undertakings, disinvestment and asset monetization.
COMMITTED EXPENDITURE	Above 90.0% of the total Revenue Receipts (including power subsidy) (2021-22)	75.0% of total Revenue Receipts (including power subsidy)	60.0% of total Revenue Receipts (including power subsidy)	Rationalizing subsidies and reducing over-dependence on public debt.
CAPITAL EXPENDITURE	6.4% of total Expenditure (2021-22)	12.5% of total Expenditure	20.0% of total Expenditure	Containing revenue expenditure especially committed expenditure.
OUTSTANDING DEBT	49.1% of GSDP (2021-22)	40.0% of GSDP	30.0% of GSDP	Mobilizing additional resources from tax and non-tax revenue sources and containing expenditure.
FISCAL DEFICIT	4.80% of GSDP (2021-22)	3.0% of GSDP	3.0% of GSDP on a sustained basis	Increasing revenue and reducing expenditure.
MITIGATING UNPRODUCTIVE AND WASTEFUL EXPENDITURE	-	-	-	Reducing unproductive and wasteful expenditure by employing Zero-based budgeting (ZBB) system.
IMPROVING THE EFFICIENCY OF FINANCIAL RESOURCES	-	-	-	Improving fiscal efficiency by adopting best practices introduced by Central and 11 State Governments in the field of outcome-based budgeting.

III
EMPLOYMENT

After the implementation of economic liberalisation policies in 1991, despite the high growth observed in Gross Value Added (GVA) in various sectors, the employment growth declined as labour productivity growth was higher compared to growth in GVA in Punjab.

Current Status:

Punjab's economy grew at a relatively lower rate as compared to the growth in the Indian economy after the implementation of economic liberalisation policies in 1991. The trend growth rate in GVA for the overall period during 1994-2019 (1993-94 to 2018-19) was modest at 5.7 per cent p.a. The GVA growth observed on a point-to-point basis during 2005-19 for the manufacturing sector was 8.0 per cent p.a., for industry 11.3 per cent p.a. and for services 8.4 per cent p.a. while the growth for the agriculture sector decelerated and was merely 2 per cent p.a.

- **High Growth in Labour Productivity Resulted in Decline in Employment:**

The adoption of capital-intensive technology resulted in a high rise in labour productivity growth of 6.8 per cent p.a. during 2005-19. The labour productivity growth, therefore, was higher compared to growth in GVA during the same period. This resulted in a decline in employment growth in the Punjab economy during FY 2005-19 by (-) 0.2 per cent p.a. The employment growth for the agriculture sector is (-) 4.4 per cent p.a., while for the manufacturing sector grew by 2.2 per cent p.a., for industry by 2.5 per cent p.a., and for services by 2.1 per cent p.a. during FY 2005-19. The labour productivity growth for the agriculture sector is as high as 6.7 per cent p.a., for the manufacturing sector is 5.7 per cent p.a., for the industry is 8.5 per cent p.a. and for the service sector is 6.1 per cent p.a. during the same period.

This created disequilibrium in the labour market in which the supply of labour far exceeded that of demand. This reduced the bargaining power of the workers and made it possible to introduce labour laws which helped the industry to informalize employment even in the formal sector with low social security benefits.

The labour thereby responded by lowering its both Labour Force Participation Rate (LFPR) and Worker Population Ratio (WPR). The LFPR per 1000 working-age persons (15-64 age group) for Punjab declined steeply from 645 during 2004-05 to 506 during 2018-19. The LFPR for rural females declined from 508 to 202 i.e. by 306 points during 2005-2019. The decline in LFPR was 108 points for rural males, 19 points for urban females and 28 points for urban males. Therefore, the decline in LFPR is observed more in rural areas, especially among females. One of the important reasons for the decline in rural LFPR was the replacement of unpaid family labour on farms and own account work (OAW) due to heavy mechanisation, especially in the agriculture sector. The low employment growth in Punjab coupled with the high inflow of unskilled and semi-skilled migrant workers resulted in a majority of Punjab youth migrating to other countries in search of better livelihood opportunities.

To understand the implication of change in per capita income caused by sector-wise changes in labour productivity and employment rate, the Shapley Decomposition Method is used for the period 1994-2019.

- **Changes in Per Capita Income Caused by Changes in Employment**:

Negative growth in employment during FY 2005-19 in the agriculture sector is one of the main causes of the decline in the employment rate in the overall Punjab economy during FY 1994-2019 and attributed to 174 per cent in total change in per capita income caused by employment rate in the economy.

- **Changes in Per Capita Income Caused by Changes in Labour Productivity:**

The other contributor to the change in per capita income is the change in output per worker (labour productivity). The change in output per workers for the Punjab economy during 1994-2019 is equivalent to Rs 2,45,429. The contribution of various sectors in this change in labour productivity was highest in the case of the service sector, followed by the agriculture and allied sector, then manufacturing and lowest in other industries for the state of Punjab. The changes in sector-wise labour productivity and change in the share of these sectors in employment contribute to Rs 8,9467 change in per capita income. This includes changes caused by the intersectoral difference in labour productivity and change in share of employment of Rs (-) 311. The highest contribution

of this change in per capita income of Rs 89,467 is attributed to the service sector at 55.4 per cent, agriculture at 42.2 per cent, manufacturing at 8.0 per cent and other industries at 4.6 per cent (see Table 1 in Annexure).

High modernisation especially in the agriculture and service sector in Punjab resulted in low overall employment growth in the economy compared to working-age population growth in Punjab. The rise in labour productivity was very high in these two sectors Therefore, the entire rise in per capita income was caused by the rise in labour productivity, out of which the service sector contributed as high as 55.4 per cent and the agriculture sector 42.2 per cent.

Challenges:

- **Lower Employment Growth Compared to Growth in Working-Age Population:**

In Punjab, the gap between the growth in the working-age population and those got employed widened by 33.3 percentage points during the overall period FY 1994-2019. Such a high gap put severe constrain on labour market conditions and resulted in the outward migration of Punjab youths to foreign countries in search of better livelihood. This aspect become much more relevant in the second period during FY 2005-19 when the adoption of capital-intensive technology accelerated in the state.

- **A Rise in Share of Dependent (old age) Population in Future:**

The working-age population of Punjab is expected to grow by merely 0.34 per cent p.a. during FY 2019-48 compared to 0.7 per cent p.a. growth for the population >=15 years and 0.41 per cent p.a. for the total population. This means that the dependent old population in Punjab is likely to grow very steeply. The share of <15 years will decline in the overall population. In the case of India, the population in the age group 15-64 will grow by 0.74 per cent p.a. and the population in the age group =>15 years by 1.04 per cent p.a. and the overall population will grow by 0.6 per cent p.a. Thus, the challenge is the low number of people in the working-age population. But since the employment opportunities are also going to be low, this constraint is not going to affect the growth prospects. But the constraint will be in the form of the rising share of the population >64 years, the majority of which will be non-working and hence dependent.

It is estimated that the share of the dependent old population (>65 age) is going to rise steeply from the current level of 8.4 per cent in 2018 to 10.1 per cent by 2030 and then steeply to 16.8 per cent by 2047. But this is unlikely to increase the share of the total dependent population (<15 years and >65 years) because of the decline in the share of the population below 15 years of age. Therefore, the overall education expenses may decline, while overall expenses for the health of an old person are likely to rise in the future. The situation in this regard, however, is likely to be less adverse in the case of Punjab as compared to India.

- **Limited Financial Resources of the Punjab Government:**

Punjab's agricultural sector though is quite capital intensive but is still less as compared to the capital intensity of industry and service in the economy. As the share of agriculture in the economy declines over time, it increases the challenge for the economy to generate more resources for investment to diversify to other sectors of the economy.

- **Unsustainable Growth practice in Punjab Agriculture:**

The growth of the agriculture sector is continuously decelerating and is likely to happen more so with soil health deteriorating with excessive use of fertilisers and pesticides and intensive focus on mono-cropping. Thus, Punjab's sustainability in the agriculture sector is at a crucial juncture. Therefore, there is an essential need to curtail the intensive use of inputs for Punjab agriculture to move towards sustainable solutions. (see Table 2 in Annexure).

- **Rising Capital Intensity in Predominant Agriculture Sector:**

Capital stock data at constant prices are not available for the States but are available for India from KLEMS (Analysis of Capital-K, Labour-L, Energy-E, Materials-M and Service-S inputs) at 2011-12 prices. The sector-wise capital stock data for the period 1980-81 to 2006-07 is available from the article published by Sethi and Kaur[1] in 2012. This sector-wise series is updated till 2018-19 by using the latest sector-wise gross capital formation

[1] Sethi, A.S., & Kaur, S. (2012). Estimation of Fixed Capital Stock: A Comparative Analysis for Punjab and Haryana States. *The Journal of Income and Wealth*, 34(12), 38-52.

data from the Statistical Abstract of Punjab. The capital stock to labour (K/L) ratio for Punjab agriculture is estimated at 20 per cent, for industry 50 per cent and for service 190 per cent for Punjab economy. For India, the K/L ratio for agriculture again is 20 per cent, for industry it is 125 per cent and for service it is 190 per cent of K/L. As the economies are moving away from agriculture to mainly the service sector and to some extent towards industry, the requirement for capital is going to rise at an accelerated rate.

- **Policy Regime Inhibits Growth of Smaller Labour-Intensive Units:**

The challenges of the development model adopted are twofold. One is how to generate more investment so that enough employment could be created irrespective of whether the investment is less or more capital-intensive. The second challenge is to engage this capital more productively, which is linked to productive employment generation as that will ensure the required demand.

- **Future Prospects:**

The Punjab economy as well as the Indian economy is unable to take benefit of demographic dividend in the past. Even in the changed scenario in the future when the population rate will decline the employment prospects are not going to improve because of the continuation of capital-intensive policies. Punjab cannot be an isolated case and hence the capital intensity policies pursued in the country will also impact employment prospects in the State.

The small-scale sector in Punjab is expected to continue to sustain the competition in future. But at the same time, there is a need to enhance its labour productivity reasonably or improve capital intensity, as expressed earlier that Punjab cannot remain isolated from the development pattern taking place in India and so is true about India in the context of the world. Therefore, labour productivity growth is likely to grow in Punjab, but at a moderate rate rather than too intensively both in the short and long run. The sector-wise employment scenario for various sectors of Punjab is projected from FY 2019-2031 and FY 2019-48 is presented in Table 3 in Annexure.

On the basis of short-term and long-term strategies specified below, the WPR for the working-age population per 1000 population is expected to increase marginally from 493 during 2018-19 to 499 by 2030-31 and then to 573 by 2047-48.

Short-Term Strategies: (2030)

MGNREGA A Viable Employment:

MGNREGA has played an important role in employment generation in the rural economy without impacting the labour supply routine economic activities. It is however, estimated using NSSO household-level data that there is a leakage of 29.5 per cent in MGNREGA wage bills. This needs to be checked for effective implementation of welfare programmes in a scenario when labour market conditions are very adverse for labour.

Improve Co-operative Functioning

Another important short-term strategy is to improve the functioning of co-operatives, which may help in more employment generation and effective usage of capital scarce resources. There are several co-operatives which are functioning well in Punjab. This kind of model is very less capital-intensive. So, promoting such kind of techniques can create economies of scale, better employment and save scarce capital.

Efficient use of Resources

Another important strategy is the efficient use of scarce resources and inputs rather than focusing merely on capital-intensive technology. Therefore, there is an important need to guide farmers about such potential and create awareness through various demonstrations/seminars, etc, by involving agricultural universities and by promoting other institutional mechanisms and making use of IT technology. The market support infrastructure and mechanisms are other crucial aspects that the Government agencies will actively address in agriculture for raising the farmer's income.

Strategy for Adoption of Precision Agriculture with the help of Technology:

The use of GIS, satellite imagery, drone technology, artificial intelligence, and data sharing would be employed to enhance the livelihoods of farmers and rural entrepreneurs. Smartphone-based irrigation, nutrient management, pest management

and marketing applications would be developed. Revenue record would be made easily accessible through smart phone. Mainstreaming new biotechnologies, judicious use of inputs and natural resources and sustainability is the need of the hour.

Restructuring of Employment

Improving the skill sets of employees especially in the labour-intensive sector to enhance labour productivity is required. Thus, there is a need to promote such a sector with strong backward and forward linkages through R&D, labour training, and infrastructural development in order to more than double the per capita productivity.

Education and Skill Development with the help of Technology

To get employed productively, the quality of education and skills are crucial. Thus, education and skilling programmes need integration and require special attention and without the active intervention of the Government, such programmes cannot be inclusive. Such programs include online distance learning programmes which would enhance the skill-set of the labour to get employed in such a technology-driven environment.

R&D and Technology Development in Labour-intensive Sector: To build upon the strengths, technological up-gradation in labour intensive sector would be a major step in the right direction. Government would put major efforts not only to set up technical institutes but also ensure that funding is there, as smaller units cannot afford to finance such projects.

Upgradation of Technology

Presently the structure of the economy is biased in terms of GVA towards large sectors, while employment responsibility mainly falls on micro and small-scale sectors. Therefore, technology improvement through proper R&D initiatives and skill development programmes can lead to growth in productivity and thus, growth of the MSME sector. There is also a need to upgrade technology for traditional industries such as food processing, garments and textiles, etc., which would generate productive employment and also make manufacturing more productive to fit better in the global chain.

Develop Infrastructure and supporting Services: There is also a need to improve rural link roads, refrigerated vehicles, dedicated rail freight traffic corridors and create dry ports; sustainable energy and develop service sectors such as information technology to promote industry and for generating inter-sectoral opportunities such as warehouses, cold-chain, logistics, food processing for a group of villages.

Support for Small Scale Sector

Innovative social marketing for the small-scale sector through the active intervention of public institutes and invest resources into capacity building so that they can leverage digital technology and marketing skills in the market.

Long-Term Strategies: (2047)

Stimulate private Investment

The judicious and efficient usage of inputs and resources can help in improving WPR even with GVA growth of 6.5 per cent p.a. during FY 2019-48. It is estimated that this would require growth in the capital stock of 6.8 per cent p.a. at 2011-12 prices and additional investment of around Rs 12.6 lakh crore at 2011-12 prices during FY 2019-31 and Rs 60 lakh crore at 2011-12 prices in 29 years from FY 2019-2048. This investment is mainly expected from private resources. Private investment can help create technology-oriented and digital economy jobs including automation, IT, software development, and data centres in the long run.

Responsive Fiscal Policy: Government would improve its resources by taking four main initiatives as recommended by Punjab Finance Commission. These include increasing the tax-to-GDP ratio, lowering the products exempted from tax, realizing optimal revenue from different economic and social services and fourthly lowering the per capita Government expenses, which are quite high for Punjab.

Expansion of industrial and service sectors: Focus on creating new jobs by expanding the industrial and service sectors through diversification and innovation which would ultimately take care of the employment needs of the masses.

Annexure

Table 1:
Growth Decomposition of Contribution to Per Capita Income in Punjab: FY1994-2019

	Contribution of within sector changes in output per worker	Contribution of changes in Employment	Contributions of Inter-sectoral Shifts	Total	Contribution of within sector changes in output per worker	Contribution of changes in Employment	Contribution of Inter-sectoral Shifts	Total
	In Rs Value Contribution to Total Change in PCY				In per cent Share of Total Change in PCY			
Agriculture & allied	34245	-35809	2219	656	42.2	-44.1	2.7	0.8
Manufacturing	6499	4645	-2505	8639	8	5.7	-3.1	10.6
Other Industry	3760	6208	-4687	5281	4.6	7.6	-5.8	6.5
Service	44963	4377	4662	54002	55.4	5.4	5.7	66.5
Total	89467	-20578	-311	68578	110.2	-25.3	-0.4	84.5
Demographic component	-	-		12604	-	-		15.5
Total change in value added per capita				81182				100

Source: Derived using NAS, Unit-wise NSSO's EUS, 50th round and PLFS, 2017-18, Population Census

Table 2:
Projection of Sector-wise GVA Share in Punjab and Indian Economy and Growth Rates: FY 2019-48

	2018-19	2025-26	2030-31	2035-36	2040-41	2047-48	Sector-wise Past Trend Gr	Point to Point Gr Rt		Projections
	Punjab (per cent share in GVA of Punjab Economy)						FY 1994-2019 (per cent p.a.)	FY 1994-2005 (per cent p.a.)	FY2005-19 (per cent p.a.)	FY2019-48 (per cent p.a.)
Agri & Allied	24.2	17.5	13.6	10.5	8.0	5.5	2.4	3.0	2.0	1.2
Manufacturing	11.4	12.6	13.3	13.9	14.3	14.9	7.1	5.4	8.0	7.5
Industry	17.5	19.3	20.3	21.2	22.0	22.8	8.7	3.4	11.3	7.5
Services	58.2	63.2	66.0	68.3	70.0	71.7	7.3	6.2	8.4	7.3
Economy	100.0	100.0	100.0	100.0	100.0	100.0	5.7*	4.4	6.6	6.5
	India (per cent share in GVA of Indian Economy)									
Agri & Allied	14.4	11.5	9.8	8.2	7.0	5.5	3.0	2.5	3.7	3.6
Manufacturing	14.9	15.4	15.7	16.0	16.2	16.5	7.1	6.7	8.0	7.5
Industry	25.2	26.0	26.5	27.0	27.4	27.8	6.7	6.7	6.9	7.5
Services	60.4	62.5	63.7	64.8	65.7	66.7	8.3	7.9	8.8	7.5
Economy	100.0	100.0	100.0	100.0	100.0	100.0	6.7*	6.0	7.3	7.1

Source: National Accounts Statistics, MoSPI
Note: On the basis of past trend growth rate, the Punjab economy would grow by 6.7 per cent p.a. and Indian economy by 7.4 per cent p.a. during FY2019-48.

Table 3:
Employment Prospects in Punjab and India based on Moderate Capital-Intensity: FY 2019-48

	2018-19	2025-26	2030-31	2035-36	2040-41	2047-48	Sector-wise Past Trend Gr	Point to Point Gr Rt		Likely Gr Rt. Projected
	Punjab Employment in Lakh Numbers						FY 1994-2019 (per cent p.a.)	FY1994-2005 (per cent p.a.)	FY2005-19 (per cent p.a.)	FY2019-48 (per cent p.a.)
Agri & Allied	27	25	23	22	20	19	-2.5	1.1	-4.4	-1.3
Manufacturing	19	22	23	26	28	31	3.5	5.2	2.2	1.7
Industry	34	38	41	45	49	55	4.2	6.3	2.5	1.7
Services	42	45	48	50	53	58	2.4	3.1	2.1	1.1
Economy	102	108	112	117	123	131	0.9*	2.6	-0.2	0.9
	Indian Employment in Lakh Numbers									
Agri & Allied	2012	1963	1930	1897	1864	1819	-0.8	0.7	-1.7	-0.3
Manufacturing	576	595	609	623	638	659	1.6	3.2	0.3	0.5
Industry	1164	1285	1378	1479	1586	1750	3.2	4.0	2.3	1.4
Services	1475	1627	1745	1873	2009	2216	2.6	3.4	2.0	1.4
Economy	4651	4875	5054	5248	5459	5786	1.0*	1.9	0.2	0.8

Source: Derived using Unit-wise NSSO's EUS and PLFS data and Population Census
Note: On the basis of past trend growth rate, employment of Punjab economy would grow by 2.5 per cent p.a. and Indian economy by 1.7 per cent p.a. during FY 2019-48.

Table 4:
Projection of Sector-wise Labour Productivity in Punjab and Indian Economy: FY 2019-48

	2018-19	2025-26	2030-31	2035-36	2040-41	2047-48	Sector-wise Past Trend Gr	Point to Point Gr Rt	Scenario I: Lab Prod Gr Rt. Projected	Scenario II: Lab Prod Gr Rt. Projected
	Punjab (Sector-wise Index of Labour Productivity) Taking Labour productivity for Indian Economy year 2018-19 as Base =100)						FY1994-2019 (per cent p.a.)	FY2005-19 (per cent p.a.)	FY2019-48 (per cent p.a.)	
Agri & Allied	121	144	163	185	209	248	4.9	6.7	4.6	2.5
Manufacturing	81	119	157	207	273	403	3.4	5.7	7.7	5.7
Industry	70	103	136	180	237	349	3.9	8.5	8.0	5.7
Services	189	286	384	517	695	1052	4.8	6.1	6.7	6.1
Economy	132	189	247	325	431	643	4.8*	6.8	7.1	5.6
	India (Sector-wise Index of Labour Productivity) Taking Labour productivity for Indian Economy year 2018-19 as Base =100)									
Agri & Allied	33	44	53	65	78	103	4.0	5.5	4.0	4.0
Manufacturing	121	194	272	381	534	858	5.8	7.7	7.7	7.0
Industry	101	151	202	271	362	545	3.5	4.5	7.7	6.0
Services	191	286	383	513	687	1032	5.5	6.7	6.7	6.0
Economy	100	153	208	283	385	593	5.7*	7.1	7.1	6.3

Source: National Accounts Statistics, MoSPI, Unit-wise NSSO's EUS and PLFS data and Population Census
Note: On the basis of past trend growth rate, the labour productivity of Punjab economy would grow by 4.1 per cent p.a. and Indian economy by 6.0 per cent p.a. during FY2019-48.

PUNJAB VISION 2047 – EMPLOYMENT
TARGETS, SHORT- AND LONG-TERM STRATEGIES

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Employment and Working-age Population Growth	Employment grew by 0.9% p.a. during FY 1994-2019, despite 5.7% growth in GVA due to high capital-intensity. The working-age population grew by 2.0% p.a.		Employment is projected to grow by 0.9% p.a. as against working-age population growth of 0.34% p.a. during FY 2019-48.	**Pursuing Social Welfare Programmes**: Pursuing social welfare programmes such as MGNREGA could help in playing an important role in employment generation without impacting the labour supply of other sectors.
Employment to Working-age Ratio	The employment rate (employment to working-age ratio) grew by (-) 12.8%.	The Worker Population Ratio is expected to increase from 493 in 2018 to 499 in 2030.	The Worker Population Ratio is expected to increase from 499 in 2030 to 573 in 2047.	**Reviving Co-operative Multipurpose Society Model** for effective usage of capital scarce resources. The scarce capital can be used for other developmental purposes like for education and skill development. This kind of model is less capital-intensive. **Focusing on building/improving infrastructure to attract large-scale investment**: Increasing labour productivity (capital intensity) at a reasonable/moderate rate by not providing subsidies for investment but rather by improving infrastructure. **Restructuring of Employment:** Improve the skill-sets of employees in the labour-intensive sector with strong backward and forward linkages through R&D, labour training, and infrastructural development.
Financial Resources	There are limited financial resources for investment.	Investment to be increased by Rs 12.6 lakh crore during FY 2019-31.	Investment to be increased by Rs 60 lakh crore during FY 2019-48.	**Lowering unproductive expenditure and focusing on generating revenue**: Develop a strategy to improve tax-to-GDP ratio, reduce the number of products exempted from tax and realizing optimal revenue from different economic and social services. Private investment can help create technology-oriented and digital economy jobs.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Capital-Labour Ratio	High modernisation especially in the agriculture and service sector in Punjab resulted in low employment growth in the economy compared to working-age population growth. The rise in labour productivity is very high in these two sectors.	Moving towards a sustainable solution rather than promoting capital-intensive technology.		**Encouraging Labour-intensive Policies for Small Sector:** The market support infrastructure and other mechanisms are crucial aspects that the Government agencies will actively address. The processes would be made easier impartially for all size units. Favouritism would be stopped for promoting competitive environment.
Agricultural Growth	Agriculture growth decelerated.	Focusing on using scarce capital and inputs efficiently.		**Guiding agricultural farmers to use the inputs judiciously and move to high-value addition crops:** This would be done by creating awareness through various demonstrations/seminars, by involving agricultural universities and by making use of IT technology.

SECTION II

COMMERCE AND INDUSTRY

I. Industry

INDUSTRY

Industrial development in Punjab is dominated by small-scale units. Most of the industry is concentrated in the three districts – Ludhiana, Jalandhar and Amritsar. In Punjab, though industrial development is dominated by small-scale units, yet Punjab contributes a substantial share in the country's overall production in industries such as woollen knitwear, textiles including yarn, readymade garments and hosiery, sewing machines, cycle and cycle parts, sports goods and agricultural machinery, including combine harvesters.

Paradoxically while Punjab is experiencing a very slow process of industrialization, the world is reaping the benefits of the Fourth Industrial Revolution (Industry 4.0).

Current Status:

Industrial development in Punjab has been examined on the basis of the temporal behaviour of share of the manufacturing sector in state income; structure of industrial development based on the relative strength of small-scale industries and large & medium scale industries; major industries; geographical distribution of industries; and constraints.

Temporal Behaviour of Share of the Manufacturing Sector in State Income

The share of the manufacturing sector in the state income of Punjab was 13.6 per cent in 2020-21, which was the lowest among the selected states except for Karnataka. The share rose to 14.4 per cent in 2021-22 (see Table 1 in Annexure).

Structure of Industrial Development

It is not only that the manufacturing sector has a relatively low profile in the economy; small-scale units dominate the industrial structure of the state**.** Small-scale units were 1,84,875 in 1993-94, constituting 99.76 percent of the total industrial units (see Table 2 in Annexure). This predominance of the small-scale sector has continued throughout the study period.

Major Industries in Punjab

In Punjab, though industrial development is relatively low but in the case of some of the industries, Punjab contributes a substantial share to the overall production in the country.

These industries include woolen knitwear, textiles including yarn, readymade garments and hosiery, sewing machines, cycle and cycle parts, sports goods and agricultural machinery, including combine harvesters.

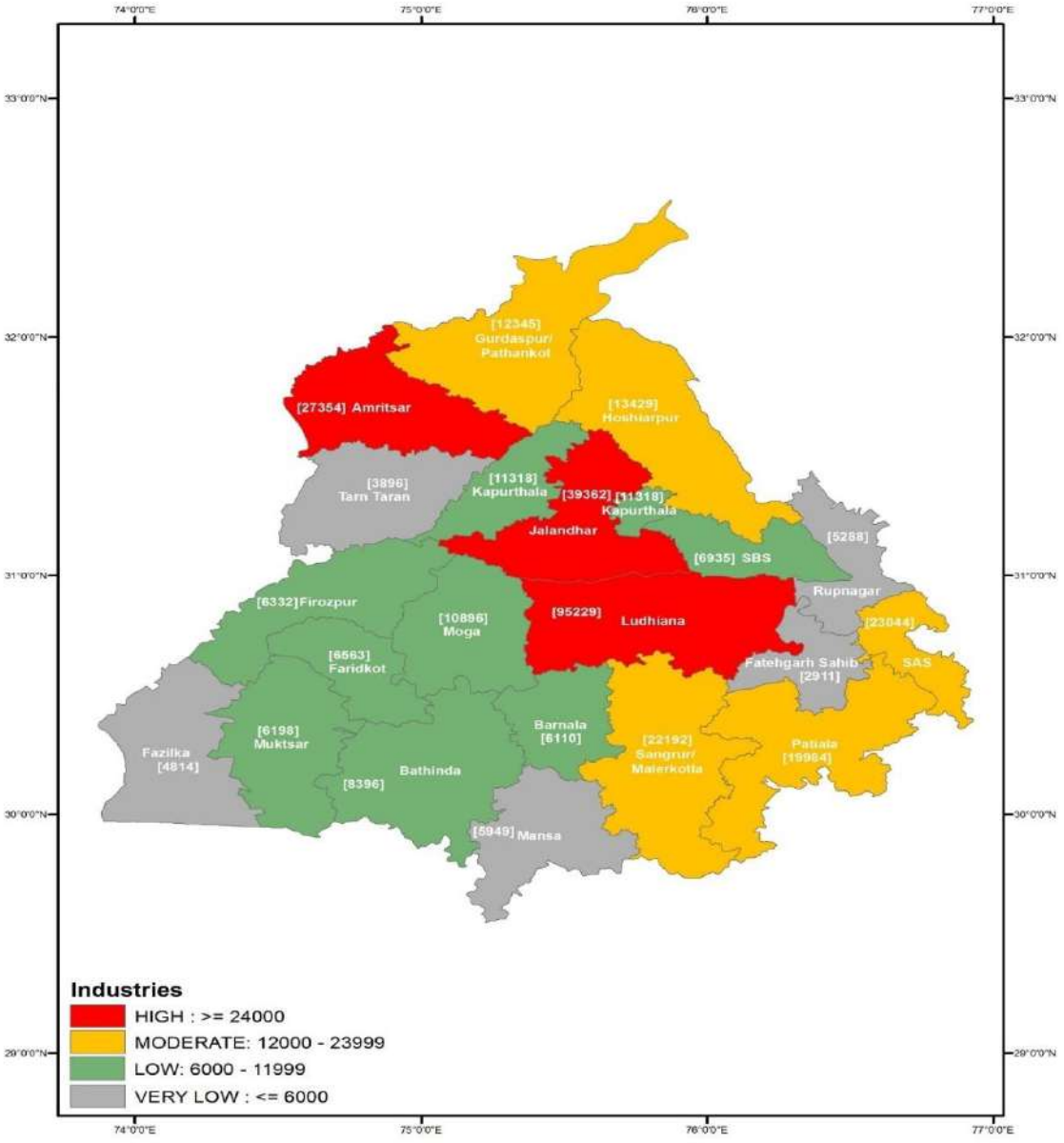
Other major industries in Punjab include light engineering, leather and leather products, food processing, information technology, pharmaceuticals, steel rolling mills and induction furnaces, transport equipment and parts, diesel engine and diesel parts, hand tools and machine tools, petrochemical and fertilizer industries.

Geographical Distribution of Industries

The industrial development in Punjab has skewed distribution across districts (see Map 1, Table 3 and 4 in Annexure). During the year 2019-20, Ludhiana district, with 95,229 industrial units, tops the state, while Fatehgarh Sahib, with 2,911 industrial units is at the bottom. Ludhiana, Jalandhar and Amritsar have a high concentration of industries. These three districts constitute almost half (47.84 percent) of the total industries in the state. Five districts, namely S.A.S Nagar, Sangrur/Malerkotla, Patiala, Hoshiarpur and Gurdaspur/Pathankot, have a moderate share in the industrial units of the state. These five districts together claim 26.88 percent share in total industries. Eight districts, comprising Kapurthala, S.B.S Nagar, Ferozepur, Moga, Faridkot, Sri Muktsar Sahib, Bathinda and Barnala, have a low concentration of industries by contributing 18.53 per cent share to the total industrial units. The remaining five districts- Fazilka, Tarn Taran, Mansa, Roopnagar and Fatehgarh Sahib have the lowest concentration of industries. This group of districts contributes 6.75 percent to the total industrial units in the state.

Map 1

District-wise Distribution of Industries in Punjab during 2019-20



Relatively Moderate linkages of Industrial Development with the Agriculture sector

Wheat, paddy and cotton are the three principal crops. The state exports the maximum of its foodgrains without value addition and imports most of the industrial products used as inputs in the agriculture sector from other states. United Nations Industrial Development Organization (UNIDO) study titled "Punjab Industrial Review" conducted during 2007-08 also opines that Punjab has not exploited its potential for industrialization and agriculture diversification.

Constraints

Punjab has led the country in agricultural development. The following factors have constrained industrial development in the state:

(i) Locational disadvantages of the state from the national market,

(ii) Poor natural resource base,

(iii) Expensive land,

(iv) Withdrawal of freight equalization policy in 1993 by the Government of India,

(v) Tax holidays to the neighboring hill states granted by the Central Government and,

(vi) Sensitive international border.

Challenges

The industrial sector in Punjab has been facing a number of challenges. The key challenges are shown below:

KEY CHALLENGES

- Rejuvenation of the industrial economy by improving its competitive edge by promoting new industries led by smart technology in tune with the Fourth Industrial Revolution (Industry 4.0); upgrading the technology of the existing units; formulating a comprehensive policy to neutralize the adverse effect of market forces and tax holidays to the neighboring hill states.
- Strengthening industrial and agricultural development linkages.
- Promoting less land-intensive industries.
- Attracting domestic and foreign capital.
- Promotion of environment-friendly industries.
- Developing an integrated model of industrialization.
- Rapid structural transformations in Industrial governance making it industry-friendly by improving the ease of doing business.
- Strengthening of industrial development corporations.

Vision

Punjab needs altogether a new vision of industrialization in tune with the Fourth Industrial Revolution, comparative advantages, experiences of industrial states, and job aspirations of educated youth.

Keeping these factors in view, the following three types of industries need to be incentivized to make Punjab an industrial hub:

I. High-tech Agro-based Industries
II. Footloose Industries and
III. Advanced Digital Technology and Knowledge-driven Industries

Short-term Targets and Strategies: 2030

In the structure of the economy of Punjab, the share of the secondary sector is aimed to be increased to 28.0 percent by 2030, and in the case of the manufacturing sector, the targeted share would be 20.0 percent.

For achieving the target of 20.0 percent share of the manufacturing sector and keeping in view the availability of human and financial resources, locational advantages, experiences of industrialized states, promoting a robust industrial sector and prospering startup ecosystem, the new Industrial Policy of Punjab should incentivize the following three types of industries:

High-tech Agro-based Industries

Punjab contributes most of the agricultural produce to the Central Pool. Similarly, many of the agricultural inputs are imported from other states. The existing composition of exports and imports needs a review. The right strategy is the promotion of high-tech food processing industries and industries supplying inputs to agriculture. This strategy of building a bridge between agriculture and industry would help in linking the first and second engines and making it a double-engine development model.

Major food processing industries suitable for Punjab are flour mills, porridge, noodles, bakery units, glucose, beer, wine, rice shellers, rice bran oil, paper mills, textiles, surgical

cotton, cushions, mattresses, cattle feed, canned vegetables, juice-processing, biomass-based power generation and livestock-based industry.

Industries supplying inputs to agriculture include chemical fertilizers, tractors, diesel engines, electric motors, harvest combines, happy seeders, paddy straw choppers/shredders/mulchers, reversible mould board ploughs and zero till drill, etc.

Footloose Industries, Advanced Digital Technology and Knowledge-driven Industries

In the Industrial and Business Development Policy 2017- Industry 4.0 has been identified as a thrust sector with a view to promote future industrialization and generate employment in the state.

For reaping the benefits of Industry 4.0, the state to incentivize the footloose industries as well as smart technology and knowledge-driven industries which use very light raw materials and intensive human knowledge.

Footloose industries, advanced digital/smart technology and knowledge-driven industries/services include the following:

(i) AI (Artificial intelligence); (ii) IoT (Internet of things); (iii) 3D printing; (iv) Robotics; (v)Cloud computing; (vi)Data analytics; (vii) Cyber security technology;(viii) Smart censors; (ix) Electronics; (x) Computers and peripherals; (xi) Software development; (xii) Tele-communication and information technology; (xiii) Pharmaceuticals; (xiv) Optical instruments and lenses; (xv) Biotechnology; (xvi) Surgical and medical instruments;(xvii) Engineering and scientific instruments; (xviii) Semi-conductors; (xix) R & D firms; (xx) Oxygen production units; (xxi) E-vehicles; (xxii) New and Renewable Source of Energy (NRSE) Equipment; (xxiii) Energy storage devices; (xxiv) Aerospace and defense; (xxv) Bio-energy; (xxvi) Consultancy services for insurance, share market, financial matters, real estate; (xxvii) Career counseling, guidance and employment services (xxviii)International business, immigration and study abroad services; (xxix) Tourism; (xxx) Hotel management and catering services; (xxxi) Event management services; (xxxii)Skill development centres; (xxxiii)Incubation centres; (xxxiv) Media entertainment; (xxxv) Logistics; (xxxvi) Shredding units; and (xxxviii) Waste management units.

These industries are environment-friendly which suit Punjab as agriculture has polluted environmental resources. Mostly these are cost-effective in terms of transportation and land requirements. These industries generate high-quality jobs which would meet the aspirations of Punjabi youth. The industries may also attract back educated youth from abroad.

For promoting research and innovations in the field of smart technology, a Research Centre for Artificial Intelligence and Machine Learning has been setup at IIT Ropar in collaboration with National Chung Cheng University, Taiwan.

Proposed Industrial hubs/clusters/parks

Further based on the existing strengths of the industrial sector and infrastructure, the following industrial hubs/clusters/parks can be considered:

i. Developing Ludhiana as a high-tech manufacturing zone.
ii. Developing S.A.S Nagar (Mohali) as IT and ITES hub and an advance research Centre for Agri-Biotech and Pharma industry.
iii. Developing Bathinda as the chemical and petrochemical hub.
iv. Developing Rajpura (Patiala) as an industrial cluster to reap the benefit of the Amritsar-Kolkata Industrial Corridor (AKIC).
v. Developing Amritsar as a trading capital of North India with state-of-the-art in logistics and infrastructure.
vi. Developing food parks in Kapurthala, Phagwara, Fazilka, Ladowal and Sirhind.
vii. Developing a dedicated cluster on about 300 acres of land for manufacturing high-tech bicycles.
viii. Plywood Park, Hoshiarpur.
ix. General Engineering Park, Wazirabad, Fatehgarh Sahib.

Policy for the Existing Industry

For protecting the existing industry and improving its competitive edge, a policy to neutralize the adverse effects of market forces and a policy of tax holidays as given to

the neighboring hill states can also be considered. The proposed policy may include the following:

i. Granting of tax holidays by the Union Government to Industry in view of Punjab being a border State.

ii. Introducing Freight Subsidy Scheme for Industrial Units located more than 1200 km from ports by the Government of India.

iii. Extending of Production Linked Incentive (PLI) to bicycles, E-bikes and their components by the Government of India.

iv. Restoring Freight Equalization Policy by the Central Government.

Long-term Targets and Strategies: 2047

In the structure of the economy of Punjab, the share of the secondary sector is aimed to be increased to 30.0 percent by 2047. Further, in the secondary sector, the manufacturing sector is assigned a pivotal role. The target is to increase the share of the manufacturing sector to 25.0 percent in the state income.

For achieving this target, the strategy of industrialization in the short-run would be continued in the long run. It is relevant to mention here that setting up of the sunrise industries mentioned during the 'Vision 2030' is long drawn process, including mobilizing huge investments having a long gestation period; equipping manpower with new skills; getting government approval for the new projects; strategies for raw material and marketing of products and other logistics. Therefore, for achieving the target of 25.0 percent share of the manufacturing sector and also keeping in view the availability of human and financial resources, locational advantages, experiences of industrialized states and decent job opportunities for educated youth, the new industrial policy of Punjab should continue to incentivize the same three types of industries in the long-run, namely, (I)High-tech Agro-based Industries with emphasis on farmer-centric rural industrialization; (II) Footloose Industries; (III) Advanced Digital Technology and Knowledge-driven Industries.

Other Facets of the Vision

Industrialization is a complex and multi-dimensional process. Therefore, in addition, to promoting a specific type of industrialization, it is equally important to support the proposed industries with other policy initiatives. Salient policy initiatives in this regard are mentioned as under:

(I) Industry-Knowledge Corridors/Industrial Parks

The footloose and knowledge-driven industries are digital technology driven and hence would offer decent jobs to educated youth. Industry 4.0 can fruitfully be developed jointly by higher education institutions and industry. The experiences of Maharashtra, Gujarat, Karnataka, Tamil Nadu and Andhra Pradesh would be very useful for developing technology parks in the state.

Keeping in view the location of universities and research institutions, five knowledge-industry corridors/parks and start-up hubs can be set up. These include (i) Chandigarh-Mohali-Patiala Corridor; (ii) Chandigarh-Mohali-Ludhiana Corridor; (iii) Chandigarh-Mohali-Ropar-Hoshiarpur Corridor; (iv) Ludhiana-Jalandhar-Kapurthala-Amritsar Corridor; and (v) Sangrur-Bhatinda-Faridkot Corridor.

(ii) Integrated Model of Industrialization

Based on the Japanese model of industrialization, in future big industries may be setup as parent units/anchoring industries; and medium and small-scale industries as ancillaries.

(iii) Promotion of Environment-friendly industries

The Union Ministry of Environment, Forest and Climate change has worked out the pollution index score (PIS) of industries. Industries having PIS up to 20 are categorized as white industries, whereas industries having PIS between 20-40 are designated as green industries. Around 100 industries belong to these two categories. PIS from 41-59 and PIS of 60 and above are respectively categorized as orange and red industries. Around 160 industries belong to these categories.

In Punjab, preference should be given to white, green and orange industries in the future.

(iv) Equitable development of the industry across the districts

It has been found that Punjab has acute regional disparities in the field of industry. To spread industry equally across the state, government to provide supportive infrastructure in the Border areas, Kandi areas and less developed industrial areas and also announce incentives like tax holidays and input subsidies for setting up industry in these areas.

(v) Setting up a Centre for the Fourth Industrial Revolution

The Government of India has set up a Centre for the Fourth Industrial Revolution, Mumbai, as a platform for technology governance and also to suggest policies to minimize the ill effects of Industry 4.0 on society. Punjab may also set up a Centre on the same pattern.

(vi) Optimizing the Benefits of Central Government Flagship Programmes and Schemes

The Central Government has introduced a host of flagship programmes /schemes to make India an economic superpower. The select programmes include Atmanirbhar Bharat Abhiyan, Make in India, Digital India, Start-up India, Skill India, Programs for MSMEs, Production Linked Incentive (PLI) Scheme, Fame India Scheme, PM FME – Formalization of Micro Food Processing Enterprises Scheme and Integrated Processing Development Scheme. Setting up a dedicated cell in the respective Administrative Department to make optimal utilization of the flagship programmes of the Central government is proposed. The progress should be monitored every quarter.

(vii) Restructuring Industrial Governance

Better quality of industrial governance for effectively implementing the Vision is considered. Industrialization of Punjab has been on the agenda of the Punjab government and it has also been organizing from time to time Invest Punjab Summits for inviting both domestic and foreign investments. For realizing these objectives, Punjab has constituted the Punjab Bureau of Investment Promotion-PBIP (2016), announced the Industrial and Business Development Policy (2017), constituted District

Level MSME Facilitation Council, introduced Invest Punjab-Business First Portal (2018)-State's Single Window for regulatory approvals and fiscal incentives, enacted the Punjab Right to Business Act 2020 permitting setting up of MSMEs based on self-certification, the establishment of a Dedicated Commercial Court in Ludhiana for resolving commercial disputes, creation of Online Land Bank for Land allotment of Industrial Plots through E-Auction (2020), introduced the Punjab Anti Red Tape Act (2021), setting up of District Bureau of Industries and Investment Promotion (2021), Promotion of One District One Product Scheme, setting up of Punjab Innovation Mission for Start-Ups (2022).

For rapid industrialization, more bold policy initiatives particularly for restructuring industrial governance, are mentioned as under:

(i) Integrating of the State Single Window Portal with the National Single Window Portal, (ii) rationalization of No Objection Certificates (NOCs) and online delivery, (iii) Decriminalization of Acts & Services, (iv) Formulation of New Industrial & Business Development Policy-2022 for next five years, (v) Development of robust infrastructure in Focal Points and setting up of new Focal Points, (vi) Strengthening of field offices and capacity building of the staff, (vii) adoption of the decentralized and digital technology-centric governance model for time-bound and corruption-free clearance of industrial projects, (viii) Appointing entrepreneurial/economic bureaucracy in the Department of Industries and Commerce and (ix) Institutional framework for a government-industry interface.

Annexure

Table 1:
Share of Manufacturing Sectors in State Income (%)

Year	Gujarat	Haryana	Karnataka	Maharashtra	Punjab	Tamil Nadu
1993-94	28.3	18.7	17.9	25.1	15.0	26.2
2011-12	28.4	19.4	17.6	21.5	14.8	21.9
2020-21	34.6	21.7	12.2	16.7	13.6	20.1
2021-22	-	23.0	12.5	-	14.4	20.2

Note: *Data at current prices
Source: Handbook of statistics of Indian states-2019, RBI and MoSPI, GoI

Table 2:
Relative Strength of Small and Large & Medium Industries in Punjab

Year	No. Of Unit			Fixed Capital/Investment (Crore Rs.)			Employees (No.)			Production (Crore Rs.)		
	SSI	L&M	Total	SSI	L&M	Total	SSI	L&M	Total	SSI	L&M	Total
1993-94	184875	440	185315	1764	5997	7761	755883	195343	951226	7075	10439	17514
%	(99.76)	(0.24)	(100.00)	(22.72)	(77.28)	(100.00)	(79.46)	(20.54)	(100.00)	(40.4)	(59.6)	(100.00)
2000-01	200603	629	201232	4109	16435	20544	897642	229626	1127268	18325	26577	44902
%	(99.69)	(0.31)	(100.00)	(20.00)	(80.00)	(100.00)	(79.63)	(20.37)	(100.00)	(40.81)	(59.19)	(100.00)
2012-13	154421	248	154849	11459	53705	65164	1077617	240293	1317909	62971	75610	138581
%	(99.72)	(0.28)	(100.00)	(17.59)	(82.41)	(100.00)	(81.77)	(18.23)	(100.00)	(45.44)	(54.56)	(100.00)
2013-14	156518	446	156964	12961	55244	68205	1112858	243820	1356678	70606	91130	165737
%	(99.72)	(0.28)	(100.00)	(19.00)	(81.00)	(100.00)	(82.03)	(17.97)	(100.00)	(45.01)	(54.99)	(100.00)
2017-18	206095	504	206599	22726	97276	120002	1487843	336581	1824424	118572	176732	295305
%	(99.76)	(0.24)	(100.00)	(18.94)	(81.06)	(100.00)	(81.55)	(18.45)	(100.00)	(40.15)	(59.85)	(100.00)
2018-19	259433	549	259982	28451	109833	138283	1779275	344323	2123598	134100	179916	314015
%	(99.79)	(0.21)	(100.00)	(20.57)	(79.43)	(100.00)	(83.79)	(16.21)	(100.00)	(42.7)	(57.30)	(100.00)
2019-20	337955	590	338545	36821	83086	1199047	2146649	291816	2438465	150459	165685	316144
%	(99.83)	(0.17)	(100.00)	(30.71)	(69.29)	(100.00)	(88.03)	(11.97)	(100.00)	(47.59)	(52.41)	(100.00)

Source: Statistical Abstract of Punjab, Various Issues

Table 3:
District-wise Distribution of Industries in Punjab during 2019-20 (Per cent)

DISTRICTS	No. of Unit		Fixed Capital/ Investment		Employees		Production	
	SSI	L&M	SSI	L&M	SSI	L&M	SSI	L&M
LUDHIANA	99.69	0.31	45.44	54.56	86.39	13.61	66.84	33.16
JALANDHAR	99.94	0.06	76.17	23.83	96.92	3.08	75.38	24.62
AMRITSAR	99.88	0.12	38.91	61.09	92.10	7.90	63.58	36.42
SAS NAGAR	99.80	0.20	29.21	70.79	78.65	21.35	26.13	73.87
SANGRUR/MALERKOTLA	99.92	0.08	62.92	37.08	86.75	13.25	16.69	83.31
PATIALA	99.80	0.20	49.18	50.82	91.39	8.61	37.65	62.35
HOSHIARPUR	99.85	0.15	14.67	85.33	78.21	21.79	4.29	95.71
GURDASPUR/ PATHANKOT	99.91	0.09	50.85	49.15	97.77	2.23	78.99	21.01
KAPURTHALA	99.92	0.08	17.24	82.76	78.89	21.11	48.15	51.85
MOGA	99.94	0.06	92.24	7.76	96.64	3.36	40.80	59.20
BATHINDA	99.83	0.17	2.84	97.16	84.20	15.80	51.45	48.55
SBS NAGAR	99.87	0.13	21.71	78.29	83.90	16.10	12.36	87.64
FARIDKOT	99.98	0.02	99.10	0.90	99.82	0.18	97.76	2.24
FEROZEPUR	99.91	0.09	66.75	33.25	97.37	2.63	52.74	47.26
SRI MUKATSAR SAHIB	99.92	0.08	35.75	64.25	93.19	6.81	18.78	81.22
BARNALA	99.92	0.08	23.43	76.57	78.50	21.50	83.12	16.88
MANSA	99.93	0.07	12.45	87.55	88.18	11.82	12.44	87.56
ROOP NAGAR	99.89	0.11	14.79	85.21	87.21	12.79	42.52	57.48
FAZILKA	99.90	0.10	85.64	14.36	97.50	2.50	97.69	2.31
TARN TARAN	99.87	0.13	44.86	55.14	95.96	4.04	19.40	80.60
FATEHGARH SAHIB	98.80	1.20	11.62	88.38	57.31	42.69	56.51	43.49
TOTAL	99.83	0.17	30.71	69.29	88.03	11.97	47.59	52.41

Source: Department of Industry and Commerce, Punjab.

Table 4:
District-wise Distribution of Industries in Punjab during 2019-20

SR. NO.	DISTRICT	UNITS			EMPLOYMENT			FIXED INVESTMENT (LAKH RS.)			PRODUCTION/TURNOVER (LAKH RS.)		
		SSI	L&M	TOTAL	SSI	L&M	TOTAL	SSI	L&M	TOTAL	SSI	L&M	TOTAL
1	LUDHIANA	94938	291	95229	769220	121233	890453	1282378	1539474	2821851	8125533	4031227	12156760
2	JALANDHAR	39340	22	39362	279832	8901	288733	489983	153308	643291	567812	185485	753297
3	AMRITSAR	27320	34	27354	133477	11452	144929	199601	313434	513034	768452	440261	1208714
4	SAS NAGAR	22999	45	23044	159779	43379	203158	354447	859106	1213554	295318	834978	1130296
5	SANGRUR/ MALERKOTLA	22174	18	22192	129143	19733	148876	218027	128488	346515	1180240	5891775	7072015
6	PATIALA	19945	39	19984	117164	11038	128202	223752	231209	454961	385459	638218	1023677
7	HOSHIARPUR	13409	20	13429	59619	16613	76232	86365	502500	588865	54811	1222453	1277265
8	GURDASPUR/ PATHANKOT	12334	11	12345	76924	1753	78677	87877	84938	172815	204490	54402	258892
9	KAPURTHALA	11309	9	11318	50262	13449	63711	77884	373927	451810	128916	138794	267710
10	MOGA	10890	6	10896	56882	1980	58862	103355	8701	112056	153683	222959	376643
11	BATHINDA	8382	14	8396	48623	9124	57747	84012	2877640	2961652	295291	278594	573885
12	SBS NAGAR	6926	9	6935	29457	5654	35111	42237	152316	194553	37396	265162	302558
13	FARIDKOT	6562	1	6563	39671	70	39741	60784	550	61334	385798	8856	394654
14	FEROZEPUR	6326	6	6332	25941	700	26641	56718	28250	84968	90324	80924	171248
15	SRI MUKATSAR SAHIB	6193	5	6198	37271	2723	39994	63671	114431	178102	142515	616318	758833
16	BARNALA	6105	5	6110	33812	9261	43073	66785	218295	285080	427256	86773	514029
17	MANSA	5945	4	5949	15549	2084	17633	37115	260979	298094	89894	632436	722330
18	ROOP NAGAR	5282	6	5288	25498	3740	29238	40211	231748	271959	216870	293173	510043
19	FAZILKA	4809	5	4814	28663	735	29398	59776	10024	69800	781482	18517	799999
20	TARN TARAN	3891	5	3896	19991	841	20832	21859	26873	48732	22860	94950	117810
21	FATEHGARH SAHIB	2876	35	2911	9871	7353	17224	25292	192404	217696	691497	532222	1223719
	TOTAL	337955	590	338545	2146649	291816	2438465	3682129	8308593	11990723	15045897	16568479	31614376

Source: Department of Industry and Commerce, Punjab.

INDUSTRY: VISION 2047
TARGETS, SHORT- AND LONG-TERM STRATEGIES

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
SECTORAL SHARE OF MANUFACTURING IN STATE INCOME	14.4% (2021-22)	20.0%	25.0%	For achieving the targets and keeping in view the locational advantages, the strategy is to upgrade the technology of the existing industry and develop three types of industries in the state: i. High-tech agro-based industries making them farmer centric; ii. Footloose industries and; iii. Advanced digital technology and knowledge-driven industries in tune with Fourth Industrial Revolution (Industry 4.0).
INDUSTRIAL INFRASTRUCTURE/ INDUSTRIAL HUBS/PARKS/ CLUSTERS	-	-	-	Proposed industrial hubs/parks/clusters at Ludhiana, S.A.S Nagar Mohali, Bathinda, Rajpura, Amritsar, Kapurthala, Phagwara, Fazilka, Ladowal, Sirhind and Wazirabad (Fatehgarh Sahib). Developing a dedicated cluster on about 300 acres of land for manufacturing high-tech bicycles at Ludhiana. Cargo Hub at Chandigarh International Airport, Mohali. State-of-art infrastructure in industrial areas. Implementation of Plug and Play Scheme in all the districts. Establishing common effluent treatment plants. Setting up of Permanent Exhibition Centres for Industry at Mohali.
INDUSTRY KNOWLEDGE CORRIDORS	-	-	-	Digital Technology and knowledge-based industry are jointly developed by industry and educational institutions. Keeping in view the location of universities and research institutions, five knowledge-industry corridors/parks and start-up hubs to be considered: These include: i. Chandigarh-Mohali-Patiala Corridor; ii. Chandigarh-Mohali-Ludhiana Corridor; iii. Chandigarh-Mohali-Ropar Hoshiarpur Corridor; iv. Ludhiana-Jalandhar-Kapurthala-Amritsar Corridor; and v. Sangrur-Bhatinda-Faridkot Corridor. Setting up Incubation Centres in universities and research institutes.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
UPGRADATION OF TECHNOLOGY OF THE EXISTING INDUSTRIAL UNITS	-	-	-	Adoption of technology upgradation and modernization schemes for MSMEs such as Credit Linked Capital Subsidy Scheme (CLCSS), Technology and Quality Upgradation Scheme (TEQUP), Lean Manufacturing, Quality Management Standards and Quality Technology Tools (QMS & QTT) and Zero Defect and Zero Effect (ZED).
DEVELOPING AN INTEGRATED MODEL OF INDUSTRIALIZATION	Small and large-scale units are working in isolation.	-	-	For rapid and sustained industrialization, integrated model of industrialization may be considered. In this model, big industries act as parent/anchoring industries and medium and small-scale industries as ancillaries.
ENVIRONMENTAL-FRIENDLY INDUSTRY	-	-	-	For promoting environmental sustainability, white, green and orange industries need to be incentivized. Incentivizing renewable energy sources including rooftop solar plants for industry.
OPTIMIZING THE BENEFITS OF CENTRAL GOVERNMENT FLAGSHIP PROGRAMMES AND SCHEMES	Programmes include Atmanirbhar Bharat Abhiyan, Make in India; Digital India; Start-up India; Skill India, Programs for MSMEs, Production Linked Incentive (PLI) Scheme, Fame India Scheme, PM FME, Integrated Processing Development Scheme	-	-	i. Setting up of dedicated cell in the respective Administrative Department to make optimal utilization of the flagship programmes of the Central government. The progress should be monitored every quarter. ii. Restoring freight equalization policy. iii. Granting tax holidays by the Union Government to Industry in the view of Punjab being a border State. iv. Freight Subsidy Scheme for Industrial Units located more than 1200 km from ports is requested from the Government of India. v. Extension of the Production Linked Incentive (PLI) to bicycles, E-bikes for consideration of the Government of India.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
RESTRUCTURING INDUSTRIAL GOVERNANCE	PBIP was constituted in 2016 to provide for expeditious clearance of investment proposals and implement investment promotion policies announced by the State Government. Formulated Industrial and Business Development Policy (2017), Invest Punjab-Business First Portal (2018), State's Single Window for regulatory approvals and fiscal incentives, Punjab Right to Business Act 2020, permitting setting up of MSMEs on the basis of self-certification, creation of Online Land Bank for Land allotment of Industrial Plots through E-Auction (2020), Setting up of District Bureau of Industries and Investment Promotion (2021), Promotion of One District One Product Scheme, Setting up of Punjab Innovation Mission for Start-Ups (2022).	-	-	For rapid industrialization, policy initiatives, particularly for restructuring industrial governance, are mentioned as under: (i) Integrating of State Single Window Portal with National Single Window Portal, (ii) rationalization of No Objection Certificates (NOCs) and online delivery, (iii) Decriminalization of Acts & Services, (iv) Formulation of new Industrial & Business Development Policy-2022 for next five years, (v) Development of robust infrastructure in Focal Points and setting up of new Focal Points, (vi) Strengthening of field offices and capacity building of the staff, (vii) adoption of the decentralized and digital technology-centric governance model for time-bound and corruption-free clearance of industrial projects, (viii) Appointing entrepreneurial/economic bureaucracy in the Department of Industries and Commerce and (ix) Institutional framework for a government-industry interface.

SECTION III

RURAL AND AGRICULTURE

I. Agriculture and Rural Development

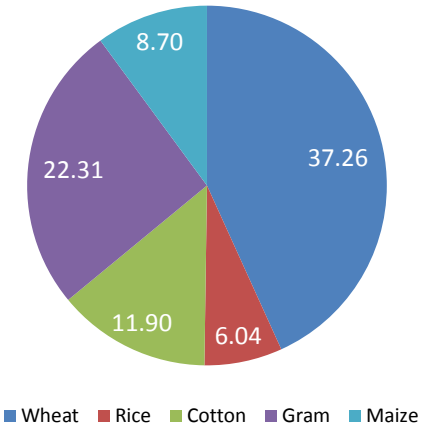
AGRICULTURE

Current Status

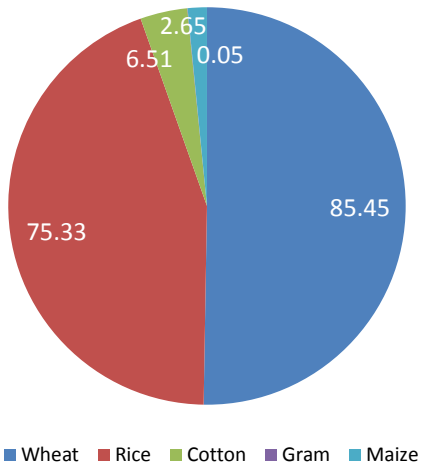
The growth of Punjab agriculture over the last four and a half decades has been remarkable. The fast and almost universal adoption of HYV technology and its concomitant developments like mechanization of farm operations, extensive tubewell irrigation, high degree of crop specialization and commercialization of production and input structure, have completely transformed agriculture in Punjab that it now resembles the agriculture of developed countries. The fast growth of Punjab agriculture has not only raised the income level and living standard of the state's farmers but also made the country self-sufficient in food grains. The huge and regular surplus of rice and wheat produced by Punjab farmers is the main pillar of the country's food security and public stock of foodgrains. With less than two percent of the area of India, Punjab contributes almost one-third to the central pool of foodgrains.

The economy of Punjab offers an interesting scenario for the study of regional development in India. A look into the structure of the state's GVA (Gross Value Added) and employment reveals that the contribution to GVA from agriculture and its allied sectors is 24.45% in Punjab, and in India, it is 18.4%. Since the green revolution period, the state experienced a fast change in the cropping pattern and is mainly dependent upon two crops i.e., wheat & paddy, (see figure 1 below and Table 1 in Annexure).

Figure 1: % age of Net Sown Area under Main Crops (1960-61 to 2018-19)
(1960-61)



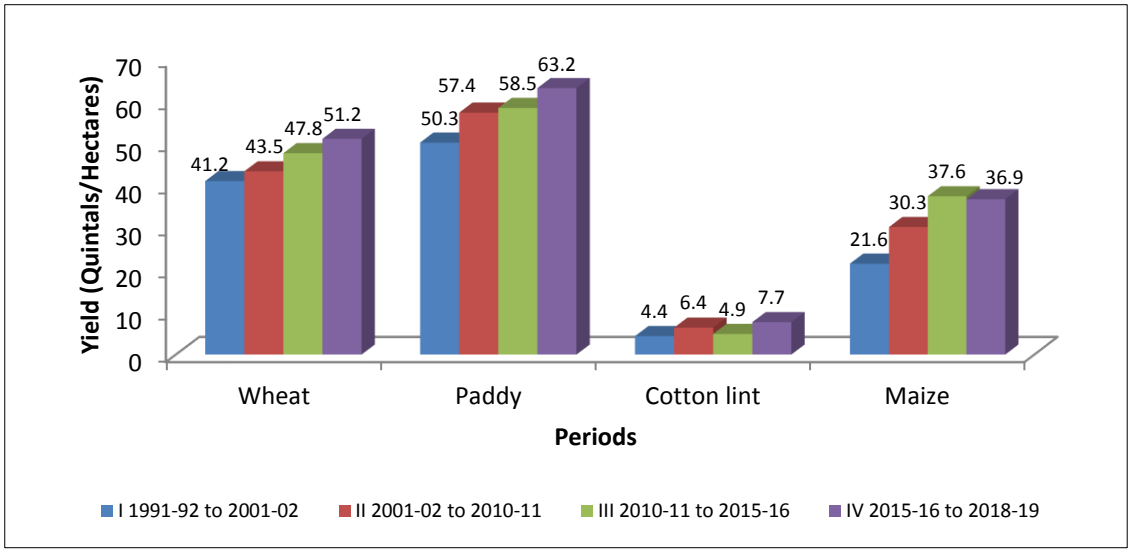
(2018-19)



Cropping Pattern: Grains Production, Agriculture and Agriculture Allied Activities

About 84% of the total cropped area of 78.40 lakh hectares is under rice and wheat cultivation; the crops contribute about 89 percent of the total value of crops produced in the State. The rice yield at present is 63 quintals per hectare and the wheat yield is 51 quintals per hectare. About 99 percent of the total cropped area is irrigated; 71% of which by tubewells and 29 percent by canals. Inspite of being the highest in the country, rice and wheat yields are still growing; albeit at a slow rate. Over the 2010-11 to 2018-19 period, rice yield increased by 4.7 quintals per hectare (8.03%) and wheat yield by 3.4 quintals per hectare (7.11%) see figure 2 below. (see Table 2 in Annexure).

Figure 2: Yield of Main Crops in Punjab (Quintals/Hectare)



Procurement and Marketing

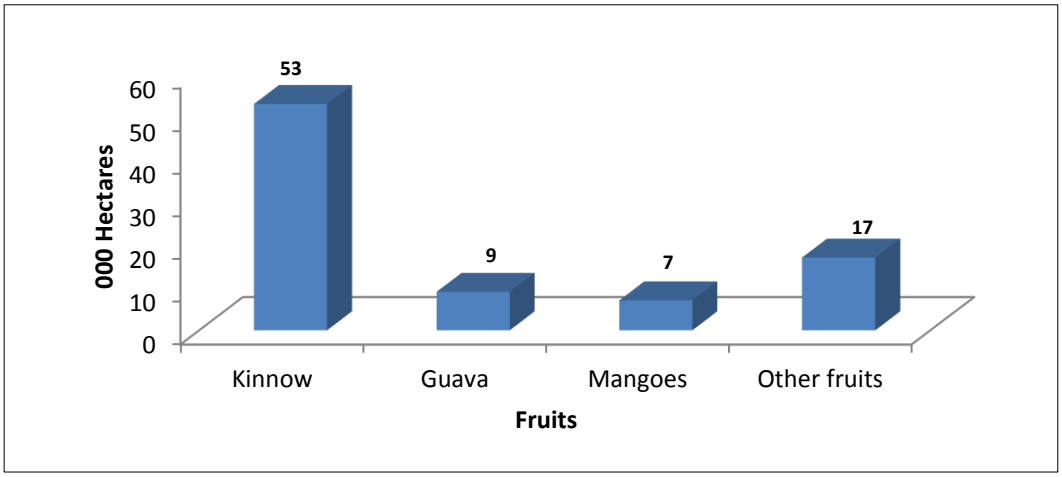
Punjab is a major source of foodgrains for the central pool of foodgrains. In 2018-19 Punjab contributed 118.34 lakh tonnes of rice to the Central Pool; which was 25.53% of the total rice procured in the country. In the same year, Punjab contributed 126.92 lakh tonnes of wheat to the Central Pool; which was 35.46% of the total wheat procured in the country.

The procurement and marketing of rice, wheat and other crops in Punjab occur through 154 regulated markets and 283 regulated sub-yards. The total storage capacity for foodgrains in the State was 270.08 lakh tonnes in 2019-20. Out of this about 46% is owned by the Food Corporation of India (FCI) and 54% by other Central and State agencies. The effective procurement and remunerative minimum support prices and assured purchase of the entire surplus production of wheat and rice have been major factors enabling Punjab farmers to attain high yield rates and high labour productivity.

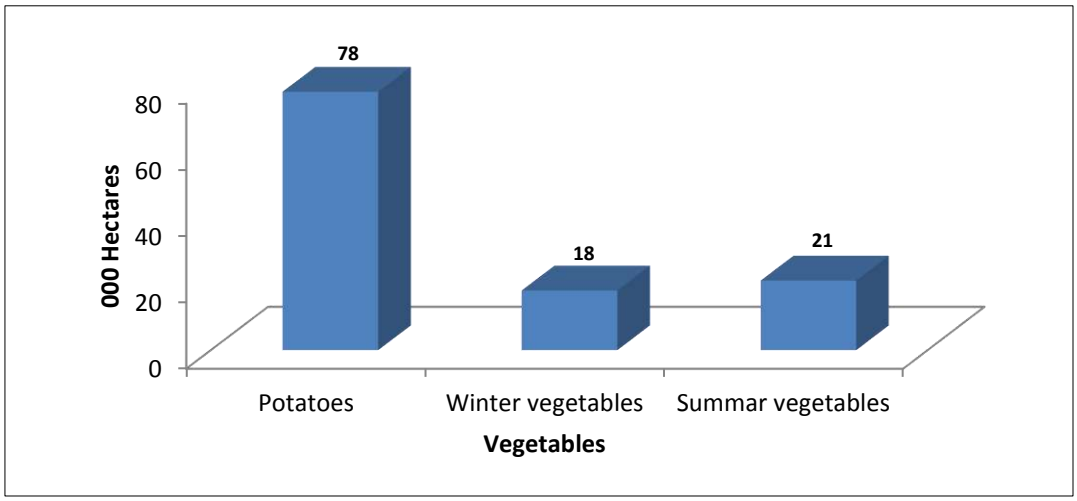
Increasing Area under Fruits and Vegetables

The area under vegetables and fruits in Punjab in 2018-19 was 2.06 lakh hectares; out of this 59% (1.19 lakh hectares) was under vegetables, and 42% (0.87 lakh hectares) was under fruits. In vegetables 78,590 hectares were under potatoes, 18,438 hectares were under winter vegetables, 21,350 hectares were under summer vegetables and 777 hectares were under other vegetables. In fruits, Kinnow accounted for 53,359 hectares, Guava for 9,172 hectares, Mangoes for 7,007 hectares and 17,236 hectares under other fruit Figures 3A and 3B below and Table 3 in Annexure.

Figures 3A: Area under Fruits (000 Hectares)



Figures 3B: Area under Vegetables (000 Hectares)



Challenges

Crop Yield Levels

The yield of rice and wheat is the highest in India and is among the best in the world. The stagnation in yield growth is partly the result of Punjab rice and wheat yield having reached almost the maximum attainable level under present HYV technology; and partly the result of wheat and rice cultivation being extended to more and more inferior lands, less suitable for the cultivation of these two crops. The only possible remedy for this slowdown is to develop still higher-yielding HYV varieties with a massive concentration of resources and scientific talent at Punjab Agricultural University (PAU) and the Indian Institute of Rice Research to develop such varieties (see Table 6 in Annexure). The PAU is already focusing on harnessing nutritional and other quality traits in its crop improvement programmes.

Water Depletion

Although a small area in southern Punjab is suffering from waterlogging but the water table is falling in most of the area of Punjab. There are more than 14 lakh tubewells in Punjab i.e., one tubewell for every three hectares of cultivated area. Out of 138 blocks of the State, 84% (116) are over-exploited[1]. As, the canal network of Punjab has become

[1]Groundwater Resources of Punjab State (2017).

aged, so, the state needs huge investment to repair and maintenance of old canal network.

Waterlogging in South-West Punjab

A recent report of the Planning Commission (High-Level Expert Group, 2013)[2] has estimated that about 53 square kilometres of area in Sri Muktsar Sahib and Ferozpur districts have been severely affected by waterlogging and salinisation. This has adversely affected the cultivation of all crops; especially cotton cultivation and kinnow orchards. The farmer households in this area have suffered a major fall in income because cultivation of cotton and other crops have become almost impossible.

The waterlogging in this area is a recent occurrence; historically, this area was known for a very deep level of the groundwater table. The extension of canal irrigation on almost the entire cultivated area due to enhanced water allowance, continuous seepage from Rajasthan Canal and Sirhind Feeder canal over the years, destruction of the natural drainage system by land levelling, the brick lining of water courses, the building of village link roads etc., are some of the factors responsible for waterlogging in the area. The hard pan of impervious clay near the surface in this area also hinders the percolation of water downward and has contributed to waterlogging.

Over-mechanisation

There are about 11 lakh farmers in the State, out of which 33% are small/marginal farmers with upto two hectares of the operated area. The average size of the holding is 3.70 hectares. Punjab farms are highly mechanised, six lakh farmers own tractors and the remaining five lakhs also use tractors by hiring. There is one tractor, on average, for every seven hectares of cultivated area, and one harvesting combine for every 60 hectares of cultivated area.

Growth of Farm Debt and Farmers' Suicide

The highly commercial agriculture has increased the problem of debt among farmers. In 2007-08 about 96% of farmers were under debt, and the total amount of farm debt was

[2]Report of the High-Level Expert Group on Waterlogging in Punjab, 2013, Planning Commission (GoI).

estimated at Rs.30394.12 crore (Shergill, IDC, 2010)[3]. The average per farmer household debt amount came to Rs.3.04 lakh and debt per operated acre amounted to Rs.28,708. The per operated acre debt of marginal/small farmers was higher than the average; being Rs.4,26,71. The share of formal sector credit agencies (Banks, Cooperatives etc.) in farm debt was 56.64% and the remaining 43.36 % share was of commission agents and traditional moneylenders.

Farmers Leaving Farming

The rising debt and low profitability have compelled the farmers to leave farming. A recent study conducted by Punjab State Farmers Commission (Karm Singh et al, 2007)[4] reported that almost two lakh farmers left farming between 1981 and 2007. Between 1981 and 2007, about 10.90% of all farmers left farming and shifted to other non-farm occupations. The proportion of farmers leaving farming was the highest among small farmers (15%), and the lowest among large farmers (4.90%).

The incidence of farmers leaving farming was the highest in the sub-mountainous zone (20.50% of farmers in the zone left farming); in the other two regions, the incidence was almost similar (10.20% in the central zone and 11.20% in the south-western zone).

The reasons mentioned by farmers for leaving farming are low income from farming, sub-division of holdings making farming unviable, repayment of accumulated debt, high land rents making leasing out more attractive and attraction of earning more in the non-farm jobs.

Environmental Consequences

The growth of modern intensive agriculture and cultivation of wheat-rice monoculture has generated considerable environmental stress in the state. Of the many aspects of this environmental stress, the most often mentioned by experts are the growth of pesticide residues in water, milk, vegetables and grains; deterioration of soil quality due to depletion of micro-nutrients and air pollution caused by the smoke generated by paddy and wheat straw burning.

[3]Growth of Farm Debt in Punjab: 1997 to 2008, Institute for Development and Communication (IDC), Chandigarh.

[4]Status of Farmers Who Left Farming in Punjab, Punjab State Farmers Commission, Mohali.

Stubble Burning

The extension of the wheat and rice rotation system to almost the entire cultivated area of the state and the short time available to farmers to prepare land for sowing of the next crop in this continuous two-crop cycle has generated the phenomenon of mass burning of paddy and wheat straw by farmers immediately after the harvesting of these two crops that generates a huge volume of smoke. The huge volume of smoke created by paddy and wheat straw burning not only pollutes the environment and generates many respiratory problems for the population, but also becomes an obstruction in the smooth flow of traffic on the roads. Despite the efforts of State government, the mass burning of straw continues.

Levelling of Land in Foothill Zone & southern Punjab

In most of the regions of Punjab, farmland has been precision levelled by farmers on their own. Only in the Foothills zone/Kandi area and Sandy dunes area in Southern Punjab, land levelling is still incomplete. Moreover, in the foothills zone, a large number of '*barsatichoes*' and rivulets are not only causing soil erosion but also resulting in a large area of waste and uncultivated land.

Short-Run Targets and Strategy: 2030

Raise the yield levels:

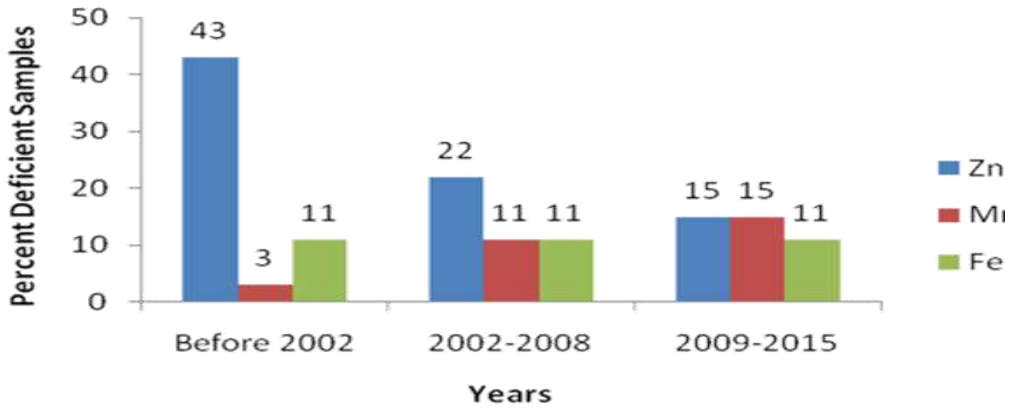
Wheat yield will be raised to 58 quintals per hectare from the present 51 quintals, and rice yield will be raised to 73 quintals per hectare from the present 63 quintals. To achieve these targets, new high-yielding varieties of rice and wheat will be developed by the state agriculture university. Low-yield blocks, villages and farmers will be identified by the state agriculture department, causes of low yield to be studied and remedial steps will be taken to raise the yield rate of these to the average Punjab level. The use of certified recommended seeds, quality fertilizers and other inputs will be ensured. The land in foothills and Kandi area will be completely levelled to raise the yield of wheat and rice in that region. The second component of the strategy is to ensure that all farmers use only university/experimental farm-produced seeds of rice and wheat. The

agricultural department will ensure that an adequate supply of such certified seeds is available to farmers at the sowing time. The third component of the strategy is to ensure the timely supply of adequate power, fertilizer, credit and other inputs so that rice and wheat are sown during the period that results in the highest yield. Other things remaining the same, the timely sowing results in a 10 to15% increase in yield. The primary agriculture cooperative societies (PACS) may be actively involved and strengthened in the distribution of agriculture inputs in villages.

TO ENSURE THE SUSTAINABILITY OF FOODGRAIN PRODUCTION

- The main threats to the sustainability of foodgrain production in Punjab are:
    - Falling groundwater level (see Table 7 in Annexure). The average rainfall is decreasing and the average decline in the water table has been by 30 cm from 1999-2000 to 2013-15.
    - Inadequate and irregular power supply especially during paddy season is a major problem.
    - Deficiency of micronutrients like Zinc (Zn) is the most widespread problem in Punjab in rice crop**.** In addition to that Mn (magnesium) deficiency in wheat and iron deficiency in rice need further attention.

Figure 5: Periodic Changes in Micronutrient Status of Punjab Soils



Source: U.S. Sadana Etal, 2010, Best crops- South Asia

- The slow growth of Minimum Support Price compared to growth in the cost of production of rice and wheat.

- Focus on a new technical breakthrough in high-yielding varieties of rice and wheat and focus on nutrition and other qualities like chapatti-making traits.
- Climate change is a big challenge for agriculture and there is a need to step up efforts to fight it through the development of climate-resilient crop varieties with enhanced tolerance to biotic and abiotic stresses, which can maintain or increase crop yields under stress conditions such as drought, flooding, heat, chilling, freezing and salinity, etc.

- To ensure the sustainability of foodgrain production, the following targets are fixed:
  - To halt the fall in groundwater table by advancing the date for starting paddy transplantation to 18th June by 2020, to 23rd June by 2025 and to 30th June by 2030.
  - To fix the maximum area for paddy cultivation per power-operated tubewell and enforce it.
  - To ensure eight hours of regular power supply to tubewells throughout the year.
- To ensure the use of quality university-approved seeds of rice and wheat. The target is to cover 75% by 2025 and 100% by 2030.
- To press the Central Government to increase the Minimum Support Price of rice and wheat in proportion to the rise in the cost of production of these two crops.

Strategy for Crop Diversification (2030)

- The area under rice will be reduced by five lakh hectares by 2030.
- Policies equally favourable for alternative crops, namely Minimum Support Price (MSP) and assured marketing are required. For ensuring a shift to alternative crops, the foremost challenge is giving the price above or at least as remunerative as for paddy. The farmers are to be motivated to shift a portion of their land to other crops and they may be compensated equivalent to their loss in income from this portion of land for three years. The returns from maize and cotton should be at least 15% more than paddy. Likewise, MSP for pulses should be implemented effectively.

- For enhancing the area under maize to five lakh hectares by 2025, there is a need to augment its use as feed in poultry and dairy farming. There is a vast scope to use it in many industrial products of which particular mention is made of ethanol which can be mixed with petrol. The blending of petrol with ethanol should be increased from 10 to 15%.
- For cotton, the State has proposed that the Cotton Corporation of India be asked to carry out MSP operations in all-cotton markets in the state. Support for textile industries is also required for enhancing cotton production. Twenty designated markets for cotton need to be upgraded under the Technology Mission.
- For sugarcane, the crushing season of at least 180 days for sugar mills needs to be ensured by developing early maturing varieties and sick cooperative sugar mills need to be revived. Though the water requirement of sugarcane is high, yet it is important for the state due to local market demand and long product shelf life. There is a need of modernizing existing sugar mills in the State.
- Wheat and rice cultivation is almost fully mechanized. The increase in area under other crops for diversification will aggravate the labour problem. Machines for alternative crops such as maize grain drier, cotton picker, sugarcane harvester, sugarcane trench planter, oilseed drill, vegetable picker, garlic planter, potato planter, etc., would be required for acceleration of the diversification process.
- Collection centres/pack houses should be set up with facilities like washing, cooling, grading and packaging for the marketing of fruits and vegetables. Punjab also requires infrastructure for the export of perishables.
- The subsidies should be targeted at land development, underground water channels, improved implements, adoption of modern technologies, installation of tubewells for marginal farmers, infrastructure for export of vegetables, flowers, fruits, farmer training, etc.
- Besides crops, diversification towards dairy farming, poultry, piggery and fish farming is extremely important. There has to be more focused research on fodder crops for developing improved varieties and their production technology so as to bring more area under these crops. The Dairy Development Department will make

every effort to improve the productivity of milch animals. Supplemental subsidiary occupations such as mushroom production and beekeeping can also play an important role in agriculture diversification and provide livelihood security to rural populations on a sustainable basis. These diversification options will provide regular income and are, therefore, more attractive for marginal and small farmers.

Increase area under Fruits, Vegetables and Wood Products

- To exploit specific adaptation, niches the state is providing technical input and managing marketing and thereby enhancing the profit of crops like basmati rice, groundnut, barley, chickpea, pea, muskmelon, watermelon, celery, kinnow, litchi, flowers, etc. The potential of the Kandi area of the state for organic production of various crops needs to be exploited. Another alternative option is promoting vegetable cultivation under net houses and in peri-urban areas.
- In all crops especially fruits and vegetables, price crash due to glut in the market is a matter of concern. Processing of fruits and vegetables, post-harvest storage and establishing cold chains are essential to ease out such a situation. For perishable commodities, niches may be developed and as far as possible, the farms should be located near the markets.
- There is a growing demand for wood products and, thus, a good scope to bring more area under agroforestry. This would require technology and infrastructure in the form of modern wood markets having the facility of high-tech sawmills and seasoning plants and wood industries making laminated wood from poplar and *Eucalyptus*.

To Check Over Exploitation of Groundwater

The groundwater extraction rate will be lowered to 130% by 2030 from the present 164.4%. The number of over-exploited blocks will be reduced to 60 from the present 116. To attain these targets by 2030, Efforts both at policy and technology levels will be made for diversifying away from paddy. Short-duration rice varieties, besides other water-saving traits will continue to be the focus of breeding programmes. To regulate the exploitation of groundwater, there is a need to frame laws and rules at the government level.

Direct Seeding Rice (DSR) technique requires less water, low production cost, better soil physical conditions for following crops and less methane emission. Aimed to shift the 50% area of traditional transplanted rice in Punjab into DSR technique upto 2030. In addition, the DoA & FW, Punjab is promoting alternate wetting & drying in transplanted rice, zero till drill and laser land levelling to save groundwater.

In the coming two-three years, special emphasis will be given to the promotion of *Rain Guns* for the cultivation of DSR Paddy in areas following the Rice-Wheat Cycle and drip irrigation for spring maize cultivation.

A project proposal titled "Promoting IoT-based Intelligent Water Saving Technologies" for conserving groundwater resources in Punjab, an amount of Rs. 12.44 crores have been kept by State Government for the year 2022-23. Under this project, there will be an expansion and promotion of IoT-based digital soil moisture sensors (CIPT) amongst 2,500 tubewells across 77 villages spread across 11 districts in Punjab.

Under NeGP-A (Digital Agriculture), a project for optimum utilization of groundwater in agriculture through Artificial Intelligence (AI) and Machine Learning (ML) both in predictive analysis and automation of management practices is presently being implemented in the State on a pilot basis by DoA & FW, Punjab in collaboration with PAU, Ludhiana and PRSC Ludhiana.

ANIMAL HUSBANDRY, DAIRY FARMING & EXPANSION IN MILK PRODUCTION:

Animal Husbandry

Livestock rearing is an important sub-sector under Agriculture and allied activities. The sector is the second largest contributor to agriculture GSVA (Gross State Value Added) with a share of over 38.63% in 2021-22 (at current prices), with a growth of 16.73% (at constant prices) during last four years.

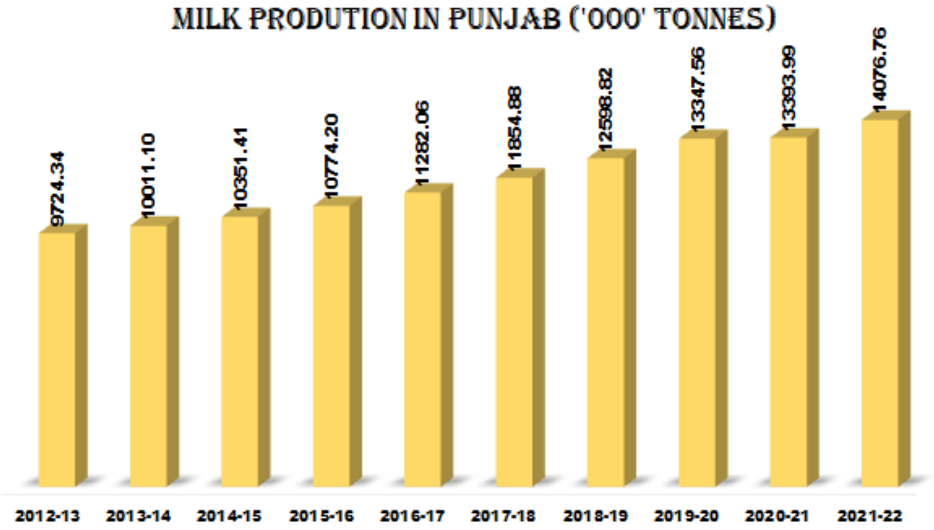
Punjab has vibrant 70 lakh livestock population which has higher growth rate than national average. Livestock includes 25.31 lakh cattle, 40.16 lakh bovine, 0.86 lakh sheep, 3.48 lakh goat, 0.53 lakh pigs and 0.19 lakh equines. Poultry population in Punjab is 174.26 lakhs.

Animal Husbandry Department is focused at sustainable growth of livestock and poultry for nutritional security, economic prosperity and livelihood support; and promotion of Disease-Free Zone concept for specific contagious animal diseases. Thus, Animal Husbandry Department preserves animal genetic resources, conserves indigenous breeds, protects, strengthens and improves livestock, creates employment opportunities and livelihood support for women and other marginalized groups, increases production, productivity and value addition of livestock, and poultry products. The services rendered by the department are measured as growth in output in terms annual milk, meat and egg productions.

Livestock Production – Milk:

In Punjab, commonly found cattle breeds are Holstein Fresian, Jersey, Sahiwal, Gir and is also home track of Murrah and Nili Ravi breed of buffalo.

Punjab produced 6.7 per cent of India's total milk and per capita availability of 1,181 grams of milk per day, the highest in the country in 2017-18. Total Milk production in Punjab is expected to reach 14580 thousand tonnes in 2022-23. With implementing various schemes for Cattle and Buffalo Development through the Animal Husbandry; milk production data has shown a positive growth over last decade:



Rashtriya Pashudhan Vikas Yojna: GOI scheme, results in enhanced productivity and benefit of the program, percolating to all cattle and buffaloes of state especially with small and marginal farmers. The scheme is important in enhancing milk production and

productivity of bovines to meet growing demand of milk and making dairying more remunerative to the rural farmers of the country This program has also benefit women in particular since over 70% of the work involved in livestock farming is undertaken by women.

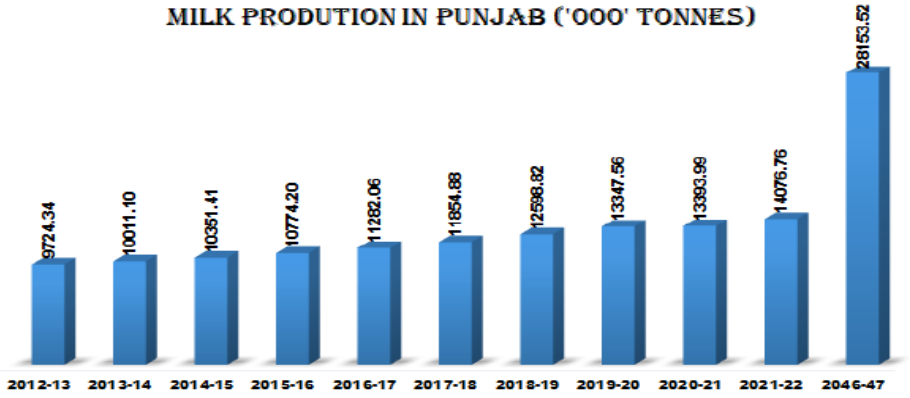
All the components of Scheme are implemented on 100% grant-in-aid basis except the components of:

- Accelerated breed improvement program under the component subsidy of Rs 5000 per IVF pregnancy will be made available to participating farmers as GoI share; through the IVF Laboratory at Centre of Excellence for Cattle Development at Patiala.
- Promoting sex sorted semen under the component subsidy upto 50% of the cost of sex sorted semen will be made available to participating farmers to promote production of high genetic merit females.
- Promotion of high genetic male calves for holistic development and conservation of Indigenous bovine breeds, Sahiwal, Murrah, Nili Ravi in their home tracts in a sustainable manner. High genetic male calves are procured which will be used in coming years to enhance milk production.

Interestingly, the state government has been religiously promoting exotic breeds, including Holstein Friesian, in Punjab since the early 1980s. However, for the past one decade, it has started promoting Sahiwal and other desi varieties with initiatives like compiling a database of all indigenous cows; giving subsidy of chilling machines, pasteurization plants and milk ATMs amid making clusters of farmers for supplying good quality of milk to the consumers. At one point of time, the government had also tried to rope in Milkfed to sell desi cow's milk under its brand Verka.

Hence, with the present pace of positive growth in milk production, readiness to commercialize and adoption of new technologies by the Department and Dairy farmers, Punjab – "Dairy and Breeder State" can be visualized to double the milk production by 2047.

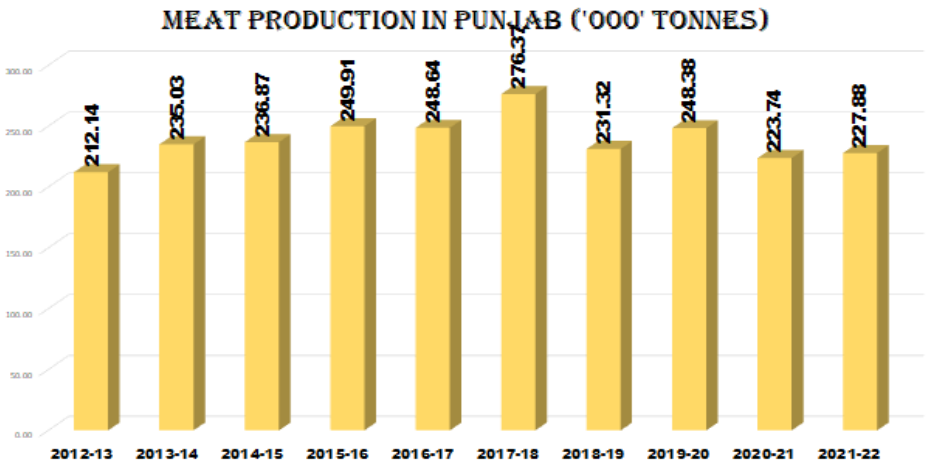
Visualizing State Milk Production - 2047



2. Livestock Production - Meat:

World meat consumption is outpacing the sale of other major agricultural commodities, especially in developing countries, according to "Agricultural Outlook 2012-2021" report by the UN Food and Agriculture Organization (FAO) and the Organization for Economic Co-operation and Development (OECD). According to the FAO study, the rapidly growing world population will be consuming two-thirds more animal protein by 2050 than it does today.

Livestock Production of meat in Punjab data is updated yearly, from 2012 to 2022, with 10 observations. The data reached an all-time high of 276.370 thousand tonnes in 2018 and a record low of 223.74 thousand tonnes 2020-21. Livestock Production: Meat, Punjab data remains active status in Census and Economic Information Centre (CEIC) and is reported by Department of Animal Husbandry and Dairying. The data is categorized under India Premium Database's Agriculture Sector.

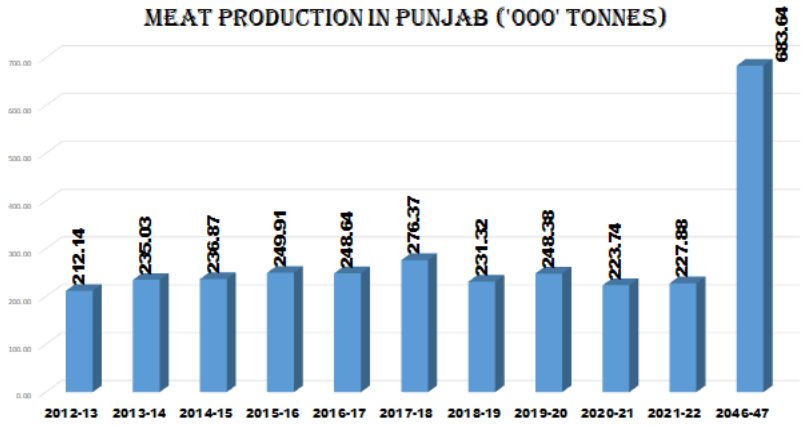


In Punjab, livestock meat production has maximum growth potential as small ruminant population count is considerably low. Hence, growth in promotion small ruminant sector will be directly proportional to the growth in state meat sector. Therefore, development of livestock production activities is important for sustaining meat sector will contribute to food security, nutrition and livelihood of rural Punjab. Livestock sector serves as an important source of milk and meat proteins. It provides employment to millions of rural people and contributes enormous amount of draught power and biomass that enriches the agricultural fields of our country. The sectoral development can be brought about by:

- Establishment of Entrepreneurship for breed development in sustainable sheep and goat farming by incentivizing individuals and groups to convert unorganized sector to organized through investment and creation of forward & backward linkages.
- Establishment of State Semen Bank for Genetic improvement of sheep/goat breeds through selective breeding by propagation of superior male germplasm through artificial insemination.
- Import of exotic sheep and goat germ plasm for Genetic improvement of sheep/goat breeds through selective breeding by propagation of superior male germplasm to produce good quality cross bred animals to increase wool, milk and meat production.
- Promotion of Piggery entrepreneurship & investment and creation of forward & backward linkages in the sector improvement of per animal productivity of pig population of the state through genetic upgradation Genetic Improvement of Pig breeds.
- Establishment of pig semen collection and processing laboratory.

With the present growth in meat production, visualizing future growth potential, funding pattern of Government of India for adoption of new technologies for small ruminant as adopted for large ruminants and extensive use of ICT applications, Punjab can be visualized to enhance the meat production three times by 2047.

Visualizing State Meat Production – 2047



Poultry Production – Eggs and Meat:

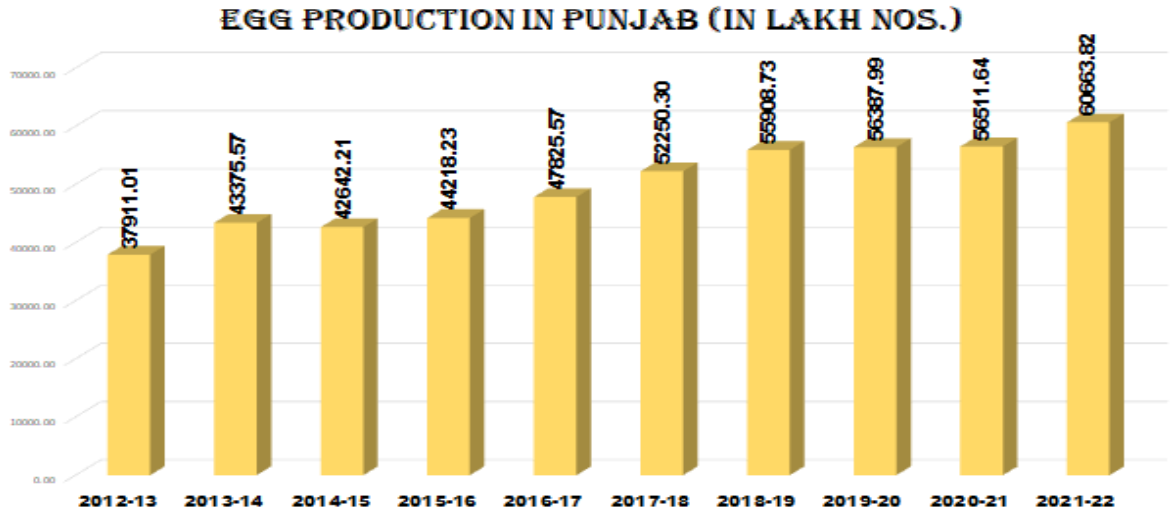
Indian poultry industry is also emerging as the world's 2nd largest market with a production of 69.73 billion eggs and 5.9 million tons of poultry meat. While the production of crop has been rising at a rate of 1.5 to 2.0 percent per annum that of eggs and broiler has been rising at a rate of 8 to 10 percent per annum. Poultry meat is the fastest-growing component of global meat demand, and India, the world's second-largest developing country, is experiencing rapid growth in its poultry sector.

The Central and State Government agencies like Agriculture Department, Animal Husbandry Department, Commerce & Industry Department, Food Processing Department, Human Resource Development Department, Indian Council of Agricultural Research (ICAR), Rural Development Department; Financial institutions like Insurance Companies and Nationalized Banks, National Bank for Agriculture and Rural Development (NABARD) are actively involved and play lead role in development of the sector.

In Punjab, NABARD plays an active role in Poultry Development by Poultry Venture Capital Funds – A Central Sector Plan Scheme in which commercial layer and broiler unit, backyard poultry, Feed mixing units, transport vehicles-open cage and refrigerated are provided for expansion of the sector.

Poultry Cooperatives, autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise work to develop manpower for poultry

industry, launch activities for production of eggs and poultry meat, provide facilities for more profitable marketing. Active institutions supporting the Poultry Co-operatives are National Agricultural Co-operative Marketing Federation, National Co-operative Development Corporation, National Scheduled Caste and Scheduled Tribe Finance and Development Corporation, Poultry Egg and Meat Production Co-operatives and Poultry Federation of India.



Future Strategy for Poultry Co-operatives:

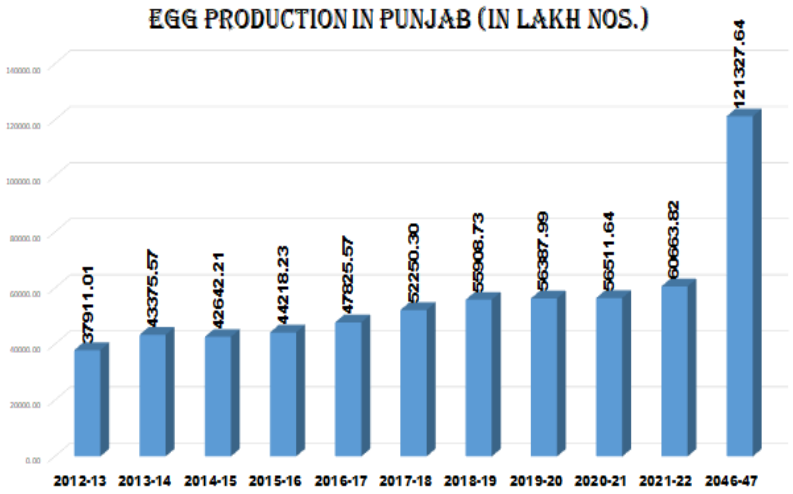
- Market growth of poultry co-operatives is oriented towards cost reduction and appropriation of value addition.
- Establishment of entrepreneurs for breed development of Rural Poultry and bringing unorganized rural poultry farming sector into organized sector in sustainable manner Popularizing the different alternative nonconventional low cost feeding.
- Development and dissemination of Database, market intelligence will facilitate development of online platform/ e-commerce platforms to enable direct linkages among producers / processors and exporters/export markets.
- Participation in fairs / events / buyer-seller meets / reverse buyer seller meets, trade delegations, To promote and enhance visibility of Geographic Indication of products of Punjab on global map.

- Assistance for new market / product development through conducting feasibility studies / assistance for trial shipment and registration of brand / Intellectual Property Rights outside India.

Presently, major Export Destinations are Oman, Maldives, Indonesia, Vietnam, Bhutan, Japan and Russia and with growth in sector, export will increase.

Hence, with the present pace of positive growth in production, readiness to commercialize and adoption of new technologies by the Department and poultry owners, state can be visualized to double poultry production (egg and meat) by 2047.

Visualizing State Egg Production - 2047



FUTURE INTERVENTIONS

Collaboration of department with Universities, Research Institutes, ICAR, GOI Ministries and adopting innovative methods regarding below mentioned components the livestock and poultry sector growth can certainly be assured by 2047:

1. Animal production and Nutrition:

Use of nutrients such as by pass protein and fat supplements to increased production in ruminants, research on rumen microbial manipulation for mitigation of methane emission and productivity enhancement in dairy animals, ration balancing in dairy animals and its effect on methane emission, use of different herbal additives as productivity enhancers in dairy animals and poultry, nutritional intervention in expression of genetic potential in dairy animals.

2. Animal Health and Reproduction:

Establishment of Research Centres for Zoonotic Diseases and for Mitigation of Climatic Stress Effect on animal and birds. Oocyte Culture, IVF, In vitro growth of embryo, splitting of embryo and sexing of embryo. Newer approaches for semen quality parameters studies for fertility and freezability. Development of kit for urine based early pregnancy diagnosis in cattle and buffalo. Introduction of telemedicine in Veterinary medicine. Introduction of telepathology for disease diagnosis. Study and validation of useful ethno-pharmaco practices.

3. Animal Biotechnology:

Genome sequencing and identification of genes related to resistance against different diseases of animals in livestock and poultry, characterization/identification of new vaccine candidates against such diseases, Development of protocols for semen sexing, Cloning elite dairy animals, Genomic selection in Indigenous cattle and buffalo breeds. Development of sterility vaccine for bovine male.

4. Poultry Development:

Development of immune-competent poultry lines for better liveability and increased egg production and profitability, Development of coloured crossbreeds for rural poultry farming, Conservation and genetically improvement of native chicken breeds, Use of molecular markers for improvement of egg production and feed efficiency through marker assisted selection.

5. Dairy Milk Production:

Development of high value ingredients from milk for health, pharma and beauty industries, Use of other species milk, e.g. camel, goat, sheep, donkey, etc. for specific heath and technological purposes, testing of quality and safety of dairy products based on molecular tools, newer techniques for multiple adulterants detection and their mitigation, development of composite dairy foods using plant based materials and ingredients and focus on development of ‘Greener Technology’ for milk and milk products’ processing.

DAIRY DEVELOPMENT AND EXPANSION IN DAIRY FARMING

Punjab is known as Land of Milk. Additionally, people of Punjab are fond of production and consumption of milk and milk products. As per the statistics approved by Central Statistical office, MOS, Govt. of India for the year 2019-20, Punjab produced 13347.56 thousand tons milk. Daily milk production in Punjab comes to 365 lac liters. Per capita availability of milk in Punjab is 1221 gms which is the highest in the country. Productivity of dairy animals is also the highest in Punjab with 16.71 kgs of exotic cows and 9.98 kgs of buffalos.

The state has a fairly well laid infrastructure for the growth and development of livestock and dairy sector. It has Milk Plants with collective processing capacity of 84.37 lac liters per day. Department of Animal Husbandry looks after animal health, animal breeding and fodder development.

Department of Dairy Development has the responsibility to provide dairy training and extension services and developing dairy entrepreneurs. The department has its Directorate at S.A.S. Nagar, Mohali. The functions of the department are accomplished through District Offices, Dairy Training Centers and Government Analytical Laboratories.

The Department runs nine Dairy Training & Extension Centers at Chatamli (Ropar), Bija (Ludhiana), Gill (Moga), Sardoolgarh (Mansa), Abulkhurana (Mukatsar), Phagwara (Kapurthala), Tarntaran, Verka (Amritsar) and Sangrur. Every Dairy Training & Extension Center has well equipped Classrooms, Demonstration Dairy Plants, Milk Laboratories, Mess, Hostel etc. Two weeks Days Dairy Training and four weeks Dairy Entrepreneurship Training courses are run regularly. Special training courses are run for SC and Women beneficiaries under different schemes. Need based short duration courses are also run as per the segment specific requirements. In addition, awareness programmes for milk producers as well as consumers are run.

New dairy units are got established by getting the institutional financial raised.

Vision 2047 of this Department envisages that the Milk Production will be doubled in the state which will translate into a growth rate of about 7% per annum. This growth will come from the efforts of Animal Husbandry Department, Dairy Development Department and Milkfed, Punjab. It is assumed that 50% share for the growth will be of

Animal Husbandry Department on account of genetic upgradation of dairy animals and disease control. The remaining 50% will be further shared by Dairy Development Department and Milkfed, Punjab on equal basis as remunerative farm gate milk price works as a growth engine. Out of the 1.75% share of the growth of this department, 1% is expected to come from the induction of new dairy animals and 0.75% from the improved dairy farm management practices triggered by the awareness, training and capacity building programmes undertaken by the department. These practices shall be made integral to the dairy development to make diary farming sustainable and self-dependent by 2030.

FISHERIES:

In Punjab, fish farming started during the early seventies and it is marketed in the neighbouring states after meeting the local demand. The main facts on the fishery resources of Punjab are given below:

Fishery Resources and Fish Production

Inland Resources	
Total Inland Water Bodies (Lakh Hectare)	0.90
Rivers and Canals (Kms.)	12068
Reservoirs (Lakh Hectare)	0.50
Tanks and Ponds (Lakh Hectare)	0.17
Saline water (Hectare)	7000
Fish Production (2021-22) (Ton)	189647

Source: (i) http://dot.gov.in(ii) Directorates and Warden of Fisheries, Punjab

Approximately 17,681 hectares of the area has been brought under fishery in Punjab by 2021-22. In Punjab, Ravi, Satluj and Beas are the main source for capturing fisheries. In State, a remarkable change came in the fishery with shrimp farming. In the Southern-Western region of the State, Shrimp farming started from one acre in 2016 and within five years, it has increased to 835 acres. Due to the rising demand for fish as a replacement for red meat, its farming is highly remunerative to farmers. There is a good scope for further expansion of the area under fish farming. As per the vision of the Directorate of Fisheries, the target is to raise the area under fishery upto 40,000 hectares by 2030 and 60,000 hectares by 2047. This will raise fish production to 3 lakh

tonnes by 2030 and to 6 lakh tonnes by 2047. The shrimp culture will be promoted by raising the area under it to 2800 hectares (7,000 acres) by 2030.

RAISE THE INCOME OF SMALL FARMERS

There are about 3.60 lakh small farmers (34% of all) in Punjab whose operated area is less than five acres. Their per-year income from cultivation is not sufficient to provide them with even the minimum satisfactory standard of living.

To raise the income of small farmers by 2030, Small farmers will be induced to shift especially to dairy farming in a big way and other enterprises like beekeeping and mushroom cultivation. The FPOs may be involved along with the well-established milk cooperative society network in the processing of milk and in supply chains from farms to the market.

EXPANSION OF HORTICULTURE: STRATEGY

At present (2018-2019) Punjab is producing 12 lakh tonnes of Kinnow, 25 thousand tonnes of Orange, 1.18 lakh tonnes of Mango, 2.07 lakh tonnes of Guava, 76 thousand tonnes of Pear, 47 thousand tonnes of Litchi and small quantities of many other fruits. The total fruit production is 18.57 lakh tonnes.

Total fruit production in Punjab has grown over 2004-05 to 2014-15. The area under fruits grew by 48%, production by 74% and productivity by 18% (see Table 9 in Annexure).

The following vision in the coming fifteen years may be adopted to diversify agriculture and raise the income of farmers.

- **Area Expansion under Horticulture Crops:** The department proposes to bring an addition of 1,30,000 hectares area under horticulture crops by 2030. The expansion of the area will be achieved with different interventions like Production Technologies, Post Harvest Management, Human Resource Development, etc.
- **Mushroom Production:** Presently, 5044 tonnes of mushroom are being produced in Punjab, which is 4.20% of the national production. *In this background, 70 more such mushroom units are proposed to be established in Punjab by 2030.*

- **Protected Cultivation:** Protected cultivation of high-value vegetables has emerged as the single most important technology for ensuring nutritional security, high productivity, improved quality and lucrative returns during the last decade or so. Keeping in mind the need of the day, it has been proposed to cover a 325 ha area under these structures.
- **Beekeeping**: Presently, 15,000 tonnes of honey is being produced in Punjab, which constitutes 37% of the honey production of the country. Punjab is the leading state in honey export by exporting 12,000 tonnes of honey out of the total export of India i.e. 33,000 tonnes. It has been proposed to promote beekeeping with the addition of 3.5 lac bee boxes along with the colonies**.**
- **Establishment of Pea Estate:** Pea being the important vegetables, covers an area of 22,149 ha with an annual production of 2.28 lakh MT. Amritsar, Hoshiarpur, Shaheed Bhagat Singh Nagar and Patiala are major growing districts in Punjab. It is proposed to establish Pea Estate at Hoshiarpur where world-class facilities will be provided.
- **Establishment of Fruit Estates by Horticulture Department:** A Fruit Estate is established in a Natural Growing Area of a crop where it can be better promoted by providing the facilities to the farmers under one roof. Five such Estates have been established for Citrus in Hoshiarpur, Sri Muktsar Sahib and Fazilka districts where world-class facilities are being provided to the citrus growers. A Pear Estate has been established in Amritsar (See Boxes 1). The aims and objectives of these fruits' estates are (Box 2):

Citrus Estate Bhunga (Hariana)

Citrus Estate Tahliwala Jattan

Guava Estate Wazidpur, (Patiala)

Pear Estate Amritsar

Litchi Estate Sujanpur Pathankot

AIMS AND OBJECTIVES OF FRUIT ESTATES

- To promote and propagate citrus and other fruit plantations and citrus-based industry.
- To make arrangements for treatment, packaging, storage, marketing, processing, preservation, transport and export of citrus and other fruits.
- To formulate a policy/action plan for the promotion of citrus and fruit cultivation.
- To help the establishment of cold storage, packing houses and processing factories concerned with citrus and other fruits.
- To take steps for the promotion of technical know-how for the proper maintenance, packing, marketing etc., to the citrus and other fruit growers.
- To undertake or assist in undertaking programmes for employment generation, growth and diversification of agriculture and industries based on citrus and other fruits.
- To promote the organization of marketing chains both for domestic and export marketing of citrus and other fruits.
- To accelerate the development of rainfed and Kandi regions through citrus and other fruits cultivation.
- To promote measures for increasing the utilization of irrigation potential, water conservation and its efficient management.
- To pave the way for the establishment of integrated producers' organizations with forward and backward linkages related to citrus, other fruits and vegetables which are used for blending with citrus juice.
- To prepare, print and publish papers, periodicals, mono Figures and books on citrus, other fruits and vegetables in furtherance of the objectives of the Society.
- To provide quality nursery plants, various other inputs such as fertilizers, insecticides/pesticides, machinery equipment, packing material etc., either directly or through authorized sale outlets.

Source: Director Horticulture (Government of Punjab).

- **Horticulture Mechanization and Hydraulic Pruning Machines:** It is proposed to provide 10000 machines like tractors, power tillers, bed makers, mulch laying, self-propelled machines, power knapsack spray pumps, tractor-mounted spray pumps etc. Due to a shortage of skilled labour, mechanized pruning has become necessary. In Punjab, Citrus Estates have already imported hydraulic pruning machines. With the pruning of orchard trees with these machines, the labour cost worth Rs. 9,000 per hectare can be saved as compared to manual pruning. Keeping in view the efficiency of these machines, 40 such machines are being proposed to be imported.

It is also proposed to import 40 electrostatic spray pumps with a capacity of 1,000 litres each.

MISCELLANEOUS STRATEGIES:

- **Management of Waterlogged Area:**

  The waterlogged area of 3,354 hectares in the Southern Punjab groundwater table will be lowered to 20 feet level by 2030. For this, deep rainwater drains network will be created and shallow tubewells will be installed on both sides of the drains that will continuously pump out water and throw it in the drains to be carried to the nearby river.

- **Management of crop residues:**

  The straw burning on the entire rice/wheat cultivated area will be stopped by 2030. A strict law will be enacted to make straw burning a criminal offence. A small subsidy per hectare may be given to farmers for not burning straw in their fields. The restrictions on using straw as fuel by the brick kiln and small factories will be removed. The bale-making machines for paddy straw will be given to farmers at low subsidized prices. The technology based on in-situ retention/incorporation of the paddy straw is already in place. Research on varietal interventions enabling the successful establishment of the crop following paddy will be strengthened. Policy and technological backup for the bio-energy-based use of paddy straw will be further strengthened.

- **Flat rate of power supplied in agriculture:**

  The present system of free power to tubewells will be rationalized by 2030.

- **Land reclamation in the foothills zone:**

  Out of the total cultivated area of 4.28 lakh hectares of the Foothills zone, 2 lakh hectares will be levelled by 2030 and 50% of the length of choes and rivulets will be canalised by that year. A suitable subsidy per hectare will be given to farmers to precision level their own land. The uneven common land and land on the sides of

choes and rivulets will be levelled by the agricultural department. The canalisation of choes and rivulets will be done by the Irrigation and Drainage Department.

- **Check on over-mechanization:**

  The number of tractors in the State will be reduced to five lakhs by 2030. Farmers will be encouraged to hire the tractor and hiring will be made easier.

- **Soil Health Management:**

  Rice-based cropping systems continue to raise concerns about the physical health of the soil. Poor aeration due to damaged soil structure and likely formation of the hard pan in rice soils is planned to be addressed by weaning farmers away from paddy, practising aerobic interventions and promoting the use of organic manures. These challenges will be addressed by promoting the use of organic materials through suitable incentives. Similarly, ploughing of green plants and wheat/rice stubble in the soil helps in improving soil fertility.

  The State and Central Governments are collectively putting efforts to keep a check on the soil fertility of each farmer. In this direction, the government has a target to provide 18 lakh soil health cards by 2030.

  Use of cover crops, green manures and crop rotations to fertilize the soil, and maximize biological activity to be encouraged in addition to maintaining long-term soil health and ensuring the sustainability of foodgrain production. The Department of Agriculture will try to bring five percent area every year under organic /natural farming.

- **Improve agricultural marketing of vegetables and fruits:**

  A chain of cold stores and a fleet of refrigerated vans will be created to help farmers avoid post-harvest losses. Remunerative prices and purchase of vegetables and fruits will be assured.

Long-Run Targets and Strategy: 2047

- **Monitoring of agriculture yield:**

  The rice yield will be raised to 82 quintals per hectare and the wheat yield to 66 quintals per hectare by 2047. For this, new higher-yielding varieties will be developed. The yield rate of each and every farmer will be monitored by agricultural experts at the field level. The quality of seeds, fertilisers and inputs used by farmers will be further improved. The sowing of wheat and rice in the best yield period will be ensured. The chronic low-yield fields will be shifted to other crops. The precision levelling of land will be completed. A remunerative minimum support price and assured purchase of all wheat and rice produced will be ensured.

- **Use of certified seeds on the entire cropped area:**

  To make easy availability of certified seeds for crops like wheat and paddy and assure that only certified seeds are used on 100% of the sown area under these two crops. In order to improve seed replacement rate and sustain quality yields, seed production programmes of the university and state agencies will be further strengthened with the target of covering entire crop acreage under the certified seeds.

- Agro-clinics may be set up by the state in every village.

- The government may start Krishi Vigyan Kendras branches in the cluster of villages.

- **Digitalisation of Seed Certification to Marketing:**

  The Punjab State Seed Certification Authority will make the entire process of seed certification online. A web portal and Apps are being developed which will be linked together to make all tasks relating to seed certification transparent and better. In the portal, the entire paper process from area registration to QR tagging will be done online, the details of which are as Area Registration, Field Inspection, Raw Seed, Physical Verification, Grading, Packing and Tagging, Testing in Labs, Seed Ledger will be available online**.** This will bring more transparency to entire system.

- **Complete replacement of low milk-yielding animals and Upgradation of Infrastructure:**

  The progressive replacement of buffaloes and *desi* cows by cross-breed cows will be speeded up. The health and milk yield of milch animals will be monitored by the veterinary staff of the veterinary department on a regular basis. A green fodder and wheat *bhusa* stall will be established in every village to enable landless milch animal owners to purchase green fodder and wheat *bhusa* at reasonable rates.

- **Increase in Milk processing:**

  A milk processing plant will be established in every cluster of 40-50 villages to create assured demand for milk produced by farmers of these villages. Remunerative price and payment of sale money to the milk seller on time will be assured.

- **Infrastructure Upgradation to Improve Animal Health:**

  The Department of Animal Husbandry, Punjab plans to upgrade all its institutions i.e., Semen Banks, Farms, State Biological Unit of Punjab Veterinary Vaccine Institute, Ludhiana (PVVI) and North Regional Disease Diagnostic Lab, Jalandhar (NRDDL) with modern infrastructure and latest equipment.

  All the emergency services at Veterinary Polyclinics at the district level are to be made available 24x7 with specialists and modern diagnostic facilities.

  Animal fairs to be organized at the district level and good incentives be given to farmers having good quality animals.

  Facilities like cattle pounds and stray dog pounds are to be created at the district level to keep redundant cows and stray dogs.

- **Stabilization of groundwater level:**

  The groundwater extraction rate will be further reduced to 100% by 2047. The member of over-exploited blocks will be reduced to zero and the water level will be stabilized at a sustainable level. For this, a number of special water recharging canals will be constructed and rainwater drains and village ponds will be deepened to sand layer level. The groundwater recharging mechanisms will be further strengthened. The development of less water-consuming rice varieties will be speeded up. The

System of Rice Intensification (SRI) developed in Madagascar will be promoted and popularized.

- **Rationalise free power supply to tubewells in agriculture:**

  To rationalise free power supply to tubewells.

- **Minimum support price (MSP) for Kharif crops:**

  The area under rice will be reduced to 20 lakh hectares by 2047. To achieve that target the steps described above to halt the fall in the groundwater table will be helpful. In addition to these measures, remunerative minimum support prices and the assured purchase will be ensured in the case of cotton, maize, sugarcane, moong and other Kharif crops. The cultivation of summer vegetables will be expanded through assured marketing and remunerative prices.

- **Increasing the income of small farmers by 2047:**

  In addition to farming and allied farming activities, special programmes will be launched to train at least one male and one female member of small farmer households to enable them to take up non-farm jobs in the informal sector of nearby towns by daily commuting to work and back.

- **Precision levelling of land:**

  By 2047, the entire 4.28 lakh hectare cultivated area of the foothills zone will be precision levelled and all the ‘choes’ and rivulets properly canalized.

- **Elimination of waterlogging:**

  The groundwater level on the entire waterlogged area of 3,354 hectares in Southern Punjab will be lowered to 40 feet in depth by 2047.

- **Options to use crop residual:**

  The law and checks on straw burning created up to 2030 will be strengthened and continued.

- **Rationalisation of the use of machinery in agriculture:**

  The number of tractors in the state will be reduced to three lakhs by 2047. The tractor-hiring market mechanisms will be further improved and the subsidy per hectare for not owning and using a hired tractor will be continued.

- **Increase in production and processing of fruits and vegetables:**

  The area under vegetables and fruits will be expanded to six lakh hectares by 2047. For achieving this target vegetable and fruit cultivation will be further improved by providing high-quality yielding seeds of vegetables and plants of fruits to farmers. Crop improvement research efforts in the case of vegetable crops will continue to be targeted at harnessing premium marketing, nutritional, consumer preference and other commercial traits. The cultivation of specific vegetables that have a longer shelf-life and high and continuous demand in big urban centres will be promoted by assured marketing at a remunerative price and easy safe transportation to big urban centres.

- **Link all 'mandis' with E-NAM:**

  By 2047, all regulated 'mandis' and sub-yards will be connected to E-NAM portal for price discovery, higher price realization of farm produce and notify more number and location of warehouses for storage purposes.

India as a global powerhouse in food systems:

(a) Centres of Excellence need to be set up for processing and value addition.

(b) Varietal technologies aimed at capturing the premium market should receive special attention.

(c) Handholding should be provided for the marketing of produce. Bulk handling of marketable produce (involving large silos) should be promoted.

(d) Market agencies will be promoted for expert promotions and marketing within the country.

(e) New biotechnologies like genome editing, marker-assisted selection (MAS), speed breeding, etc., need to be mainstreamed for breeding various horticultural and field crops.

Annexure

Table 1:
Cropping Pattern in Punjab: 1960-61 to 2018-19

Crop	1960-61			2018-19			Change in Area 2018-19 (-) 1960-61 ('000 Hectares)
	Area ('000 Hectare)	% age of		Area ('000 Hectare)	% age of		
		Total Cropped Area	Net Sown Area		Total Cropped Area	Net Sown Area	
Wheat	1400	29.59	37.26	3519	44.89	85.45	2119
Rice	227	4.80	6.04	3102	39.57	75.33	2875
Cotton	447	9.45	11.90	268	3.42	6.51	(-)179
Potatoes	9	0.19	0.24	103	1.31	2.50	94
Seasum	8	0.17	0.21	3	0.04	0.07	(-)5
Sunflower	-	-	-	5	0.06	0.12	(+)5
Gram	838	17.71	22.31	2	0.03	0.05	(-)836
Maize	327	6.91	8.70	109	1.39	2.65	(-)218
Sugarcane	133	2.81	3.54	95	1.21	2.31	(-)38
Bajra	123	2.60	3.27	1.0	0.01	0.02	(-)122
Rapeseed/ Mustard	107	2.26	2.85	31	0.40	0.75	(-)76
Groundnut	67	1.42	1.78	1	0.01	0.02	(-)66
Barley	66	1.39	1.76	6.0	0.08	0.15	(-)60
Pulses	65	1.37	1.73	28	0.36	0.68	(-)37
Jowar	6	0.13	0.16	-	-	-	(-)6
Linseed	3	0.06	0.08	-	-	-	(-)3
Miscellaneous Crops	906	19.15	24.11	566	7.22	13.74	(-)348
Total Cropped Area	4732	100	-	7839	100	-	-
Net Sown Area	3757	-	100	4118	-	100	-

Source: Statistical Abstracts of Punjab.

Table 2:
Yield of Main Crops in Punjab (Quintal/Hectare)

Period	Average for period (Years)	Wheat	Paddy	Cotton lint	Maize
I	1991-92 to 2001-02	41.2	50.3	4.4	21.6
II	2001-02 to 2010-11	43.5	57.4	6.4	30.3
III	2010-11 to 2015-16	47.8	58.5	4.9	37.6
IV	2015-16 to 2018-19	51.2	63.2	7.7	36.9

Source: Statistical Abstract of Punjab.

Table 3:
Area under Vegetables and Fruits

Parameter Description	2018-19
Total area under vegetables (Hectares)	119155
Potatoes	78590
Winter vegetables	18438
Summer vegetables	21350
Other vegetables	777
Total area under fruits (Hectares)	86774
Kinnow	53359
Guava	9172
Mangoes	7007
Other fruits	17236

Source: Statistical Abstract of Punjab.

Table 4:
Milch Animals and Milk Production

Parameter Description	2012-13	2019-20
Total number of milch animals	2878870 (100.00)	2856320 (100.00)
Buffalos	1960000 (68.08)	1692960 (59.27)
Cows	918870 (31.92)	1163360 (40.73)
Cross Breed Cows	858450 (93.42)	1032390 (88.74)
Desi Cows	60420 (6.58)	130970 (11.26)
Milk production (000 Tons)	10099	13347.56
Milk yielding (Kilograms) (Animal/day) Buffalos	8.81	9.98
Cross Breed Cows	10.88	16.71
Desi Cows	6.50	7.00
Per capita availability of milk (Gms./Day)	962	1221

Source: (1) Statistical Abstract of Punjab and Dairy Development Department, Government of Punjab.
(2) Figures in brackets are % ages.

Table 5:
Poultry Birds, Egg, Meat and Wool Production

Parameter Description	2015-16	2019-20
Total number of poultry birds (Lakh)	740.86	1321.04
Total egg production (Million)	4264	5591
Per capita availability of eggs (No./Year)	155	180
Total meat production (Thousand Tons)	250	270
Total wool production (Lakh Kg.)	4.73	5.00

Source: Statistical Abstract of Punjab.

Table 6:
Growth and Slow Down in Rice and Wheat Yield

(A) Yield Rate Level: 1971-72 to 2011-12		
Time Period (Figures are Triennium Average)	**Yield (Kg./Hect.)**	
	Rice	**Wheat**
Triennium Ending 1971-72	1767	2296
Triennium Ending 1981-82	2763	2819
Triennium Ending 1991-92	3332	3704
Triennium Ending 2001-02	3466	4597
Triennium Ending 2011-12	3860	4633
Triennium ending 2018-19	4215	5120
(B) Yield Growth Rates (% /Year)		
Time Period	**Growth Rate (% /Year)**	
	Rice	**Wheat**
1971-72 to 1981-82	4.57	2.07
1981-82 to 1991-92	1.89	2.77
1991-92 to 2001-02	0.40	2.18
2001-02 to 2011-12	0.98	0.10
1971-72 to 1991-92	3.22	2.42
1991-92 to 2011-12	0.74	1.13
2011-12 to 2018-19	1.57	1.01

Source: Statistical Abstract of Punjab.

Table 7:
Water Table Decline in Central Punjab

Period	Average decline (cm/year)	Average Rainfall (cm)	Additional Tubewells (no. In Lakh)
1990-2000	-25	64	1.53
2000-2005	-90	37	2.58
2005-2008	-75	41	0.92
2008-2013	-45	53	1.20
2013-2015	-55	36	0.31

Source: State of Environment Reports, Punjab, 2007-14

Table 8:
Current Status and Future Strategies for Enhancing Milk Production

S.No	Production parameters.	2005-06	2010-11	2015-16	2019-20	2029-30
1.	Total milk production. (thousand tons)	8908.52	9423	10774.20	13347.56	19000
2.	Average Milk yield /animal/day/ Exotic Crossbreed Indigenous Non-Descript Buffalo:- Indigenous Non-Descript	 -- 9.050 kg. -- 2.836 kg. 7.111 kg. --	 -- 10.947 kg. -- 6.501 kg 8.567 kg. --	 15.06 kg. 10.81 kg. 6.76 kg. 5.01 kg. 9.04 kg. 5.08 kg.	 18.00 kg. 16.71 kg. 7.00 kg. 5.25 kg. 9.98 kg. 5.50 kg.	 22.00kg. 14.00 kg. 9.00 kg. 7.00 kg. 11.00 kg. 7.00 kg.
3.	Per capita availability. (Gms.)	919	931	993	1050	1200
4.	Total Egg production. (million)	3520	3544	4422	4600	4830
5.	Per capita availability (no.).	134 eggs	128 eggs	152 eggs	180 eggs	190 eggs
6.	Total Meat Production. (Thousand tons)	4.46	175	249.91	270.00	300.00
7	Total wool production. (lac kg)	7.12	5.06	4.73	5.00	5.50
8.	Green fodder availability (per animal/day)	19.6 kg.	28 kg.	30 kg.	35 kg.	42.00

Source: Vision Document (2030), Department of Animal Husbandry (Government of Punjab).

Table 9:
Decadal Growth of Area and Production of Horticulture Crops

Particulars	2004-05	2014-15	% Increase	Water Consumption of Increased Area
Area (lac ha)	2.10	3.11	48%	1 lakh ha area consumed 30% less water as compared to wheat-paddy rotation.
Production (lac MT)	33.84	59.00	74%	
Productivity (MT/ha)	16.00	18.97	18%	

Source: Department of Horticulture (Govt. of Punjab)

Table 10:
Schemes and Targets of the Department of Agriculture and Farmers Welfare and Horticulture, Punjab

Sr. No.	Name of Scheme	Funds released during 2021-22 by Centre (Rs.)	Funds released by the State (Rs.)	Targets Upto 2030	Funds required Upto 2030	Target Upto 2047	Funds required Upto 2047
1.	Soil Health Management	129.83 (Lakhs)	86.56 (Lakhs)	18 Lakh Soil Health Card	5400 lakhs	54 Lakhs Soil Health Cards	16200 lakhs
2.	Pramprgat Krishi Vikas Yojana	225.00 (Lakhs)	255 (Lakhs)	Cover 600 clusters	4500 lakhs	1800 clusters	13500 lakhs
3.	Rasthriya Krishi Vikas Yojana	44.56 (Lakhs)	None	NA	NA	NA	NA
4.	Agriculture Census	0.95 (Lakhs)	None	Agriculture Census for 2021 and 2025-26	9 lakhs	To complete Census after upto 2047	30
5.	Minor Irrigation Census	1.25 (Lakhs)	None	To complete Census for 2022-23 and 2027-28	8 lakhs	To complete Census upto 2047	29
6.	Strengthening Agrimark Laboratory	210 (Lakhs)	210 (Lakhs)	NA	NA	NA	NA
7.	Power Subsidy Scheme	-	6745.06 crore	-	-	-	-
8.	Pani Bachao Paisa Kamao	-	-	-	-	-	-
9.	Crop Loan Waiver Scheme	State Scheme	590 crore	-	-	-	-
10.	Crop Diversification Plan	102.66 lakhs	30.80 lakhs	To shift from Paddy to other crops	113 lakhs	To diversify from Paddy	125 lakhs
11.	National Horticulture Mission (NHM)	8.22 crore	Central Scheme	7000 Farmers to shift in Horticulture	245 crores for infrastructure to double Horticulture	1500 farmers to shift in Horticulture	840 crores to develop infrastructure in Horticulture

VISION@2047
CURRENT STATUS AND STRATEGIES FOR FUTURE: AGRICULTURE SECTOR

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
Wheat and Rice Yield[1]: • Wheat Yield • Rice Yield	51 Quintals per hectare 63 Quintals per hectare	58 Quintals per hectare 73 Quintals per hectare	66 Quintals per Hectare 82 Quintals per hectare	• Identification of low-yielding blocks, villages and farmers and the causes of their low yield; • Raising the rice/wheat yield of low-yielding blocks, villages and farmers to the Punjab average level; • Use of certified quality seeds (recommended by PAU) of wheat and rice in the entire wheat and rice sown area; • Increasing capacity for quality control of farm inputs; • Sowing of wheat and rice on the entire area during the best yield period; • Complete precision levelling of all land; • Regular monitoring of each rice and wheat field by farm experts to advise farmers to get the highest possible yield; • Shifting of chronic low-yield fields to other crops; • Development of higher-yielding varieties of rice and wheat by Punjab Agricultural University.
Crop Diversification and Area under Rice[2]: • Area Under Rice	30.64 lakh Hectare	25.00 Lakh Hectare	20.00 Lakh Hectare	• 10 lakh hectare area withdrawn from rice cultivation will be shifted to cotton, maize, sugarcane, moong, summer vegetable, etc; • A limit of four acres of rice cultivation per tubewell will be imposed up to 2030. This will leave the area under rice of small farmers intact and compel medium and big farmers to shift area out of rice; • The limit of rice area per tubewell will be lowered to three acres after 2030;

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
				• Remunerative MSP of cotton, Maize, Moong etc. will be ensured to farmers shifting area to these crops; • Higher yield varieties of cotton, maize, sugarcane, moong, etc. will be developed by Punjab Agricultural University; • Modernization of existing sugar mills and establish five more sugar mills up to 2030 and five more sugar mills between 2030 to 2047; • Payment for sugarcane sold by farmers within three months of sale will be ensured; • Mechanical harvesting of cotton and sugarcane will be promoted; • Promotion of summer vegetable cultivation; • Promotion of Basmati rice and other fine varieties of rice; • To promote cotton cultivation, one cotton ginning mill will be established in each district.
Milk Yield[3]: Average Milk Yield (combined) • Buffaloes • Cross-Breed cows • Desi Cows	10.0 KG per animal per day 9.98 KG per animal per day 16.71 KG per animal per day 7.00 KG per animal per day	12.00 KG per animal per day 11.00 KG per animal per day 14.00 KG per animal per day 8.00 KG per animal per day	15.00 KG per animal per day 13.00 KG per animal per day 25.00 KG per animal per day 9.00 KG per animal per day	• Complete identification of low yield Milch Animals and their replacement with higher yield Milch Animals; • Progressive replacement of buffaloes and Desi Cows by Cross-breed cows; • Progressive improvement in the quality of buffaloes, cross-breed cows and desi cows; • Regular monitoring of the health of Milch animals by veterinary experts. This service will be provided free to all farmers; • Development of the animal feed industry and complete regulation of the quality of animal feed; • The sufficient area will be brought under green fodder crops to ensure sufficient, regular and cheap availability of green fodder in the villages;

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
				• A green fodder and wheat 'busa' (Turi) stall will be established in each village to enable small farmers/landless households to get a regular supply of these items for their animals; • To provide sufficient and clean sheds to milch animals of small farmers / landless households they will be given low-interest loans to construct double-storey houses of which the ground floor serves as animal shed; • Remunerative prices and easy sale of milk will be ensured.
Horticulture[4]: Area under (Hectares): • Fruits • Vegetables	86774 119155	104200 143000	135500 186000	**Technological Advancement at Plantations/sowing level:** • To analyse the soil fertility and quality of water of fields; • On the basis of the quality of soil to recommend the use of fertilisers and pesticides; • To supply high-quality plants to farmers; • To provide machinery at subsidised rates; • Training of farmers relating to new technological advancement in horticulture' **Development of Special Zones:** • To develop special zones in the production of special fruits like Litchi, Kinnows, Guava, Mangoes, etc. **Marketing and Processing of Fruits:** • To develop a chain of cold stores, refrigerated vans/ farm cold rooms, and ripening chambers; • Processing plants of fruits and vegetables in the major growing areas.

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies

Fishery[5]:
• Area under Fishery:
• Area under Shrimp Culture (Hectare)
• Production (Ton)Processing and Marketing:
  • Shrimp/Fish Processing.
  • Cold Storage and Processing Plants.
  • Ornamental Fish Breeding Hatcheries.
	17681 (Hectare)
	338 (Hectare)
	189647 (Ton)
	-
	-
	-
		40000 Hectare
		2800 (Hectare)
		7000 (Acres)
		3.0 Lac
		1
		1
		1
			60000 Hectare
			8000 (Hectare)
			20000 (Acres
			6.0 Lac
			2
			5
			5
				Management of water use in Industry and agriculture:
				• Overuse of water in two sectors affects the aquatic ecosystem;
				• To check on the pollution of water of rivers in the State.
				• The polluted water affects the productivity of fishing;
				• Promote ornamental fishing as it has developed as a cottage industry in several Asian countries.
				• Strengthen marketing system, processing plants and sanitary conditions in fish markets;
				• Promote Fishermen Cooperative at the reservoir sites.

Agriculture Mechanisation[6]: • Total Number of tractors • Number of tractors per 1000 hectares of cultivated area	6 Lakh 143	5 lakh 125	3 lakh 70	• Suitable per hectare subsidy for not owning a tractor and for using hired tractors; • Improving the efficiency of tractor hiring market procedures; • Promote Custom Hiring Centres. • Create hubs for hi-tech and high-value farm equipment.
Power Supply to Tube wells[7]: • Power supply to 13.36 lakh power-operated tube wells	Free No charges	• To rationalise free power supply to tubewells.	• To rationalise free power supply to tubewells.	• To rationalise free power supply to tubewells.

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
Land Levelling[8]: • Total area of Foothills districts (Net sown area) • Barsatichoes and rivulets	4.28 lakh hectares (not levelled at present) None canalised at present	2 lakh hectares to be levelled 50% of choes to be canalised	4.28 lakh hectares to be levelled 100% of choes to be canalised	• Suitable subsidy per hectare to be given to farmers to precision level as per the land owned by them; • Uneven common land and land on the sides of choes and rivulets to be levelled by the agricultural department of the government; • All choes and rivulets to be canalized by the government.
Waterlogging[9]: • Waterlogging in southern Punjab	Waterlogged Area 3354 Hectare	• Lowering the groundwater level to 20 feet below the surface in the entire area	• Lowering groundwater Level to 40 feet below the surface in the entire area	• Construction of deep rainwater drains network in the entire water-logged area and connecting these drains to the nearby river; • Installation of a sufficient number of shallow tubewells, near the rainwater, drains that continuously pump out water and discharge it into rainwater drains; • Special incentives to farmers to put the entire waterlogged area under suitable varieties of rice that survive and thrive even in waterlogged lands and encourage fish ponds, agroforestry, especially eucalyptus; • Proper cement plastering of canals/ canal tributaries to reduce the seepage of canal water into the land; • Completely halting the supply of canal water in the waterlogged area;
Groundwater level[10]: • Groundwater extraction as % of total percolation • Total number of	166% 138	130% 138	100% 138	• Complete scientific assessment of groundwater resources block-wise; • Making canal/tubewell network symbiotic. Canals recharge, tubewells suck groundwater. No tubewell should be beyond 10 KM of a canal or canal tributary;

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
blocks • Number of over-exploited blocks • Number of critical blocks • Number of Semi-critical blocks • Number of Safe Blocks	116 (79%) 2 (1.45%) 5 (3.60%) 22 (15.94%)	60 (43.48%) 0 0 78 (56.52%)	0 0 0 138	• Implementation of mechanisms of recharging of groundwater aquifers. Existing ponds will be deepened to sandy layer level; new ponds will be dug in each village. A water recharging dug/bore was made mandatory for each and every tubewell. The network of seasonal rainwater drains will be cleaned and deepened to recharge groundwater; • Development of rice varieties that consume less water; • Suitable adjustment in transplantation date and promoting the adoption of other water-saving technologies within rice; • Promoting micro-irrigation; • Direct sowing of rice will be encouraged through subsidies and extension education; • Adoption of the System of Rice Intensification (SRI) developed in Madagascar; • Proper pricing of power given to tubewells; • The area planted under rice should be fixed at four acres maximum up to 2030, at three acres after 2047.
Straw/Stubble Burning[11]: Crops that create residue for burning and Area under these crops • Rice • Wheat	31.02 Lakh hectare 35.19 Lakh hectare	Straw burning completely stopped Straw burning completely stopped	Stubble burning completely stopped Stubble burning completely stopped	• Aggressive publicity/education against straw/stubble burning to create a strong public opinion against the practice; • Consultation and cooperation of farmers' organizations to stop the practice; • Strict law and its enforcement to make straw/ Stubble burning illegal; • Satellite monitoring of straw and stubble-burning fields and farmers • Small subsidy per hectare for a few years to wean away farmers from straw/stubble burning;

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
• Sugarcane • Total Residue Generated: • Burned:	0.95 Lakh hectare 50.75 million Tonnes 19.65 million Tonnes	Straw burning completely stopped	Stubble burning completely stopped	• Availability of bale-making machines for paddy stray at low rates; • Development of paper/cardboard and other industries that use wheat/paddy straw as a raw material; • No restriction on using paddy/wheat straw as fuel in brick kilns and small factories; • Cheap transportation facilities for transporting wheat '*turi*' (bhusa) to Rajasthan and other states where it has a high demand.

Source: 1. Statistical Abstract of Punjab, 2020.
2. Statistical Abstract of Punjab, 2020.
3. Statistical Abstract of Punjab, 2020 and Vision Document, 2030, IDC.
4. Statistical Abstract of Punjab, 2020 and Department of Horticulture, Government of Punjab.
5. Directorates of Warden and Fishery, Government of Punjab.
6. Census of Agriculture, 2015-16 (GoI).
7. Statistical Abstract of Punjab, 2020.
8. Statistical Abstract of Punjab, 2020.
9. Wasteland Atlas of India, Ministry of Land use (Government of India).
10. Sustainability of Tubewell Irrigation in Punjab, 2019, IDC and Ground Water Resources of Punjab State (2017).
11. National Policy for Management of Crop Residues, 2014, Government of India.

RURAL DEVELOPMENT

Rural development depends vitally on agricultural development. To fulfil and improve the well-being of rural people, agriculture and rural development encompass, upgrading rural infrastructure/public facilities and standard of living. Presently in Punjab, 98% of villages have electricity and piped drinking water and all the villages have link roads.

(I) Rural Infrastructure and Public Facilities

Current Status

There are about 12,000 villages in Punjab. 98% of these villages are linked with nearby towns by pucca link roads; 78% of these link roads are all weather, and 51% are eight feet wide. In 60% of the villages, the outer ring road (Phirni) is an asphalt concrete carpeted road. 82% of the villages are connected/covered by local bus transport. 93% of the villages' streets are pucca brick-lined and in 91% of the villages, there is a network of drains (Nalis) for the disposal of wastewater. The street light facility is available in 34% of the villages and 98% of the villages have water works and piped tap water facilities. In 30% of villages, a Primary Health Sub-Center exists, and in 29% of villages, a Primary Veterinary Sub-Center is available for looking after animal health. The Bank facility is available in 22% of the villages; 17% of villages have an ATM facility. In 28% of the villages, a Sub Post Office exists, and 84% of villages have an Anganwadi Centre. Electricity is available in 98% of the villages.

Challenges

1) To upgrade the rural infrastructure and public facilities to reduce the rural/urban gap to the minimum.
2) Proper continuous maintenance of Rural Infrastructure and public facilities.

Short-Term Targets and Strategy: 2030

- **Link road widening:**

  The percentage of villages with link roads is to be increased to 100%, and the percentage of villages with all-weather roads will be increased to 90%. 80% of village link roads will be widened to 10 feet level.

- **Outer ring roads (*phirni*):**

  The percentage of villages with asphalt concrete carpeted ring roads will be increased to 80%, and asphalt concrete carpeted, inner streets will be increased to 50%.

- **Disposal of wastewater:**

  50% of wastewater disposal drains (Nalis) will be converted into covered types.

- **Piped Tap water:**

  The piped tap water supply will be extended to all 100% of villages by 2030, and piped water will be supplied as per village-specific requirements. This will be done by the State Government with the help of the Central Government, NABARD and other development agencies running various schemes for making available safe and clean drinking water (see Table 4 and 5 in Annexure).

Focus of the Department of Water Supply and Sanitation:

- Identification of habitations where water quality is poor and cover these habitations with piped water supply through water treatment plants.
- To involve the PRIs (Panchayati Raj Institutions) to utilise the grants sanctioned under the 15th Finance Commission.
- To enhance the capacity building of PRIs for management of existing rural water supply infrastructure and promote regular IEC (Information, Education and Communication).
- Effective redressal of public grievances.
- To sustain the drinking water sources.
- Sustainable financial sources for operation and maintenance of rural water supply schemes.

- To keep a check on wastage and usage of water, metering should be installed in all households.

Infrastructure:

- **Bus transport and street lights:**

  By 2030, 90% of villages will be covered by bus transport, and 70% of villages will have street lights.

- **Health facilities and veterinary services:**

  The Primary Health Sub-Centres will be established in 70% of villages by 2030, and Veterinary Sub-Centres will also be in 70% of villages.

- **Post offices & Banks:**

  By 2030, 60% of villages will have a Bank branch and a Sub-Post Office, and in 50% of villages, an ATM facility will be established.

- **Electrification:**

  All 100% of villages will have electricity facility by 2030.

- **Anganwadi Centers:**

  By 2030, the Anganwadi Centres will be functioning in all 100% of villages.

Long-term Targets and Strategy: 2047

By 2047, all the above-mentioned public facilities will be available in all the villages and also in the Scheduled Castes localities of all the villages. In addition, by 2047, the following facilities will be provided in all the villages; a Community Centre, two Pubic Parks, one Public Gym, one Tailoring and Embroidery Training Centre, one Cooking Training Centre and one or more night Watchmen depending on the size of the village. By 2047, a proper local system for the maintenance and administration of these public facilities will be created.

The financial resources for expansion and upgradation of rural infrastructure will come from the following sources: (1) State Government; (2) Central Government grants; (3) Rural Development fund; (4) Per acre flat-rate levy on all land owners; (5) Flat rate levy on all Shopkeepers; (6) Donations from village NRIs. The culture of active participation of all villagers in the repair and maintenance of these public facilities will be evolved by 2047.

(II) Rural Standard of Living

Current Status

At present 96% of rural households are having pucca houses, 91% have a separate covered kitchen and 92% have a proper bathroom on house premises. The piped tap water facility is available to 81% of households in their own house premises, and 88% of households have a flush latrine in their house premises. About 49% of households own a sofa set and 17% own even a dining table. The electricity facility for lighting is used by 98% of rural households, and 97% have an LPG connection also. The Phone/Mobile set is owned by 97% of households and a TV set by 91% of households. The Refrigerator is owned by 90% of households, a washing machine by 68% of households, an AC by 26% of households, an Air Cooler by 85% of households, and a Sewing Machine by 47% of households. 91% of households own a Bicycle, 61% own a Motorcycle/Scooter, and 26% own a Car. This gives a clear picture of the standard of living of Punjab rural households (see Table 3 in Annexure).

Challenges

1) To reduce the gap between the rural and urban standard of living to the minimum.
2) To improve the quality of durable consumer goods, houses owned by rural households and living facilities enjoyed by them.

Short-term Targets and Strategy: 2030

- **Pucca house with amenities:**

  By 2030, all households will have a pucca house with 25% more covered space than the present on the first floor. All the households will have a proper kitchen with a dishwashing sink in the kitchen by 2030, and all the households will have a bathroom with a hot water geyser in the bathroom by that date.

- **Piped tap water:**

  The piped tap water facility will be available in every house.

- **Sanitation:**

  - The flush latrine facility will be available in every house by 2030.

- Achievement of Open Defecation Free (ODF) plus status for 100% villages.
- Awareness and capacity building of all stakeholders on Solid and Liquid Waste Management (SLWM).
- Focus on the operation and maintenance of assets created to manage SLWM.
- Faecal sludge and plastic waste management through urban and rural sector convergence.

- **Electricity and LP Gas facility:**

  The electricity and LP Gas facility will be available in every household by 2030. The regular 24-hour supply of electricity and two refill cylinders of LPG will be available in every household by 2030.

- **Gadgets in households:**

  All 100% of households will have at least two mobile phones, one TV and one Refrigerator by 2030 and 80% of households will have a sofa set and 50% of households a dining table by that date. By 2030, Washing Machine will be owned by 80% of households, Sewing machines by 80% of households, AC by 50% of households, Air Cooler by 100% of households, Bicycle by 100% of households, Motorcycle/Scooter by 80% households and Car/Jeep by 40% of households.

Long-Term Targets and Strategy: 2047

- **Water Supply:**
  - The Department of Water Supply and Sanitation will introduce online monitoring of the delivery of services.
  - Community and PRIs participation in handling the operation and maintenance of rural water supply system.
  - Coverage of quality-affected habitations with long-term sustainable measures.
  - Upgradation of water supply and sewerage facilities.

- **Expansion of houses:**

  By 2047, all 100% of households will have 50% additional covered space in their house, every household will have a smoke chimney in the kitchen and two bathrooms and two flush latrines on the house premises.

- **Electric supply:**

  A 24-four hour regular power supply will be assured to every rural household, and every household will own a modern improved cooking 'Chula'.

- **Means of communication and transport:**

  By 2047, a motorcycle/scooter will be owned by every rural household and a car/jeep by 50% of rural households and at least two bicycles in every rural household.

- **Sanitation:**
  - Achieve 100% sustainable open defecation-free plus status.
  - Achieve a clean and hygienic living environment in rural areas.

Financing of durable goods:

The financing for purchasing these durable goods and other facilities will come from the following sources: (1) own savings; (2) suitable subsidy to Scheduled Caste households; (3) easy bank loans (4) remittances from NRIs. Moreover, the second-hand durable consumer goods market will also be promoted.

RURAL INFRASTRUCTURE, AGRICULTURE RESEARCH AND EXTENSION

(A) Rural Infrastructure

- The target is to improve rural roads:
  - To widen the village link roads at least by two feet (one foot on each side). The target is to cover 60% of villages by 2025 and 100% by 2030.
  - To upgrade the quality of village link roads to the main highway roads level. The target is to cover at least 60% of villages by 2025, and 100% by 2030.
- This will not only improve the road infrastructure for farmers but will also make a lot more land available for setting up industry along these widened roads.

(B) Agriculture Extension Services

- The target is to have a trained extension worker resident in each village to supervise the sowing, growth and harvesting of rice and wheat crops by farmers of

the village. He will be made responsible for monitoring the sowing, growing and harvesting of rice and wheat on each and every separate plot under cultivation in his village.

- The target is to have such village-level agricultural extension workers in 70% of villages by 2025, and 100% of villages by 2030.

ENSURE PROPER FUNCTIONING OF FOODGRAIN MARKETS

- Almost the entire surplus production of rice and wheat in Punjab is purchased by government agencies at a minimum support price fixed by Central Government.
- At present, there are 154 regulated agricultural markets, and 283 sub-yards attached to these markets.
- On an average, a regulated market/sub-yard is serving 27 villages and 2,260 farmers.
- Owing to the entire output of wheat and paddy flowing into these markets immediately after harvesting, these markets are not able to properly accommodate the produce and that results in wastage and hardship for farmers.
- Rice and wheat flowing into the market are kept in open spaces without any cover to protect them from rain and storms. This results in considerable damage to foodgrains kept in the open space.
- To reduce this wastage of foodgrains and hardship to farmers the market network needs to be expanded and improved.
- The target is to expand the network of markets in the coming 15 years. The target is to increase the number of regulated markets from 174 in 2020 to 200 by 2047.
- The aim is to provide a regulated market/sub-yard for every cluster of 15 villages and 1,250 farmers.
- To provide adequate space for the loading of rice and wheat produce, the existing floor area of the market is to be increased by 50% upto 2030 and by 100% in 2047.

- To protect the foodgrains lying on the market floor, adequate arrangements for covering them at the time of rain and storm will be made. The target is to make this arrangement in 70% of markets by 2030, and 100% of markets by 2047.
- To ensure the speedy disposal of rice and wheat coming to markets, the target is to ensure the sale, weighing and lifting of rice and wheat marketed within three days of its arrival in the market.
- To ensure timely and speedy payment of the sale money to farmers, the target is to ensure full payment of sale money to farmers within seven days of the sale.
- The operations of Punjab State Warehousing Corporation (PSWC) are at present manual and entirely labour-intensive. To be future-ready and cater to the business needs of upcoming times, PSWC envisages having fully mechanized, flexible and IT-enabled warehouses for real-time inventory management for its clients, eliminating or minimizing human interferences in its operations.
- To provide these products to customers, PSWC envisages modern cold warehouses, which are flexible to cater to the needs of B2B clients and can provide in case of storage in high-value crops as well. It is proposed to be built in urban areas or centres of high consumption to ensure their economic viability.
- PSWC envisages to provide a complete solution for warehousing of agricultural produce, from procurement to storage of different agricultural products viz foodgrains, pulses, etc. in time to come. It can provide grading and standardisation services also.
- The PSWC needs a mandate from the Government of Punjab to operate beyond State to have a strategic tie-up with other SWCs & Warehousing companies to provide end-to-end solutions as operation in the state restricts growth potential. It will also provide value addition to clients as well and make it competitive.
- A sound financial model & robust financial framework is the hallmark of any successful business. The PSWC intends to upscale its accounting practices and rules to global practices to make its finances robust.

Household Register of Village Panchayat:

At present, Panchayats do not maintain any record of households living in the village in terms of various features of the households. It is proposed to introduce a system whereby all the relevant information on households of the village is to be recorded in a register and is updated frequently. The household register of all villages will be prepared by 2030, and thereafter it will be updated every five years upto 2047. The detailed Performa for preparing the household record register of the village Panchayat is given (see Table 6 in Annexure).

Maintenance of Accounts of Village Panchayats:

The Panchayati Raj Act empowers the village Panchayats to impose certain taxes, fines and penalties. Moreover, the Panchayats have the right to get a share of the natural resources of the village in form of royalty and rents. The need is for proper accounting of the revenue and expenditure of the village Panchayats. In the preparation of revenue/expenditure details, the Panchayats may be given the help of financial experts of the Rural Development Department. The process of a complete accounting of village Panchayats may be completed by 2030, and by 2047, it may be improved and digitalised. After this, the progress may be reported for each village Panchayat at the end of a financial year and information may be updated on the website of the Rural Development Department. The detailed Performas for this purpose are given in Tables 7 & 8 in the annexure.

Royalty from Mining and Quarrying:

Punjab is not as rich in mineral resources as some Eastern Indian States. Mining and quarrying contribute less than one per cent to the State's Domestic Product. Along the main rivers and seasonal rivulets and in the Foothills region Punjab has adequate deposits of sand and stone. Most of the land on which sand and stone deposits are found belongs to village Panchayats. As a result of extensive mining and quarrying of sand and stone, the rural population suffers from many environmental problems. To compensate the rural population, village Panchayats may be granted sufficient royalty on the mining and quarrying carried out in their neighbourhood. The complete listing of villages and the area in their neighbourhood on which mining and quarrying are being

carried out will be completed by 2030, and a suitable royalty would be fixed and paid to the Panchayats of these villages. The details of this list and the mining and quarrying area should be digitalized and put online by 2047. The amount of sand and stone mined from the area of each village should be recorded on yearly basis and updated every year. The royalty paid to the Panchayats for mining and quarrying should be increased in line with the increase in quantity and prices of sand and stone. The money received as royalty by Panchayats should be exclusively used for the development of village infrastructure and for rehabilitation of the area from which mining and quarrying have been done.

Annexure

Table 1:
Profile of Rural Punjab

Sr. No.	Item Description	Current Value/Quantity/ Number
1.	Number of inhabited villages in Punjab	12120
2.	Total rural population (2019-20, Estimated)	1.89 crore
3.	Total rural area (sq. km.)	47252.20
4.	% age of rural population below the poverty line (2011-12)	7.60
5.	Number of rural poor (2011-12)	13.35 lakh

Source: Statistical Abstracts of Punjab

Table 2:
Current Status of Rural Infrastructure and Public Facilities

S. No.	Item	Current Value
1)	Total length of village link roads (KM)	64878
2)	% age of villages connected to all-weather roads	78
3)	Length of village link roads 10 feet wide (KM)	3289 (51%)
4)	% age of villages with Asphalt concrete carpeted ring roads (*Phirni*)	60
5)	% age of villages connected/covered by local bus transport	82
6)	% age of villages with *pucca*(Brick lined) streets	93
7)	% age of villages with street lights	34
8)	% age of villages with proper drain (Nali) outlet for disposal of wastewater	91
9)	% age of villages having water works and piped tap water facility	98
10)	% age of villages having overhead water reservoirs (Tanks)	65
11)	% age of villages having primary health centre/ sub-centre	30
12)	% age of villages having veterinary health sub-centres	29
13)	% age of villages having Anganwadi centres	84
14)	% age of villages having a bank branch	22
15)	% age of villages having ATM facility	17
16)	% age of villages having a sub-post office	28
17)	% age of villages having electricity	98
18)	% age of villages having public parks	Not Available
19)	% age of villages having public community centres	Not Available

Source: (i) Statistical Abstracts of Punjab and Government of India Data.
(ii) Field Survey, IDC, 2022.

Table 3:
Current Level of Rural Standard of Living

S. No.	Standard of Living Item	Current Value
1)	Percentage of Households having Pucca House	96
2)	Percentage of Households having a proper separate kitchen in house premises	91
3)	Percentage of Households having a proper bathroom in house premises	92
4)	Percentage of Households having piped tap water in house premises	81
5)	Percentage of Households having flush latrine in house premises	88
6)	Percentage of Households having a sofa set	49
7)	Percentage of Households having a dining table	17
8)	Percentage of Households having LPG for cooking	97
9)	Percentage of Households having electricity for lighting	98
10)	Percentage of Households having phone/mobile	97
11)	Percentage of Households having a TV	91
12)	Percentage of Households with refrigerator	90
13)	Percentage of Households having a washing machine	68
14)	Percentage of Households having A.C	26
15)	Percentage of Households having Air Cooler	85
16)	Percentage of Households having Bicycle	91
17)	Percentage of Households having Motorcycle/scooter	61
18)	Percentage of Households having car/jeep	26
19)	Percentage of Households having a sewing machine	47

Source: (i) Statistical Abstracts of Punjab and Government of India Data.
(ii) Field Survey, IDC, 2022.

Table 4:
Schemes of Department of Water Supply and Sanitation, Punjab
(Financial Year: 2021-22) (Rs. in lacs)

1	Sub - Head/ Scheme	Plan Allocation			Funds drawn from Treasury			Expenditure			% age Expenditure out of Funds Drawn
		CS	SS	Total	CS	SS	Total	CS	SS	Total	
1.	CS (RWS- 2) Swachh Bharat Mission (Gramin)	29477.57 (100)*		29477.57	3871.73	3045.07	6916.80 (23.46)**	3871.73	3045.07	6916.80	(100%)***
2.	CS (RWS- 2) Swachh Bharat Mission (Gramin) Incentive Fund	90.13 (100)	0.00	90.13	86.08	0.00	86.08 (95.50)	86.08	0.00	86.08	(100%)
3.	CS (RWS-3) National Rural Drinking Water Supply Programme (NRDWP)/Jal Jeevan Mission	25000.00 (100)	0.00	25000.00	24782.63	0.00	24782.63 (99.13)	24782.63	0.00	24782.63	(100%)
4.	RWS-9/9(i) Provision/ Augmentation of water supply & sewerage facilities in specific towns	0.00	1200.00 (100)	1200.00	0.00	864.80	864.80 (72.06)	0.00	864.80	864.80	(100%)
5.	RWS-8 Court Cases Arbitration Cases	0.00	400.00 (100)	400.00	0.00	293.38	293.38 (73.35)	0.00	293.38	293.38	(97.82%)
6.	Nabard Aided Installation of RO Plants RIDF XXII	0.00	600.00 (100)	600.00	0.00	315.37	315.37 (52.56)	0.00	315.37	315.37	(100%)
7.	Nabard Aided improvement of the water supply programme RIDF XXIII	0.00	5000.00 (100)	5000.00	0.00	3578.94	3578.94 (71.57)	0.00	3578.94	3578.94	(100%)
8.	RWS- 04/4- Punjab Rural Water Supply Sanitation Project with World Bank Assistance - (PRWSSIP)	0.00	20000.00 (100)	20000.00	0.00	18157.27	18157.27 (90.78)	0.00	18157.27	18157.27	(100%)
9.	CS(RWS)-4: Special assistance for mitigation of drinking water problems in the habitations affected with arsenic and fluoride (100% CS)	400.00 (100)	0.00	400.00	257.93	0.00	257.93 (64.48)	257.93	0.00	257.93	(100%)

1	Sub - Head/ Scheme	Plan Allocation			Funds drawn from Treasury			Expenditure			% age Expenditure out of Funds Drawn
		CS	SS	Total	CS	SS	Total	CS	SS	Total	
10.	Providing Sewerage facilities in Villages (Bahadurgarh, Ghuman, Budha Theh & Mehra) of District Patiala, Gurdaspur, Amritsar & Bathinda RIDF -XXIV	0.00	3500.00 (100)	3500.00	0.00	2619.46	2619.46 (74.84)	0.00	2619.46	2619.46	(100%)
11.	Augmentation/enhancement/ Replacement and rehabilitation of existing infrastructure in Rural WSS Scheme.	0.00	2500.00 (100)	2500.00	0.00	2260.62	2260.62 (90.42)	0.00	2260.62	2260.62	(100%)
12.	State Share for providing surface-based piped water supply scheme in Arsenic / Fluoride affected border areas of State under RIDF-XXVI	0.00	5000.00 (100)	5000.00	0.00	4995.38	4995.38 (99.90)	0.00	4995.38	4995.38	(100%)
13.	RWS- 25 - For providing/upgradation of existing 58 rural piped water supply schemes and providing sewerage scheme in one village Assarpur of district Patiala under NABARD RIDF XXVII	0.00	770.00 (100)	770.00	0.00	494.91	494.91 (64.27)	0.00	494.91	494.91	(100%)
14.	RWS - 26 - For providing 5 surface-based piped water supply schemes for covering 700 water scarcity/quality affected villages of districts Ferozepur, Fazilka, Hoshiarpur & Rupnagar under NABARD aided RIDF XXVII	0.00	2500.00 (100)	2500.00	0.00	635.00	635.00 (25.04)	0.00	635.00	635.00	(100%)
15.	Construction of Jal Bhawan & Other Office Buildings of the Department	0.00	1400.00 (100)	1400.00	0.00	1294.26	1294.26 (92.59)	0.00	1294.26	1294.26	(100%)

Note: *Percentage share of Centre and State out of total allocation.
**Percentage of funds drawn out of total allocation.
*** Percentage expenditure out of total funds drawn.

Table 5:
Schemes of NABARD Department of Water Supply and Sanitation, Punjab ***(Rs. in lacs)***

Sr. No.	Sub Head/ Scheme	Annual Plan 2021-22 Plan Outlays			Funds drawn from Treasury			Expenditure		
		Total Allocation	Nabard/ EAP Share	State Share	Total Amount	Nabard/ EAP Share	State Share	Total Amount	Nabard/ EAP Share	State Share
1.	RWS- 04/4- Punjab Rural Water Supply Sanitation Project with World Bank Assistance - (PRWSSIP)	20000 (100)	14000 (70)*	6000 (30)*	18157.27 (90.78)**	12710.09	5447.18	18157.27 (100)***	12710.09	5447.18
2.	Nabard Aided Installation of RO Plants under RIDF-XXII	600 (100)	510 (85)	90 (15)	315.37 (52.56)	268.06	47.31	315.37 (100)	268.06	47.31
3.	Nabard Aided improvement of the water supply programme RIDF XXIII	5000 (100)	4250 (85)	750 (15)	3578.94 (71.58)	3042.1	536.84	3578.94 (100)	3042.1	536.84
4.	Providing Sewerage facilities in Villages (Bahadurgarh, Ghuman, Budha Theh & Mehra) of District Patiala, Gurdaspur, Amritsar & Bathinda RIDF – XXIV	3500 (100)	2975 (85)	525 (15)	2619.46 (74.84)	2226.54	392.92	2619.46 (100)	2226.54	392.92
5.	State Share for providing surface-based piped water supply scheme in Arsenic / Fluoride affected border areas of State under RIDF-XXVI	5000 (100)	4250 (85)	750 (15)	4995.38 (99.91)	4246.07	749.31	4995.38 (100)	4246.07	749.31
6.	Providing/upgradation of existing 58 Rural Piped Water Supply Schemes in Patiala under NABARD RIDF – XXVII	770 (100)	654.50 (85)	115.50 (15)	494.91 (64.27)	420.67	74.24	494.91 (100)	420.67	74.24
7.	Providing Piped Water Supply Schemes for 700 water scarcity/quality affected villages of Ferozepur, Fazilka, Hoshiarpur and Rupnagar RIDF – XXVII	2500 (100)	2125 (85)	375 (15)	635 (25.40)	539.75	95.25	635 (100)	539.75	95.25

Note: *Denotes percentage share of Centre and State.
**Shows the percentage of funds drawn out of total allocation.
***Shows % age expenditure out of total funds drawn.

Table 6:
Household Record Performa

Sr. No.	Particulars	Household Numbers	
		1	2
1.	Serial Number		
2.	House Number		
3.	Name of Head		
4.	Name of Father of Head		
5.	Caste		
6.	Religion		
7.	Education of Head		
8.	Occupation of Head		
9.	Number of Family Members		
10.	Number of Adult Male Members working		
11.	Number of Adult Female Members working		
12.	Number of Children going to School		
13.	Number of Children going to College/University		
14.	Number of Family Members living abroad		
15.	Is the household receiving remittance from abroad		
16.	Number of Family Members having non-farm salaried jobs		
17.	Area owned (Acres)		
18.	Area operated (Acres)		
19.	Owns Tractor (Yes/No)		
20.	Owns Tubewell (Yes/No)		
21.	Type of House (Pucca/Kutcha)		
22.	Has piped tap water in the house		
23.	Has flush latrine in house		
24.	Has proper drainage outlet for wastewater		
25.	Has LP Gas		
26.	Has electricity for lighting		
27.	Has Phone/Mobile		
28.	Has Radio/Transistor		
29.	Has Television		
30.	Has Bicycle		
31.	Has Motor Cycle/Scooter		
32.	Has Car/Jeep		
33.	Has Computer/Laptop		
34.	Has Sewing Machine		
35.	Has Washing Machine		
36.	Has Air Conditioner		
37.	Has Air Cooler		
38.	Has Microwave		
39.	Has Oven		
40.	Has a Bank Account		
41.	Is the household under Debt (Yes/No)		
42.	Number of family members getting the old age pension		
43.	Is the household getting a free ration under any PDS Scheme		
44.	Is the household covered under Ayushman Health Scheme		
45.	Has the household Yellow Card		

Table 7:
Revenue/Income Record
(Village_____Block_____District_____)

Sr. No.	Source of revenue	Dimension (size)	Real ownership in records (applicable units)	Actual Possession	Revenue (Rs.)	Maintenance Cost / Expenditure	Nature of maintenance	Comments
1.	Leased out Shamlat Land							
2.	Forest land							
3.	Cess on Agriculture produce							
4.	Horticulture							
5.	Auction of village ponds							
6.	Collection from village tube-wells							
7.	Any sale of water for agriculture							
8.	Rent from shops							
9.	Rent from Village community							
10.	Cow dung (Waste of animals) etc.							
11.	Chulha Tax							
12.	Fuel Wood Sale							
13.	Fodder and sale of grass							
14.	Tax on 'pheriwalas'							
15.	Toll Tax (if any)							
16.	Royalty from Land/Mines etc.							
17.	Collection from Libraries							
18.	Donations (any)							
19.	Fines and penalties							
20.	Entertainment Tax							
21.	Rent from playground etc.							
22.	Orchards							
23.	Tax on sale of liquor in the village							
24.								
25.								

Prepared by:_____ Verified by: _____

Table 8:
Expenditure of a Panchayat
[Financial Year: _____ to _____]
(Name of Village Panchayat _____ Block _____ District_____)

Sr. No.	Items	Govt. Grants (Rs.)	Expenditure out of Panchayat revenues (Rs.)	Any other source (Rs.)	Dimension (mention units)	Comments
1.	Reclamation of agricultural land					
2.	Social forestry					
3.	Orchards					
4.	Installed any Panchayati tubewells					
5.	Land of fodder or grass					
6.	On the construction of shops					
7.	On building a community centre					
8.	School building					
9.	Panchayat Ghar					
10.	Dharamshala for SCs					
11.						
12.						
13.						

Prepared by: _____ Verified by: _____

VISION@2047
CURRENT STATUS AND STRATEGIES FOR FUTURE: RURAL DEVELOPMENT
(IMPROVEMENT OF RURAL INFRASTRUCTURE AND PUBLIC FACILITIES)

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
1. Percentage of villages connected to all-weather roads	78	90	100	• Regular repair & maintenance of link roads; • Outer ring roads linking the fields will be carpeted; • Special planning for the construction of drains and pucca streets in SC localities; • Increase solar streets lights; • Easy permits to village bus routes.
2. Percentage of villages with link roads widened to 10 feet	51	80	100	
3. Percentage of villages with asphalt concrete carpeted ring roads	60	80	100	
4. Percentage of villages with asphalt concrete carpeted streets	Zero	50	100	
5. Percentage of villages with covered wastewater disposal drains (*Nalis*)	Zero	50	100	
6. Percentage of villages with street lights	65	85	100	
7. Percentage of villages connected by local bus transport	Zero	50	100	
8. Percentage of villages having overhead water reservoir	34	70	100	• Regular repair and maintenance of drinking pipelines; • Community participation in the management of water supply and checking wastage of water; • Special public taps in SC localities; • Increase water pressure at tail end houses and houses at heights; • Water samples must be checked regularly for bacterial and chemical composition.
9. Percentage of villages with 12 hours (day time) regular piped water supply	82	90	100	
10. Percentage of villages with primary veterinary sub-centres	30	70	100	• PHCs may be started under the PPP model or with NGO/religious organizations; • Religious/social organizations may be involved to start diagnostic labs in villages; • Each village should have its own ambulance under NRHM; • Involve religious/social organizations to start veterinary care services in villages.
11. Percentage of villages with primary health sub-centre	29	70	100	

Indicator	Current Status/Baseline	Target 2030	Target 2047	Strategies
12. Percentage of villages with a bank branch	27	60	100	• Involve local shopkeepers to start ATM/Sub Post Offices in villages.
13. Percentage of villages having Post Office/Sub Post Offices	28	60	100	
14. Percentage of villages with ATM facility	17	50	100	
15. Percentage of villages having electricity	98	100	100	• Increase the number of hours of electric supply in villages.
16. Percentage of villages with community centres	NA	50	100	**I. Financial resources for the expansion and upgradation of rural infrastructure and Public facilities will come from the following sources:** 1) State Government budgetary allocation; 2) Central Government grants; 3) Rural Development Fund of Mandi Board; 4) Per hectare flat-rate levy on all land owners; 5) Flat rate levy on all job holders and shopkeepers of the village; 6) NRI Donations.
17. Percentage of villages with public parks	NA	50	100	
18. Percentage of villages with Public Gym facility	Nil	50	100	
19. Percentage of villages with Anganwadi Centres	84	100	100	
20. Percentage of villages with tailoring/embroidery training centres	NA	50	100	
21. Percentage of villages with cooking training centres	NA	50	100	

VISION@2047
IMPROVEMENT IN RURAL STANDARD OF LIVING

Indicator Item (Percentage of Households)	Current Value/Baseline	Target 2030	Target 2047	Strategy and financing for improvement
1. Having pucca House	96	100+ 25% increase in covered space of every household	50% increase in covered space in every household	1) Own savings of households; 2) Suitable subsidy to scheduled caste households; 3) Easy bank loans; 4) Promotion of second-hand durable goods market to enable low-income households to purchase cheap and good-condition second-hand durable goods; 5) Remittances from NRIs.
2. Having a separate kitchen in the house	91	100 plus dishwashing sinks in every kitchen	Smoke chimney in every kitchen	
3. Having a separate bathroom in the house	92	100 plus hot water geysers in every bathroom	2 bathrooms in every house	
4. Piped tap water	81	100	Water supply as per need of village.	
5. Flush Latrine	88	100	2 Flush latrines in every house	
6. Sofa set	49	80	100	
7. Dining table	17	50	100	
8. LP Gas	97	100 plus two refill cylinders in every house	Improved cooking Chula in every house	
9. Electricity	98	100 plus 24 hours regular power supply	100 plus 24 hours regular power supply	
10. Phone/Mobile	97	100 plus two mobiles in every house	All adult family members with mobile phone	
11. Television	91	100% will have Television and 50% will have a Laptop	All households with 1 Television set and 1 Laptop	
12. Refrigerator/Oven	90	100% will have a Refrigerator and 50% will have a Micro Wave Machine	All households with 1 Refrigerator and one Micro Wave Machine	

Indicator Item (Percentage of Households)	Current Value/Baseline	Target 2030	Target 2047	Strategy and financing for improvement
13. Washing Machine	68	80	100	
14. Air Conditioner	26	50	100	
15. Air Cooler	85	100	Two Air coolers in every house	
16. Bicycle	91	100	Two bicycles in every house	
17. Motor Cycle/Scooter	61	80	100	
18. Car/Jeep	26	40	50	
19. Sewing Machine	47	80	100	

SECTION IV

INFRASTRUCTURE

I. Infrastructure Development

II. Sustainable Cities and Communities

I
INFRASTRUCTURE DEVELOPMENT

Infrastructure is the foundation for all the activities in a State as well as the nation. It is mainly composed of public and private physical structures such as roads, railways, bridges, airports, power, and social sector infrastructure. It is one of the major sectors that drives the overall development of a State's economy along with providing under-developed regions, disadvantaged groups, sections or members of the society, a better access to economic and social opportunities and as a result tends to reduce inter-spatial divergence in inequalities as well as poverty.[1] Along with highlighting issues relating to building infrastructure other important, issues such as equitable access to healthcare, power supply, and quality education have been addressed for citizen's well-being in the preceding chapters for this document. According to a recent study conducted by the World Bank on 'Why do Indian States differ in their Infrastructural development; three different levels of infrastructure have been taken into consideration to explain the growth of Indian States:

1. **Physical Infrastructure**: which includes transportation- road/rail, energy, information, telecommunication.
2. **Social Infrastructure**: includes education and health in the State which is covered under chapter 5.
3. **Financial Infrastructure:** which deals with access to finance and financial institutions.

The Covid-19 pandemic has provided an impetus to the digital/technological infrastructure. Punjab has adopted and incorporated digital infrastructure such as Artificial Intelligence, nano-based devices, drones, Blockchain etc across various sectors. Punjab's infrastructure plan for 2047 must ensure seamless as well as efficient movement of goods and people across several modes of transport with effective eco-operation between different sectors such as roads/highways, railways, civil aviation, tourism, etc.

[1]Timilsina G.R., Sahoo P., Dash R.K., 'Why do Indian States Differ in Their infrastructural Development?' World Bank, Development Research Groups, June 2022.

With the Punjab Rural Development (Amendment) Ordinance, 2022, the government aims to spend the fund on strengthening the rural infrastructure and establish an advanced procurement system for the farmer.

ROAD INFRASTRUCTURE, RAILWAYS & AIRPORTS (Connectivity)

Current Status

Roads form a fundamental part of the development process and make travel more expedient. These increase the mobility and also affect the holistic well-being of citizens. In every State, roads, railways, and at times airports emerge as relevant components and mode of transport. Double-laned roads in all areas, traffic management in all cities, a network of flyovers and well-developed highways is deemed as an appropriately developed infrastructure of a particular State. Tables 1, 2, 3, 4 and 5 (Annexure) depict the picture of connectivity in Punjab with its cities, villages, and other neighbouring States.

The State's primary transportation need is divided into three parts i.e., inter-city connectivity, intra-city connectivity and rural connectivity. The State of Punjab is spread over an area of about 50,362 square kilometres, which is 1.53 % of the total geographical area of India. Punjab is wholly dependent on roads and railways for transportation. The prime objectives of having a standardised road and transport infrastructure includes-

1. Sustainable, efficient, and safe road network in Punjab.
2. To achieve enhanced connectivity and quick mobility.
3. Development of global standards road network in Punjab with uninterrupted flow of traffic and enhanced safety features.
4. Connecting the remote and rural areas of Punjab to enhance the mobility.
5. Upgradation of Rural roads network within Punjab.

Roads and highways are vital for providing access to markets, work, education, services and ultimately for enhancing life quality (See Table 6 and 7 in Annexure).

However, with the development of State Roads and National Highways, people face various economic and social issues such as loss of livelihood, displacement, and loss of

access to community facilities through the widening of roads, bypasses, service roads, underpasses, and other facilities, but this is more important for the overall growth of the State where the masses are connected to large span of facilities and important places.

The large network of roads consisting of highways dramatically alter the rural and urban landscape. The open and green spaces in and around cities and rural areas decrease with the construction of new roads, often adding to pollution and congestion, but this is one of the most important demand and requirement of the time whereby hassle-free movement and availability of resources is needed by the citizens.

Accessibility is an important factor that boosts the economy of any State. It has a world-class heritage of religious shrines, forts and palaces, ancient and historical monuments, wetland and areas of natural beauty. It is also famous for its handicrafts, woodcrafts and intricately designed rich traditional patterns, moderates, and needle work products. However, there is a need to facilitate, enhance and emphasise on the optimum utilization of aviation infrastructure in the State of Punjab to establish an eco-friendly infrastructural development leading to growth of civil aviation, promoting tourism, increasing employment, and providing socio-economic boost to the State. Additionally, it is indispensable to promote digitization in tourism to develop unified tourism.

Challenges

1. **Road accidents, fatalities and injuries are increasing at an alarming rate:** The major districts roads of Punjab along with the link roads carry the bulk of traffic every day and due to lack of road safety measures on these roads, the chances of road accidents increase manifolds.
2. **Lack of availability and accessibility of public transport:** Inter-city public bus operations have seen a decline over the last few decades, and public transport for intra-city travel in the cities in Punjab is either completely absent or inadequate.
3. **Connectivity Issue with the Rural Areas**: Rural areas have poor access to public transport. Although the rural road network is extensive in Punjab, yet it needs to improve. More importantly due to the lack of connectivity, the people residing in rural

areas are deprived of various services which can be availed through facilities like schools, hospitals, and Government facilitation centres.

4. **Existing Road Infrastructure requires overall reconstruction by keeping non-motor transport (NMT) like cyclists, rickshaws, and pedestrians in view**: In Punjab, nearly 45 percent of the traffic mix on roads comprises of non-motorized vehicles including pedestrians, cycles, cycle rickshaws, animal driven carts, and 25 per cent of total road accident fatalities (924 deaths) occurred related to non-motorized vehicles comprising of pedestrians, cyclists, animal driven, etc.

5. **Establishment of eco-friendly infrastructural development:** Punjab despite being a small State has two international Airports and four domestic airports. However, there is a need to facilitate, enhance and emphasise on the optimum utilization of aviation infrastructure in the State to establish an eco-friendly infrastructural development leading to overall growth of the State.

Short-term Targets and Strategies: 2030

1. **Physical infrastructural enhancement of roads:** Roads in Punjab lack service lanes, median cuts, pedestrian tracks, and streetlights, ultimately creating congestion, crashes, and fatalities.

2. **More visible warning signs at strategic places** such as blind spots, bends, diversions, road works in progress, sharp turns, etc. The 2030 target is *identification of rural roads*; further, the Transport Department shall establish a Road Safety Data Centre/Laboratory for collection and analysis of Road Traffic Accident Data in collaboration with State Police and various Central and International Agencies; Construction of Green Road Corridors & Green Buildings which are ECBC compliant.

3. **Prioritise road safety with digital technology**: Installing radar speed guns on the most used roads can regulate the traffic, reduce black spots, and prevent road fatalities.

4. **Intelligent Traffic Management System** would enable road users to be better informed and to make safer, more coordinated, efficient, and smarter use of transport networks to rectify and thereby eventually reduce the number of black spots in Punjab.

5. **Need for improved technological infrastructure**: Creatively developing and implementing road safety strategies like Video Vehicle Detection System (VVDS) using PTZ cameras and AI. Other systems like Dynamic Traffic light Sequencing, Emergency Vehicle Notification System and Cooperative Intersection Collision Avoidance System (CICAS) will to be implemented on a priority basis.
6. **Increase availability of public transport:** To improve access to educational and medical institutions, especially in rural setting, public transport services will be enhanced.
7. **Railway Infrastructure:** Existing railway transport infrastructure is not extended to connect the Malwa area of the State and the border area region directly with the State capital. Therefore, an effort shall be made to upgrade and enhance the existing railway rail network of 2265 Km. Further, State is aiming for the electrification of old railways routes and extension of existing railway routes towards remote area of Punjab.
8. **Air Infrastructure:** The State to enhance air connectivity by increasing the number of domestic and international flights and tourist destinations in Punjab and neighbouring States. Aviation industries like MROs and the latest training technique like flight stimulators to be set up in the State for enriching Punjab's air infrastructure.
9. **Promote tourism via connectivity:** State to address the development of Rural eco-tourism, digitization to promote Punjab's tourism and lastly connecting major heritage cities/sites with the aviation sector. The focus will be to preserve and restore the protected monuments. Additionally, facilitate the adoption of digital technologies and platforms for providing technical and networking support to enterprises engaged in tourism activities.

Long-term Targets and Strategies: 2047

1. **Physical infrastructural enhancement of roads:** State to create a more robust and increase the road network by 50% for safe pedestrian and cycling environments. (In the urban centres of Punjab) use of global best practices in the construction of Roads, Bridges & Buildings. Emphasis and commitment for construction of Green

Road Corridors and Green Buildings (ECBC compliant) along with regular maintenance of Green Corridors and Buildings.

2. **Prioritise road safety with digital technology**: Use of varying road speed limits based upon road congestion, use of micro or nano satellites for live satellite and position data to implement data-driven enforcement and traffic management in real-time. Further placement of electric vehicle charging stations throughout the State.
3. **Autonomous vehicle infrastructure:** State to upgrade the existing road infrastructure as per the requirement of self-driving vehicles.
4. **Increase availability of public transport:** To cater to the migration inflow and growing population of the State, the State authority shall introduce a smart network corridor by designing hyperloop trains, connecting major cities and towns of Punjab. The State shall devise a system that uses the magnetic levitation technology to evolve a less expensive, faster travel and sustainable high-speed mass transit system as a future mode of travelling within Punjab. The corridor shall be designed keeping in mind the creation of a thriving mega-region with high-speed transportation.
5. **Construction of a dedicated railway** route by the name of "golden triangle" corridor which cover all regions of Punjab and finally enhances the connectivity of the regional and interior areas with all urban centres and capital of the State.
6. **Enhance Urban Transport strategy**: Projects like providing bypass routes for long-distance commuters and truck traffic to avoid traffic conflicts with traffic on city roads. Identifying feeder systems that connect different pockets and wards in the city to the most convenient point in one or more of the mobility corridors, providing a network of dedicated cycle tracks, footpaths, and pedestrian crossings in municipal towns of Punjab and identifying the number of trunk mobility corridors along with an integrated multi-modal mass transport system plan on various corridors of Punjab in order to cater to traffic by the year 2047.
7. **Air Infrastructure:** Department of Culture and Tourism, Punjab will be encouraged to promote Heli-tourism within the State and neighbouring States. Additionally,

convert the existing and new airports into green field airports for eco-friendly infrastructural development.

8. **Promote tourism via connectivity:** To launch Hospitality Sector Skill mission to create synergy between skill development framework and sectoral growth strategies. The focus will be laid on developing an interface to enable open and interoperable search, discovery, information exchange and digital transactions. Lastly, the adoption of digital technologies from time to time and platforms for providing technical and networking support to the enterprises engaged in tourism activities.

Annexure

Table 1:
Road Infrastructure in Punjab (2019-2020)

National Highway Roads in Punjab	3,639.68 Kms
State Highway Roads in Punjab	847.81 Kms
Major District Roads in Punjab	1,848.11 Kms
Other District Roads in Punjab	5,179.85 Kms
Link Roads, managed by PWD	32,890 Kms
Link Roads, managed by Punjab Mandi Board	31,988 Kms
Total Length of Punjab Roads	**76393.45 Kms**

Source: Public Works Department (B&R) in Punjab, Transport and Communications

Table 2:
Rail Network in Punjab

Sr. No.	Railways Division	Rail Length (Km)
1	Ferozpur	1849.95
2	Ambala	1134.82
3	Delhi	1470.68
4	Total	4455.45

Source: Statistical Abstract Punjab, 2020

Table 3:
Road Density in Punjab

State	Roads/100 Sqr Kms of Area (Km)	Road/Lakh Population (Km)	Total Villages Linked with Roads
Punjab	183	295	12096

Source: Statistical Abstract Punjab, 2020

Table 4
Airports in Punjab

International Airports in Punjab	**2**
Domestic Airports in Punjab	**4**

Table 5:
Public Transport in Punjab

State Bus transport	4 Agencies (3 Government Operated, 1 Private operator)
Name of Agencies	Punjab Roadways, PEPSU Road Transport Corporation, Municipal Corporation Transport, and Private Operators.

Source: Public Works Department (B&R) in Punjab, Transport and Communications

Table 6:
Composite index of ease of living: Rural

	Social well being	Economic ability	Sustainability	Composite index	Rank
Shambhu to Rajpura	53.70	52.70	54.22	53.54	2
Rajpura to Sirhind	47.44	52.38	54.77	51.53	4
Sirhind to Mandi Gobindgarh	49.76	61.50	46.88	52.71	3
Mandi Gobindgarh to Khanna	39.99	46.61	49.11	45.24	11
Khanna to Ludhiana	46.82	55.03	48.61	50.15	7
Ludhiana to Phillaur	55.18	59.04	49.95	54.72	1
Phillaur to Phagwara	46.44	44.23	60.02	50.23	6
Phagwara to Jalandhar	47.33	51.17	51.57	50.02	8
Jalandhar to Bhogpur	43.68	38.23	42.41	41.44	12
Bhogpur to Dasuya	54.31	48.40	45.95	49.55	9
Dasuya to Mukerian	50.32	45.49	46.06	47.29	10
Mukerian to Pathankot	55.32	45.82	50.43	50.52	5

Source: IDC Survey 2021

Table 7:
Composite index of ease of living: Urban

	Social well being	Economic ability	Sustainability	Composite index	Rank
Rajpura	51.80	51.04	57.74	53.53	2
Sirhind	44.65	59.21	55.00	52.95	3
Mandi Gobindgarh	47.99	58.71	48.17	51.62	4
Khanna	46.09	46.11	49.79	47.33	10
Ludhiana	44.98	50.35	48.23	47.85	8
Phillaur	45.06	53.68	55.80	51.51	5
Phagwara	56.61	52.35	52.22	53.73	1
Jalandhar	55.53	48.54	48.10	50.72	6
Bhogpur	50.39	46.57	46.09	47.68	9
Dasuya	52.84	41.52	45.90	46.75	11
Mukerian	49.37	44.29	44.55	46.07	12
Pathankot	54.68	47.65	46.74	49.69	7

Source: IDC Survey 2021

INFRASTRUCTURE: SHORT-TERM AND LONG-TERM STRATEGIES

Sector	Indicator	Current Status/Base line	Target (2030)	Target (2047)	Strategies
CONNECTIVITY & TRANSPORT	To reduce **road** fatalities	5203 road accidents including 3,898 deaths	Reduce by 60% of total fatalities	Making Punjab a 'Zero Road Fatality State'	• Use of varying road speed limits based upon road congestion, use of micro or nano satellite for live satellite and position data to implement data driven enforcement and traffic management in real time. • Transport Department to establish a Road Safety Data Centre/Laboratory for collection and analysis road traffic accident data in collaboration with State Police and various central and international agencies. • Construction of Green Road Corridors which are ECBC compliant.
	• Urban scenario	43% road fatalities	Reduce the road fatalities to 35%	Minimising road fatalities to make Punjab a 'Zero Road Fatality State'	• Placement of electric vehicle charging station throughout the State • Projects like providing bypass routes for long distance commuter and truck traffic to avoid traffic conflicts with traffic on city roads. • An integrated multi-modal mass transport system plan on various corridors of Punjab in order to cater to traffic up to the year 2047.
	• Rural scenario	57% road fatalities	Reduce the road fatalities to 48%	Minimising road fatalities to make Punjab a 'Zero Road Fatality State'	• More visible warning signs at accident-prone areas/sharp turns
	To ensure infrastructural safety measures for pedestrians and non-motorized vehicles Public Transport	25% pedestrian deaths of total road accident fatalities in both urban and rural Punjab	Enhance 100 % rural road connectivity	Strengthening 100% link road network-	• Widening of rural link roads from 10ft to 14ft. • Retrofitting and quality enhancement of widened link roads entering/terminating on major highways and village mandis. • Create road network for safe pedestrian and cycling environments • Use of global best practices in the construction of Roads, Bridges & Buildings.

Sector	Indicator	Current Status/Base line	Target (2030)	Target (2047)	Strategies
	To ensure 24*7 public transport connectivity in Rural areas through link roads	Low fleet strength at 80 buses per 10 lakh population	Increase Public transport by 350 buses per 10 lakh population 40% villages of Punjab	Increase Public transport by 500 buses per 10 lakh population 100% villages of Punjab	• To have a multi-modal transport system in all major urban centres by enhancing the public transport system in place. • Dedicated public transport feeder bus system integrated with the mainstream mode of transport to cater to the villages of Punjab.
	To upgrade the existing **railway** network	Existing railway network is of 2265 kms	Extend railway connectivity to remote areas	Connecting three regions of Punjab with the State's capital	• Electrification of old railway routes and extension towards the remote areas of Punjab. • Construction of the 'Golden Triangle' corridor covering all regions of Punjab and connecting the regions with Chandigarh.
	Identification and reduction of black spots	798 black spots on National Highways, State Highways, other district roads, municipal roads, link roads and other roads in Punjab	Rectification of 556 identified black spots on National Highways in Punjab i.e., 70% of total black spots	Rectification of the remaining 242 identified black spots on other major roads in Punjab i.e., 30% of total black spots.	• Prioritise road safety with digital technology: Installing radar speed guns on the most used roads can regulate the traffic and prevent road fatalities; • Intelligent Traffic Management System would enable the road users to be better informed and to make safer, more coordinated, efficient, and smarter use of transport networks • Ensuring stakeholders participation while constructing new roads that minimises the new emerging black spots and road fatalities while rectifying the already identified black spots.
	To upgrade the existing **air** network	2 International Airports, 4 domestic Airports	Enhance air connectivity by increasing the number of domestic and international flights	Promotion of Heli-tourism and converting existing and new airports into greenfield airports.	• Aviation industries like MROs and the latest training technique like flight stimulators to be introduced in the State. • Deploy advanced technologies for the optimal growth of the sector. • Develop efficient air traffic management and air navigation system

Sector	Indicator	Current Status/Base line	Target (2030)	Target (2047)	Strategies
					• Increase the number flights of from domestic airports to the major industrial and tourist destinations in Punjab and neighbouring States. • Increase international air connectivity • Department of Culture and Tourism, Punjab to be encouraged to promote Heli-tourism within the State and neighbouring States
	To promote tourism via connectivity	94 protected monuments along with others	Development of Rural eco-tourism, digitization to promote Punjab's tourism and connect major heritage cities/sites with aviation sector.	To launch Hospitality Sector Skill mission to create synergy between skill development framework and sectoral growth strategies.	• Reserve and restore the protected monuments. • Focus on developing an interface to enable open and interoperable search, discovery, information exchange and digital transactions. • Facilitate adoption of digital technologies and platforms for providing technical and networking support to the enterprises engaged in tourism activities.
Urban Planning	To reduce transmission and distribution losses	Reduced from 20.12% to 13.68%	Reduce from 13.68% to 7.14%	Reduce it to minimum	• By replacing incorrectly sized transformers, improving the connection quality of conductors (Power lines), and increasing the availability of reactive power by installing capacitor banks along transmission • Installing smart meters and network shielding to reduce electricity thefts. Putting motoring system in place can prevent the power loss caused due to electricity theft
	To conserve energy and switch to renewable sources of energy	Electricity generation has increased by 20% however, 13% of the total installed capacity is attributed to renewable energy	Increase the share of renewable energy to 30%	Increase the share of renewable energy to 55% which an intention to achieve Net zero emissions by 2070	• Installing solar power plants on the grounds and roof tops • Energy conservation by implementing ECBC in the building sector, LED streetlighting and energy-efficient water pumping in municipal sectors.

Sector	Indicator	Current Status/Base line	Target (2030)	Target (2047)	Strategies
	To ensure access to **adequate, safe housing for all and green urban infrastructure**	--	100% coverage	100 % coverage with improved and well-maintained facilities. Adoption of 100% artificial intelligence	• By improving road safety for commuters. • All towns in Punjab to be provided access to water supply, sewerage treatment, closed drainage, and solid waste management. • provide universal access to safe, inclusive, and accessible, green, and public spaces, in particular for women, children, senior citizens and persons with disabilities. • Encourage the construction of green buildings and make rainwater harvesting mandatory. • Have green belts. Services like water supply, sewerage and waste management should be professionalized. • to make urban living safe, face mapping and Automatic Number Plate Reader (ANPR) and CCTV cameras be installed to locate the movement of any person or a vehicle in the city.
	To improve the living conditions of the slums and slum-dwellers eventually be provided with good quality alternative housing.	15% of the population presently lives in slums	Provide 100% coverage to the population living in slums with affordable housing	To develop affordable and green housing for all to eradicate the existence of slums	• Identification of slums in every town in Punjab. For slum development it is imperative to enumerate them to arrive at an intervention strategy at each slum level, to achieve the goal of "Housing for All," • GIS mapping of the location of slums with respect to the existing green spaces.
	To have an infrastructure that supports digital governance	526 Suvidha Centre/ e-centres to make digital infrastructure accessible to every citizen and to provide on-demand governance and digital empowerment	Minimize the human intervention is to manage the services with digital technology.	Adoption of 100% artificial intelligence	• Robust GIS implementation having all layers on GIS platform. For example- Water/Sewerage pipelines, Road network, Properties etc.

II
SUSTAINABLE CITIES AND COMMUNITIES

The urbanization rate in India is rapidly increasing with its urban population growing by 91 million between 2001 and 2011. Over the next 50 years, India is expected to add another 416 million urban dwellers and is expected to have seven megacities with a population growth of 10 million by 2030 only. The urban population of India was 31.8 percent in 2001 and the predictive analysis anticipates that it will be 38.2 percent by 2036 (India, 2002).[1] In Punjab rate of urbanisation is also high.

Current Status

Rapid Urbanization in Punjab

In 1951 only 21.72% of the total population of Punjab was living in urban areas (see Table 1 in Annexure). The percentage of the urban population in Punjab has increased rapidly over the years and is projected to be at 45.5 % by the year 2036. It is also observed that the number of Class I, Class II, and Class III towns are increasing (see Table 2 in Annexure). At this rate of Urbanization, the state is expected to be the 9th most urbanized state in the country (MOHFW, 2020).[2] However, recognizing the contribution of urbanization to the development of the state and the communities at large, this paper elucidates the issues and a roadmap to guide the quality development of the urban areas.

Punjab ranks first in Criteria 11 (Sustainable Cities and Communities) of the SDGs and for Criteria 7 (Affordable & Clean Energy) state is ranked first along with 14 other Indian States (Punjab SDG Index 2020-21 by NITI Aayog).[3] Punjab has exceeded the targets for the construction of household toilets. It also has 99.52 % of wards with door-to-door waste collection.

Challenges

It has been observed that some of the cities in Punjab face issues such as inadequate housing, proliferating slums, polluted spaces, and overcrowding. Besides this, the lack of

[1] Chapter 8, Punjab State Development Plan by Planning commission 2002.
[2] Population projection report 2011-2036 by MOHFW 2020.
[3] Punjab SDG Index 2020-21, Sustainable Development Goals Coordination center, Government of India.

basic services such as safe drinking water, basic sanitation, uninterrupted electricity, public transport, etc., are some of the other issues faced by the people on day to day basis.

1.0 Policy, Planning, and Governance Framework

1.1 Perspectives on Regional Planning

Punjab's urbanization is increasing in the absence of a State urban policy framework for sustainable land development and planning. Developing a Perspective Regional Plan at a state level shall aim to establish seamless spatial development of the rural and urban land settlements in Punjab. This is necessitated more in response to the distinctive pattern of the existing rural-urban continuum of Punjab that represents a binary land usage of either fertile irrigated agricultural fields or city/town settlements. In the absence of a perspective plan, erratic and amorphous peri-urban growth will potentially disrupt the equilibrium between rural and urban areas. In addition, a peculiar challenge is presented by an increasing number of census towns in Punjab that usually possess urban characteristics but are governed through a rural governance structure.

1.2 Urban Planning and Governance

Presently, the spatial development of cities and human settlements in the State of Punjab is governed by The Punjab Regional and Town Planning and Development Act, 1995. The Act was primarily formulated for better planning and regulating the development and use of land in planning areas delineated for that purpose.

Accordingly, 166 institutionalized local urban bodies for regulating urban development have been constituted (see Table-3 in Annexure). The primary instrument for development of cities is through its Master Plan, Zonal Plan and Local Area Development Plan. A total of 41 master plans have been prepared for the various urban areas of the State.

Within the framework of the Digital India Program, the state government has launched the Digital Punjab Scheme. The digitization process is intended at reducing the management of personal data by humans and augmenting the decision-making capabilities of the government. These programs intend to make digital infrastructure

accessible to every citizen and to provide on-demand governance and digital empowerment. At present, 526 Suvidha Centers have been successfully developed in the state. All the districts in the State have been covered with e-services.

1.3 Rural-urban continuum

The increasing urbanization fueled by the migration of rural dwellers presents a sustainability challenge to the continual inhabitation of rural settlements on the one hand, an urban blight on the other. The Rurban Mission aims for the development of a cluster of villages with urban facilities perceived to be essentially urban, thus creating a cluster of "Rurban Villages". In this context Punjab is ranked as the sixth best-performing State on the basis of performance-based indicators in the Shyama Prasad Mukherji Rurban Mission. (Framework of Implementation, 2015).[4]

Census Towns: There were 74 Census towns identified during the Census 2011 by the Government of India. These account for a total population of 6,86,773 in 2011.

Peri-urban Development: Areas around the Urban Agglomerations have seen development happening outside the city boundary like in Mohali, Ludhiana, and Jalandhar. This is because land outside the city limits is usually more economical and not bounded by strict rules and regulations.

Regional Development Plan: At present, one regional development plan Greater Mohali Regional Development Plan has been prepared. Besides, Regional Development Plans for six major regions identified by the government of Punjab are being prepared.

2.0 Housing

In 2015, Punjab had 1.46 million people living in the slum areas. The Affordable Housing Policy, 2021 is applicable for the areas approved by the Department of Housing and Urban Development in residential and mixed land use zones in Master plans (except Master Plan-Chandigarh) and in 3 km belt around the Municipal limits even if outside the Master plan. As on 4th July 2022, 871 projects under the Pradhan Mantri Awas Yojana had been considered and the construction of 1,11,896 houses has been

[4] Framework of Implementation, Shyama Prasad Mukherji Rurban Mission, National Rurban Mission, Ministry of Rural development, GOI, 2015

sanctioned in the state. The highest number of sanctions have been registered in Ludhiana, Amritsar, Kharar, Dera Bassi, and Zirakpur. The trends broadly indicate that most of the affordable housing is being developed in the peri-urban areas.

In addition, the Rental Housing Accommodation Policy provides financial and physical incentives to build rental accommodation for providing proper housing to various citizen groups like the students, working professionals, senior citizens, and migrant laborers in the state.

The percentage of the urban households living in kutcha houses in Punjab is 0.10 percent which is much lower than the national average of 0.8 percent as per the Punjab SDG Index (2020-21 by NITI Aayog). The percentage of urban households having drainage facilities is 97% vis a vis the national average of 87.6%. In addition, Punjab has exceeded the targets for the construction of household toilets.

3.0 Ease of Living: Livable, Inclusive, and Future Ready Cities

The government has been working to ensure necessities for all citizens of the country through various programs and schemes for holistic welfare of the poor and marginalized sections of society. This is reflected in ideals of “Sabka Saath, Sabka Vikas, Sabka Vishwas, Sabka Prayaas” to build an equitable nation.

The 'Ease of Living Index 2020' ranks Ludhiana at 14th and Amritsar at 45th position in the category of million + cities, while Jalandhar city ranked 32nd of 62 cities in the category of cities with fewer than one million people.

The Punjab Government has started the Divyangjan Shaktikaran Yojana (Punjab Disability Empowerment Scheme) for the empowerment of differently abled people who constitute about 2 percent of the total population of Punjab. The scheme also ensures four percent job reservation for persons with disabilities.

Rs. 825 crores are allocated in FY 2021-22 for providing nutrition under the Integrated Child Development Scheme and Rs.4,000 crores towards pension schemes for the elderly, widows, orphans and disabled.

3.1 Smart Cities

The three cities of Amritsar, Jalandhar, and Ludhiana from Punjab are chosen for development as "Smart Cities" under Smart City Mission of India which aims to develop 100 smart cities in India. There are 11 smart projects in Amritsar for Rs 3385 crore, 19 projects in Jalandhar costing Rs 1899 crore, and 19 projects worth Rs 1898 crore. These projects include building "Integrated Smart City Centers", "Smart Roads", and other elements. In Ludhiana, the first phase of the integrated command and control center has been finished which will reduce traffic congestion, expand open space, and enhance public facilities after completion. Sultanpur Lodhi is also being developed on the lines of smart cities.

3.2 Social Infrastructure

Punjab has performed well in both the health and education sectors, which is dependent on the public and private sector.

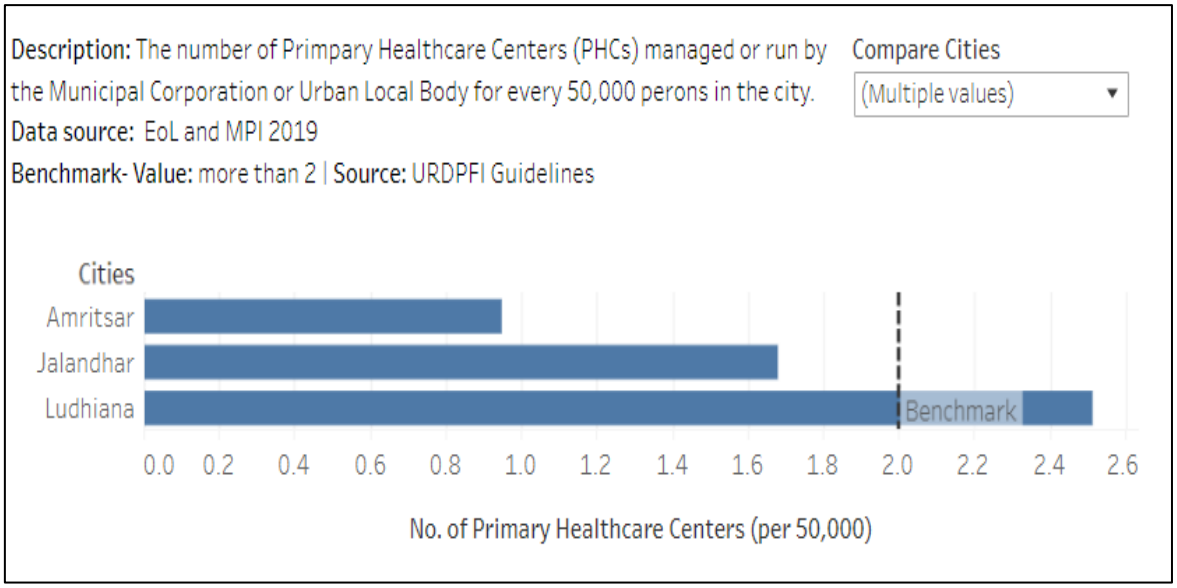


Figure 1: Number of Primary Healthcare centers managed by Municipal corporations for every 50,000 people in the city

Fig 2 reflected that Amritsar and Jalandhar recorded a considerable number of dengue and cholera cases in 2018 as per the ITC dashboard of the Ministry of Housing and Urban Development.

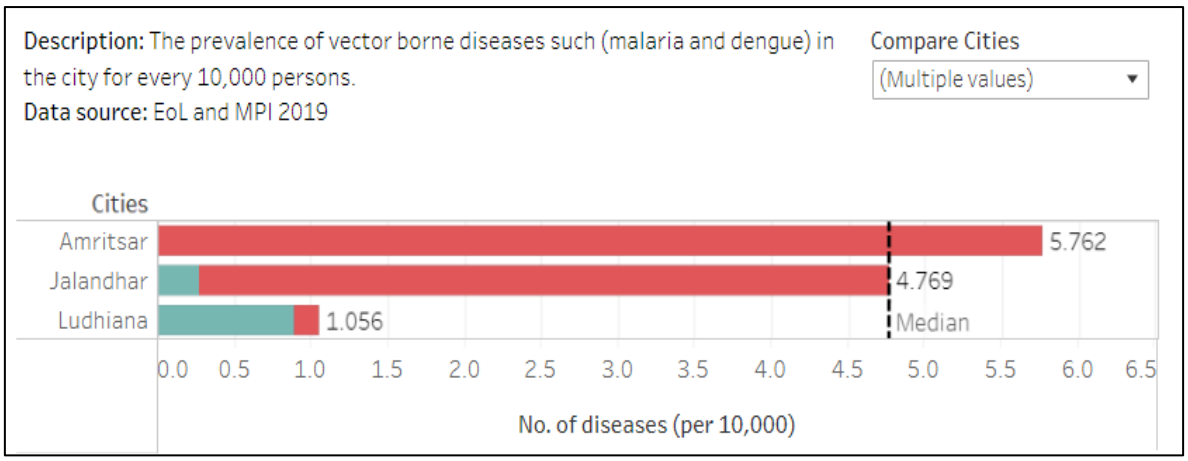


Figure 2: The prevalence of Vector borne disease in a city for every 10,000 persons

3.3 Heritage and Culture

Punjab has been actively developing tourist and heritage sites lately even as its heritage potential remained mostly untapped in previous development plans. The Punjab Heritage and Tourism Promotion Board established under the Infrastructure Development & Investment Program for Tourism funded by the Asian Development Bank has identified various sites for the development of tourist infrastructure. The Pilgrimage Rejuvenation and Spiritual Augmentation Drive (PRASAD) and National Heritage City Development and Augmentation Yojana (HRIDAY) have been helpful in developing and protecting the heritage structures across the State.

Punjab Directorate of Cultural Affairs, Archaeology, and Museums under took conservation works on 23 State monuments under the 13th FC at an approximate cost of Rs 100 crores. Many of the projects are near completion, and several monuments have been modified for use. Additionally, Amritsar executed heritage projects totaling Rs 61 crore under HRIDAY, including projects to upgrade the Maharaja Ranjit Singh Panorama, Golbagh, and Rambagh Gardens. Further, as per the Ancient Monuments and Archaeological Sites and Remains Act (or AMASR Act) there are 61 protected monuments and heritage sites in Punjab.

Punjab is taking a lot of initiatives for preserving its rich Heritage & Culture by doing several activities involving the development of the Tourist & Heritage Sites, along with beautification & re-development of various forts, buildings, and monuments, etc. Punjab Heritage & Tourism Promotion Board (PHTPB) established under the

Department of Tourism & Cultural Affairs; Punjab has identified various sites for the re-development of tourism infrastructure. Ministry of Tourism, Govt. of India (MoT, GoI) is also extending its support to Punjab by its centrally funded schemes like Swadesh Darshan Scheme and The Pilgrimage Rejuvenation and Spiritual Augmentation Drive (PRASAD) for the purpose of developing and protecting the heritage structures across the State.

In Swadesh Darshan 1.0, from Punjab only one destination has been taken into consideration for development i.e., Amritsar. Nonetheless, PHTPB has executed 36 Projects under the Swadesh Darshan Scheme 1.0 with the budget's estimation of Rs. 82.63 Cr., out of which expenditure till 30-09-2022 is Rs. 52.46 Cr. 13 New works/projects have been started from savings. The works under this scheme have been mostly completed and remaining works are at advanced stage of completion. In Swadesh Darshan 2.0, Punjab Tourism has nominated 05 destinations (Amritsar, Anandpur Sahib & Nangal, Kapurthala, Patiala and Rupnagar) to MoT, GoI out of which 02 Destinations i.e., Amritsar & Kapurthala has been shortlisted by MoT, GoI.

Prasad Scheme was launched in year 2014-15 by MoT, GoI, under which the town of Sri Chamkaur Sahib in Punjab was chosen for infrastructural development owing to its historical & religion background. Several activities like Development of Tourism Infrastructure at Gurudwara Katalgarh Sahib, Dastaan-e-Shahadat, etc., and many others are carried out under the said scheme.

In addition to the above mentioned projects/works going on under the PRASAD & Swadesh Darshan Scheme, there are also some other important projects/works being done by the department which are as follow:

(i) Construction, conservation, restoration and operation and maintenance of various museums/memorials/monuments in the State of Punjab during 2022-23, for which Rs. 60.00 Cr has been allocated by the State.

(ii) The major projects include Sri Guru Ravidas Memorial at Khuralgarh, Development of State-of-the-art PANORAMA at the Bhagwan Valmiki Ram Tirath Sthal Complex, conservation of Fort at Rampura Phul, construction of Bhai Jaita Ji Memorial at Anandpur Sahib, landscaping works on 62 Acre land at Virasat-e-

Khalsa complex at Sri Anandpur Sahib, upgradation of Shaheed-e-Azam Bhagat Singh Museum at Khatkar Kalan.

(iii) Government of Punjab and Himachal Pradesh have entered into a MoU to jointly develop a ropeway connecting Sri Anandpur Sahib, Punjab and Sri Naina Devi Ji, Himachal Pradesh on PPP basis to connect the two pilgrim towns.

(iv) The State Government is also bidding out an approved site at Ranjit Sagar Dam on Ravi for developing leisure and adventure tourism facilities.

(v) There are many historical properties that are being taken up for adaptive reuse after conversation and restoration as heritage hotels and for other uses by the community.

Disaster Management:

The High-Powered Committee (HPC) of the Government of India has identified 33 hazards, of which Punjab is vulnerable to 21 hazards. Currently, a District Disaster Management Plan has been prepared for 10 districts out of 23 i.e., Amritsar, Patiala, Barnala, Ferozepur, Bathinda, Hoshiarpur, SAS Nagar, Sangrur, Shahid Bhagat Singh Nagar, and Sri Muktsar Sahib.[5]

4.0 Urban Environment, Physical Infrastructure and Climate Resilience

4.1 Power supply

The power is essential to all economic activities. It is crucial for domestic illumination as well as for the expansion of commerce, industry, and agriculture. Punjab has combined thermal and hydel resources. In terms of per capita energy usage, access to power has improved, from 1466 KWH to 1552 KWH between 2016–17 and 2017–18.

4.2 Water supply

Water is essential for maintaining all types of life on earth. With the help of 8669 groundwater and 922 canal-based water delivery projects, the Department of Water Supply and Sanitation, Punjab, can provide potable water to 15,024 habitations. The DWSS officially published its first Annual Water Quality Report in 2018, which details the

[5] State Disaster Management Plan Punjab. (2015). Department of Revenue, Rehabilitation and Disaster Management. GOI.

water quality status, which states that out of 15,024 habitations, 2,989 habitations are subjected to receiving contaminated water.

4.3 Solid waste management

According to a study conducted by TERI in 2015, Punjab was expected to generate 3802.6 TPD of solid waste by 2021, increasing to 4992.5 TPD in 2013 and further to 6366.8 TPD by 2041 (see Table 4 in Annexure). Against this, according to official sources (Dept. of Local Government, GoP) total solid waste generation in the state stands at 4100 TPD till Nov 2022.

All Urban Local Bodies in the state are managing their solid, plastic and construction & demolition waste as per provisions of the Solid Waste Management Rules, 2016, Plastic Waste Management Rules 2016 as amended from time to time and Construction & Demolition Waste Management Rules, 2016. In compliance of Rules and orders of Hon'ble National Green Tribunal, ULBs are managing their waste in decentralized manner to save unnecessary transportation cost and environment impacts.

Accordingly, the requisite infrastructure for door-to-door waste collection & transportation (i.e., manual & mechanized vehicles with facilities of segregated collection of wet & dry waste) and processing of waste (compost units, material recovery facilities) have been set up by the ULBs.

At present, 99% of urban households have been covered under door to door waste collection, 84% households have been covered under segregation of waste at source and around 74% waste is being processed through aerobic composting. This is planned to be augmented to 100% by December 2023. The state is taking various initiatives like constructing honeycomb aerobic compost plants in addition to big capacity plants, parks, green belts for on-site composting, material recovery facilities etc to ensure that solid waste is managed well in the State. In addition, the Department of Local Government plans to remediate all 152 legacy waste dumpsites by March 2024. As on date, 41 ULBs have already remediated the legacy waste and remediation of waste is under process in 102 ULBs.

Short-term Strategies: 2030

Preparation of Development Plans: Perspective Regional Plan

In view of rapid urbanization, the state to develop Perspective Regional Plan/s to promote seamless spatial development of rural and urban land settlements.

- The regional plan/s will bridge the gap in the urban-rural continuum by planning congruently for the development of urban and rural areas in convergence with the Shyama Prasad Mukherji Rurban Mission.
- Most of the urban development is concentrated in the peri-urban areas of Mohali, namely Kharar, Zirakpur, and Dera Bassi, with intrastate as well as inter-State migration. The regional plans, GMADA have already been notified for these peri-urban areas of Mohali. Regional plans for other potential areas shall be prepared aiming not only to regulate future urban growth, but also to address the issue of affordable housing and provision of basic services in prevailing peri-urban areas or census towns.
- All major urban agglomerations to have Master Plans or City Development Plans aligned with the Sustainable Development Goals. The urban land-based planning will be on a GIS platform in view of its efficacy in cohering information towards the resolution of urban complexity. These plans would also target to achieve a high score on the ease of living indicators.

Housing: Slum enumeration and decentralized strategy

The growth and development of urban areas has resulted into an increasing influx of migrant population from the immediate hinterland as well as from the distant areas. Many unauthorized slums have come up on Government lands over the past few decades. For sustainable growth of the cities, management of slums in urban areas of the state is a major concern. Multi-pronged efforts are required to improve the quality of life of the slum dwellers and for the all-round development of the city/town in which they are situated.

To solve this problem, state Government has already notified the Punjab Slum Dwellers (Proprietary Rights) Act 2020 and Punjab Slum Dwellers (Proprietary Rights) Rules, 2020.

To implement the said rules, the Department of Local Government, Punjab has also prepared 'BASERA - Chief Minister's Slum Development Programme' which outlines the guiding framework for the Urban Local Bodies (ULBs) to implement the Act, supported by The Punjab Management and Transfer of Municipal Properties Act, 2020.

BASERA lays the foundation for creating an urban environment that fosters a dignified quality of life for the slum dwellers and is a progressive and inclusive step towards extending affordable housing to all. BASERA aims to realize the goal of “Slum free Punjab”, with inclusive and equitable cities in which every citizen has access to basic civic services, social amenities, and decent shelter.

The scheme will be implemented for period of five years 2020-2025 in two phases: -

a) The Phase I for a period of 12 months from the date of launch, focused on undertaking geo-spatial and primary household surveys in slums on the state government land, updating the spatial and textual records based on the survey, tenability analysis of slums in Punjab and conferring proprietary rights to the eligible slum dwellers across the state. Additionally, select districts were identified to undertake pilots for comprehensive slum up-gradation based on which relevant SOPs for slum up-gradation and delisting was drawn.

b) The Phase II till 2025: will focus on comprehensive up- gradation of basic civic infrastructure in slums across all the urban towns and cities in Punjab and delist them upon upgradation. Efforts initiated for slum up-gradation and delisting in pilot slums during Phase I will be scaled up across the state based on SOPs issued post testing their applicability.

   Initially, 55 slums and 12000 households have been approved for the grant of Proprietary Rights by the Empowered Committee and the Steering Committee, out of which around 9700 Proprietary Rights have been distributed.

Ease of doing business: Streaming of approvals system

The existing process of licensing and approval for undertaking housing and infrastructure works is a cumbersome, time-consuming and expensive process that

leads to delays and financial losses. The existing process have to be revamped to overcome the following limitations:

a. The existing process of sequential approvals/NOCs and their suggestive interdependence often results in approaching multiple departments many times.

b. Non-adherence to the defined timelines for the approvals

c. The NOCs issued by various departments such as Water Supply and Sewerage Board and Urban Development authorities etc. are issued in isolation to the applicant, and the copy of the same is not shared for information with other related departments.

d. Approvals are not categorized as sequential and parallel activities to ensure the most efficient process.

e. The Absence of a nodal agency to oversee the coordination between various departments.

All these factors should be critically evaluated, and measures to maximize efficiencies may also consider single window, time-bound automated system.

Regularization of 'Lal Dora' lands

It is recommended that a comprehensive policy be framed for 'Lal Dora' land in urban areas of Punjab with a view to regularizing and regulate such land for formal housing. A committee led by the Revenue Department with representatives from the Directorate of Urban Local Bodies (DULB) and respective ULBs is required to be constituted to undertake this exercise.

Rental accommodation for construction/ migrant workers

It is recommended that across-subsidization-based community or individual-based rental housing scheme be worked out for the migrants, disabled, old and infirm, and other disadvantaged groups who have no means to support themselves. This could be alternately explored through schemes with a commercial component that pays for the subsidized residential units etc. Again, proposals could be invited from public agencies through the adoption of the Swiss Challenge as a method.

For housing of the construction workers, Housing Board or Slum Development Board may be assigned the responsibility to provide suitable shelters at places with good connectivity to construction sites. Also, the cess money of construction workers could be used to provide proper rental housing shelters to construction workers. Land costs and external services like transport connectivity to construction sites can be borne as a state-Supported Social Security Activity. The rentals should simply cover the operating maintenance costs. Similar arrangements may be considered to provide shelter to the migrant workers in rural areas and homeless people.

Utility services infrastructure and common infrastructure

- Establishing service level benchmarks for the provision of sustainable urban infrastructure including electricity, water supply, sewerage, waste collection, etc. The thrust is to consider a decentralized approach for small/ medium settlements and a combination of large-scale and local solutions for the larger settlements.

Public transportation and mobility

Developing a comprehensive mobility program integrating all modes of transportation for de-congestion of the cities; and to facilitate mobility of daily commuters from peri-urban, and rural areas to cities and towns. This exercise to be undertaken considering the projected demands for the next 25 years.

- Evolve an urban transport strategy to reduce travel time, overcome unpredictability and reduce the cost of travel. An integrated approach would be taken while considering the road and transport needs of different sections of people like the elderly, women, children, and disabled who will be commuting for different reasons like work, education, health, and recreation.
- To encourage and incentivize for shifting towards environment-friendly travel habits to reduce pollution levels like promoting usage of small cars, two-wheelers, bicycles or car-pooling and public transport.
- State to enact strong regulations, enforcement of rules, and promote technological advancements to make cities pollution-free and safe with minimal road accidents.

Providing robust social infrastructure

- Develop 'Urban Greening Guidelines' for implementation. Providing adequate public green spaces, parks, and walkways apart from being useful for inhabitants also contribute to reducing environmental pollution and climate change.
- In view of concerns related to water shortage and developing water resilience, the state to frame a policy for water management in urban areas.

Long-term Strategies: 2047

The state to prepare Master Plan/ Zonal Plans/ Local Area Plans/ Infrastructure Plans for all planning units based on GIS platform. The state to develop a municipal cadre for urban governance.

- GIS Mapping of green spaces, slums, and diverse use zones to comprehensively identify and creatively develop interstitial spaces within the cities. This would also include mapping of slums/ informal spaces along with formally planned precincts.
- Development of technology-driven solutions to address urban challenges like air/ water pollution, traffic congestion, and parking, safety and security, equitable availability of social and physical infrastructural services like electricity, water, sanitation, civic spaces, and open greens, health and education facilities, etc. in accordance with accepted service level benchmarks.
- Regional level plans would consider mitigation of negative consequences of climate change by including detailed recommendations for the construction of green buildings, sustainable transportation, and urban water management.
- Principles of a circular economy to be followed while formulating strategy for reducing and recycling waste gainfully on a regional/ city level. Solid waste and sewage water from cities would be treated and reused to prevent soil toxicity, and air and water pollution. It would be ensured that no untreated waste either flows into water bodies or is dumped in open spaces.
- The framework of existing digitalized services for the marginalized sections of society to be expanded by adding more services to offerings. In addition, the services would

be available in the regional language to increase their efficacy, and also rationalize user charges.

- In view of the fast-deteriorating environmental conditions and frequent natural disasters of varying scales, modern forecasting and early warning systems in the state would be supported by Information Technology (IT) and Communications for quick response and reliability in case of disasters.
- State to develop MRTS in all major cities to de-congest the cities, provide connectivity to neighboring areas, and increase institutional and human resources for an integrated sustainable urban transportation system to meet the demands of all the urban transportation. The pedestrian facilities to be strengthened and the infrastructure needs to be built for accessible roads and streets for the physically-challenged.
- To ensure a major thrust on the provision of equitable social infrastructure for ease of living in urban areas. This would involve construction of community centers, libraries, and places of recreation and social interaction to deal with the issues of loneliness, anxiety, and depression which affect the well-being of urban inhabitants including youth as well as the elderly.

Annexure-I

Table 1:
Percentage of the Urban population in Punjab

Year	Percentage of Urban population	
	Punjab	India
1951	21.0	17.2
1961	22.0	17.9
1971	23.7	19.4
1981	26.1	23.3
1991	29.7	25.7
2001	33.9	27.7
2011	37.4	31.8

Source: Census of India, 2011

Table 2:
Number and the Classification of the cities in Punjab

Year	Class I	Class II	Class III	Class IV	Class V	Class VI	Total
1951	3	2	17	20	36	32	110
1961	4	5	23	20	35	19	106
1971	1	8	22	31	29	11	102
1981	7	10	27	36	40	14	134
1991	10	18	25	46	14	7	120
2001	14	19	35	54	28	7	157
2011	17	23	49	60	50	18	217

Source: Census of India, 2011

Table 3:
District- wise Class- I, II, III and Nagar Panchayats in the State of Punjab

District/ADC (UD)	Municipal Corporations/ Municipal Councils/ Nagar Panchayats				
	Corporation	**Class- I**	**Class- II**	**Class- III**	**Nagar Panchayats**
1. Amritsar	1. Amritsar	-	1. Jandiala Guru	1. Majitha 2. Ramdass	1. Ajnala 2. Baba Bakala Shaib (Newly constituted on 04-08-2021) 3. Raja Sansi 4. Rayya
2. Gurdaspur	2. Batala	1. Gurdaspur	1. Dhariwal 2. Dinanagar	1. Dera Baba Nanak 2. Fatehgarh Churian 3. Qadian 4. Sri Hargobindpur	-
3. Pathankot	3. Pathankot	-	1. Sujanpur	-	1. Narot Jaimal Singh
4. Tarn Taran	-	-	1. Patti 2. Tarn Taran	-	1. Bhikhiwind 2. Kehmkaran
5. Bathinda	4. Bathinda	-	1. Bhucho Mandi 2. Goniana 3. Maur 4. Raman 5. Rampura Phul 6. Talwandi Sabo (06-09-2021)	1. Kotfatta 2. Sangat	1. Bhagta Bhai Ka 2. Bhai Rupa 3. Kotha Guru 4. Kot Shamir 5. Lehra Mohabbat 6. Maluka 7. Mehraj 8. Nathana
6. Mansa	-	1. Mansa	1. Budhlada	1. Bareta	1. Bhikhi 2. Boha 3. Joga 4. Sardulgarh
7. Sri Muktsar Sahib	-	1. Malout 2. Muktsar	1. Gidderbaha	-	1. Bariwala

District/ADC (UD)	Municipal Corporations/ Municipal Councils/ Nagar Panchayats				
	Corporation	**Class- I**	**Class- II**	**Class- III**	**Nagar Panchayats**
8. Faridkot	-	1. Faridkot 2. Kotkapura	1. Jaitu	-	-
9. Fazilka	5. Abohar	1. Fazilka	1. Jalalabad	-	1. Arniwala Sheikh Subhan
10. Ferozepur	-	1. Ferozpur	1. Guru Har Sahai 2. Talwandi Bhai 3. Zira	-	1. Makhu 2. Mallanwala Khas 3. Mamdot 4. Mudki
11. Moga	6. Moga	-	1. Bagha Purana 2. Dharamkot	-	1. Badhni Kalan 2. Kot Ise Khan 3. Nihal Singh Wala 4. Fatehgarh Panjtoor
12. Hoshiarpur	7. Hoshiarpur	-	1. Dasuya 2. Garh Shankar 3. Mukerian 4. Urmur Tanda 5.Talwara (13-12-2021)	1. Garhdiwala 2. Hariana 3. Sham Churasi	1. Mahilpur
13. Jalandhar	8. Jalandhar	1. Nakodar	1. Adampur 2. Bhogpur 3. Kartarpur 4. Nurmahal 5. Phillaur 6. Goraya	1. Alawalpur	1. Lohian Khas 2. Mehatpur 3. Shahkot 4. Bilga
14. Kapurthala	9. Kapurthala 10. Phagwara		1. Sultanpur Lodhi	-	1. Begowal 2. Bhulath 3. Dhilwan 4. Nadala
15. Shaheed Bhagat Singh Nagar	-	1. Nawan Shahar	1. Banga	1. Balachaur 2. Rahon	-
16. Fatehgarh Sahib	-	1. Gobindgarh	1. Sirhind- Fatehgarh Sahib 2. Bassi Pathana (30.12-2021)	1. Amloh	1. Khamano

District/ADC (UD)	Municipal Corporations/ Municipal Councils/ Nagar Panchayats				
	Corporation	**Class- I**	**Class- II**	**Class- III**	**Nagar Panchayats**
17. Ludhiana	11. Ludhiana	1. Jagaon 2. Khanna	1. Doraha 2. Mullanpur Dhakha 3. Raikot 4. Sahnewal 5. Samrala	1. Machhiwara 2. Payal	1. Maloud
18. Roop Nagar	-	1. Nangal 2. Anandpur Sahib 3. Roop Nagar (21-08-2021)	1. Morinda 2. Chamkaur Sahib (23-12-2021)	-	1. Kiratpur Sahib
19. Barnala	-	1. Barnala	-	1. Bhadaur 2. Dhanaula 3. Tapa	1. Handiaya
20. Patiala	12. Patiala	1. Nabha 2. Rajpura 3. Samana	1. Patran	1. Sanaur	1. Bhadson 2. Ghagga 3. Ghanaur 4. Devigarh (Newly Constituted on 31.12.2021)
21. Sangrur	-	1. Sangrur 2. Sunam	1. Dhuri 2. Lehragagga 3. Bhawanigarh	1. Longowal	1. Cheema 2. Dirba 3. Khanauri 4. Moonak
22. S.A.S Nagar	13. S.A.S Nagar	1. Dera Bassi 2. Kharar 3. Zirakpur 4. Lalru	1. Kurali 2. Nayan Gaon 3. Banur	-	1. Gharuan (Newly Constituted on 10.12.2021)
23. Malerkotla	-	1. Malerkotla	1. Ahmedgarh	-	1. Amargarh
Districts/ADC (UD) 23	**M. Corps 13**	**Class- I 27**	**Class- II 51**	**Class- III 23**	**Nagar Panchayats- 52 13 M. Corp + 153 M.C. & N.P Total= (166)**

Table 4:
Per capita waste generated, and Total waste generated

Year	Per capita waste generated (KG/Day)	Urban Population (X1000)	Waste generated (T/day)
2011	0.276	10119.61	2793.5
2021	0.315	12070.35	3802.6
2031	0.359	13885.88	4992.5
2041	0.410	15516.66	6366.8

Source: "Industrial and urban waste management in Punjab, Teri 2015."

Table 5:
Schemes for urban Development: Grants released by FD 2019-20 (Rs in lakhs)

Schemes	CS	SS	Total
Atal Mission for rejuvenation and urban transformation (AMRUT)	14300	12347	26647
Urban infrastructure and governance(UIG) JNNURM	0	7369.15	7369.15
Mission for Development of 100 smart cities	5800	5800	11600
Swachh Bharat Mission (urban)	2869.20	5179.80	8049
Holding of musical and cultural festivals, heritage melas, seminars, and conferences	500	0	500
Funds for maintenance and development of Amritsar culture and tourism development authority	500	0	500
Heritage grant for restoration conservation of Quila Mubarak Patiala and Bathinda fort	250	0	250
To implement the Punjab State cultural and heritage policy -2017	10	0	10
100 years centenary celebrations to commemorate Jallianwala Bagh martyrs	300	0	300
Pradhan Mantri Awas Yojana – Housing for All	397.2	158.40	555.60
PMAY-Insitu Slum redevelopment vertical –i	0	2000	2000
PMAY- Beneficiary led construction vertical –iv	0	20000	20000
PMAY-preparation of action plan and establishment of technical cell	175	700	875
Consolidated project proposal for flood protection works along Indo-Pak border (RMABA)	0	660.60	660.60
Houses for Houseless (urban)	1	0	1
Pradhan Mantri Awas Yojana (G)	3471.04	0	3471.04
Construction of New Bus stand at Sirhind	650	0	650
Provision/Augmentation of water supply and sewerage facilities in specific towns	1500	0	1500

PUNJAB VISION 2047

Indicator	Current Status/ Baseline	Target/s 2030	Target/s 2047	Strategies
HOUSING				Slums constitute 14.04 of the urban population but vary from 1.05% to 69.27% share in different towns. The urban and slum population has grown sharply. In many towns slums have not been identified and notified effecting supply of basic facilities. Besides lack of infrastructure and basic amenities can include majority of class-II to Class-V towns as slums. Basera- Chief Minister's Slum Development Programme being implemented in a phased manner from 2020-2025.
• Slum and informal settlements		100% coverage of all Class II towns	100% coverage of all towns of the State	
–Percentage of population in slums	5.26 (2011)			
– Housing shortage	9,74,892 (2011)			
– Water Supply population covered	86%	100% coverage of all Class II towns	100% coverage of all towns of the State	Programmes to achieve targets - BUSP, AMRUT and JICA,
– Sewerage – Population covered – Sewerage treatment percent treated	60% 40%	100% coverage of all Class II towns	100% coverage of all towns of the State	Swachh Bharat, Punjab Urban Development Mission Scheme
– Close Drainage		100% coverage of all Class II towns	100% coverage of all towns of the State	Swachh Bharat,
– Storm water drainage (Road coverage)	5-15%			
– Solid waste management percent Managed	15%	100% coverage of all Class II towns	100% coverage of all towns of the State	Punjab Urban Development Mission Scheme
– Parks and open spaces	1.2 Sq.km against 9 Sq.km			

Indicator	Current Status/ Baseline	Target/s 2030	Target/s 2047	Strategies
SLUM UPGRADING				Programmes to achieve targets
– Water supply		100% coverage of all Class II towns	100% coverage of all towns of the State	BUSP, AMRUT and IHDSP
– Sewerage system		100% coverage of all Class II towns	100% coverage of all towns of the State	BUSP, AMRUT and IHDSP
– Closed drainage		100% coverage of all Class II towns	100% coverage of all towns of the State	BUSP, AMRUT and IHDSP
– LPG		100% coverage of all Class II towns	100% coverage of all towns of the State	BUSP, AMRUT and IHDSP
ROAD SAFETY				
• All-weather roads – Percentage access within km to road – Vehicular congestion (vehicles/lane km) – Transport • Share of public transport	170 (norm 112) 20 against a basic of 50			Increase the share of the public transportation Increase the ridership percentage of public transportation
HERITAGE PROTECTION				
Risk Reduction • Capital projects for controlling floods – Expenditure on river bank construction – Community participation in tree plantation on river bunds/banks. – Preservation of cultural and natural heritage	51.28 crore			Religious and cultural cities/centers/sites to be identified and site-specific preservation and risks to be mapped. Promotion of heritage/tourism to be part of plan to safeguard monuments and settlements.
Master Planning	41/81		100% coverage of all towns of the State	PUDA, Digital Punjab, AMRUT

Indicator	Current Status/ Baseline	Target/s 2030	Target/s 2047	Strategies
Regional Planning			100% coverage of all towns of the State	PUDA, Digital Punjab, AMRUT
GIS Mapping of all Punjab cities	22/81		100% coverage of all towns of the State	PUDA, Digital Punjab, AMRUT
Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage	393 crores spent in 2021 on tourism and culture			National Heritage City Development and Augmentation Yojana (HRIDAY) Pilgrimage Rejuvenation and Spiritual Augmentation Drive (PRASAD) Swadesh Darshan, for the development of different wetlands and protected areas. Punjab State cultural heritage policy 2017 Punjab Eco-Tourism Policy, 2009 Heritage Circuit under Swadesh Darshan Ancient Monuments and Archaeological Sites and Remains Act
Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	37(2010)		Making all citizens resilient to disasters	Strengthening of existing State disaster management plan and making district State disaster management plan for all districts
Direct economic loss attributed to disasters in relation to Gross Domestic Product (GDP)	Rs. 279475000(2009)			
Damage to critical infrastructure and (b) number of disruptions to basic services, attributed to disasters	(a)5967476 buildings are vulnerable to disaster (2006)		Making all buildings resilient to disasters	
Urban Greening	4 cities		100% coverage of all towns of the State	Identified Nagar Van Scheme, by The Ministry of Environment, Forest and Climate Change (MoEFCC)

SECTION V

SOCIAL

I. Ensuring Inclusive and Equitable Quality Education

II. Health Infrastructure and Provisioning

I
ENSURING INCLUSIVE AND EQUITABLE QUALITY EDUCATION

Education is geared towards building capacities amongst citizens for sustainable and inclusive growth across communities, and marginalised groups such as scheduled castes, women, and religious minorities. The National Education Policy 2020 envisions an education system to be rooted in the Indian ethos that directly contributes to sustainability for an equitable and vibrant knowledge society by providing quality education to all.

Punjab has displayed considerable effort over the past two decades to improve the quality of education and transform its education landscape – a few proof points include a sharp increase in the number of schools, a reduction in drop-out rates, a focus on computer literacy etc. All these initiatives have resulted in the state emerging as a lighthouse in education – for example, Punjab's Level 2 position in the Performance Grading Index (both 2020 and 21), as well as in the National Achievement Survey 2021 - where it significantly improved its performance from the previous years. The India Innovation Index 2021 presents state-wise rankings based on the innovation landscape and performance of the country's states and union territories. Among the major states, Punjab ranks six (6) all over the country with a score of 15.35 on the Innovation Index. While there is a continuous upward trajectory, there is still scope for further improvement in terms of improving learning outcomes, building faith in the public schooling system, and improving the secondary education enrolment rate. In addition, the introduction of NEP and global/ national trends impacting the education landscape call for a need to revisit and realign our priorities in the education system. As the country moves towards the centenary jubilee of Independence, the Government of India and its Planning Department flagged a collective action to define Vision 2047.

The vision of the policy is to instil among learners a deep-rooted pride in being Indian, not only in thought but also in spirit, intellect, and deeds, as well as to develop knowledge and skills, being conscious about fundamental duties, constitutional values and dispositions that support responsible commitment to human rights, sustainable development and global well-being thereby reflecting a truly global citizen.

Current Status of School Education

Since the implementation of SSA, Punjab has seen significant improvement in terms of the number of children enrolling in school, the rates at which they transit between grades, and the proportion of students who drop out during the course of their schooling. Punjab has been very proactive in addressing the issues of access, equity, and quality in school education. Efforts are made to bring the children to school and achieve grade-level competencies in them. Various indicators have shown improvement over the year because of the sustainable efforts of the state.

Enrolment Ratios

Punjab has achieved the GER (Gross Enrolment Ratio) target of 100% in primary and in upper primary. The state has seen an improvement in its GER at the higher secondary level as in 2020-21, the GER was 77.8% which increased to 82.02% in 2021-22. Further, Punjab's NER (Net Enrolment Ratio) is above the national average. (Table 1)

Gender-wise, the GER in the case of girls is quite at par with the rates of GER in the case of boys at all stages. GER in the case of SC students (boys and girls) is quite similar to that of all groups up to Upper Primary classes. However, at the Secondary and Higher Secondary stage, there is a marginal difference in GER, showing slightly lower rates of GER in SC category students.

Drop-out Rate

Drop-out rates measure the proportion of students failing to complete a particular level of education or not enrolling for the next level of schooling or education. Punjab has a drop-out rate of 1.31% at the Primary level indicating the success of Punjab state at this stage. The dropout rate progressively increases in higher grades with as high as 17.24% for Secondary level and 12.53% for Higher Secondary. (Table 1)

Transition Rate

According to transition rates in Punjab, most students progress to the next level of education in the state. As of 2021-22, the transition rate stood at 96.10% for primary to upper primary and 79.32% for secondary to higher secondary. Comparison with the national average indicates that Punjab's performance on these indicators is relatively

better (refer to table 1). However, Punjab has a low transition rate when we compare the transition rates with the neighbouring states of Haryana, Himachal Pradesh, and Delhi. The difference is quite large at secondary to higher secondary levels, which is an area of concern.

The Retention Rate

At the primary and elementary stages is 100%. It is almost 81.3% at the secondary stage and 64.5% at the higher secondary stage. However, as compared to India, the Retention Rate in the case of students of Punjab at all stages of education is higher.

Student migration

Extensive student migration– Between 2016 & 2021, one in 33 Punjabis emigrated from India. In absolute percentages, this is lower than in Kerala (6%). However, 38% of immigrants from Punjab were on a student visa – with the same accounting for only 5% in the case of Kerala. This results in low uptake of secondary and higher education.

KEY INITIATIVES

- **Smart School Project**: Smart School Policy has been notified by the Department on 25th October 2019. The main features of the policy are Sharing Pattern (40:60), where school commits to contribute 60% of the total required funds for developing the school into a smart school and the rest of the funds i.e 40% would be provided by the Department. So far 14976 schools out of 19173 have been converted into smart schools with state funds. Now the department is working on the concept of converting Smart schools into Super Smart schools.
    - **Parameters**: Smart Classroom, coloured coordinated buildings, Building As Learning Aid (BALA) Work, landscaping, CCTV cameras, green board/whiteboard, furniture for all students, and lecture stands for students and teachers. Well-equipped laboratories, Display of Board of Honours in the school for both staff and students, and other prominent infrastructural amenities and facilities.
- **Pre-Primary Schooling**: As of 2022-23, approximately 3.51 lakh students are enrolled in schools in pre-primary sections. The state has also focused on ensuring quality with quantity. Several initiatives have been taken to enhance the teaching

and learning in pre-primary sections such as child-friendly material, E-content to create higher engagement in students, training for pre-primary teachers and school head teachers, and different types of supplementary material for skill development.

- **Community Engagement**: The activities were conducted for parents of Pre-Primary children includes *Mothers' Workshop*, *Graduators Ceremony*, and *Mega PTM* to to enable strong partnerships between parents and teachers by welcoming parents into school.
- **Mission 100 %**: The prime aim is to improve the performance of students of classes 8^{th}, 10^{th}, and 12^{th} in the forthcoming examinations of Punjab School Education Board. The programme has been run in mission mode and in a systematic, planned, and time-bound manner by putting in place support like data analysis, sorting learning gaps, and providing remedial material.
- **Welcome Life**: The new subject 'Welcome Life' is introduced in all classes from 1st to 12th to inculcate values like ethics, positive attitude, gender equality, etc. through stories, activities, mind maps, situation-based questions, and role plays.
- **Setting up of Schools of Eminence:** It aims to re-imagine education in Government schools with state-of-the-art infrastructure, for the holistic development of children and for preparing them to be responsible 21^{st} century citizens. These schools will be learning spaces for children to imbibe knowledge and grow in a safe and joyful environment. These schools will nurture their intrinsic curiosity, and contribute to their physical, cognitive, social, and emotional development, leading to holistic development.
- Initiatives such as International Education Affairs Cell (IEAC), Young Entrepreneur Programme Scheme, and Foreign Teacher Training on government expenses have been announced to enhance the quality education and to provide students with real-world entrepreneurship experience.

Learning Outcomes

The state has emerged as a front-runner in the NITI Aayog SDG Index 2020-2021 with a composite score of 68 and a score of 60 in SDG 4 (Quality Education). Regarding reporting the learning outcomes of students of Punjab in Grades 3, 5, and 8, the primary

sources referred to in the document are the National Achievement Survey (NAS) 2021, the Foundational Learning Survey (FLS) 2022 (both conducted by NCERT, GOI).

The overall situation of accessibility to education in the case of all categories of children in all schools has improved. The data reported in Table 1 (Annexure) indicates there is gender parity with respect to the enrolment ratio of boys and girls at all stages of school education. It requires short-term and long-term strategies to frequently revise the curriculum of secondary and higher education, vocational training, and also skill upgradation to meet the production demands of the industry and global market; and invest in Universities to produce graduates and researchers to enable them to address global challenges through creative thinking and problem-solving.

Quality Education for All

There are standalone Primary Schools (Class I – V) which constitute 78% of all Primary Classes and 93% of all standalone Primary Schools in Punjab. Only 7% of Primary Schools are in the Aided and Unaided Schools category. Similarly, there are four Aided and Unaided Schools with only three classes (6-8) and three schools with two classes (9-10), and three schools with three (9-12) classes. Similarly, in terms of composite school classes (1-10), there are 2,446 schools, of which 2,375 are Unaided Schools. Out of 2,938 Schools with (1-12) classes, there are 2,814 schools in Aided and Unaided categories (Source UDISE+, 2021-2022). So, the concept of a common school system that requires teaching and learning resources and physical infrastructure in the present scenario is thinly distributed, leading to the higher unit cost. So, a vision of quality education for all will take another 25 years.

In NEP 2020, it is recorded that over 85% of child's cumulative brain development takes place before the age of six, indicating the critical importance of appropriate care and stimulation of the brain to ensure healthy brain development. Earlier, the ICDS (Integrated Child Development Scheme), of the Ministry of Women and Child Development was focused on catering to both the health and education of children in the early stages of their physical and mental growth. As noted in NEP 2020, the quality ECCE is not available to crores of young children, particularly from socio-economically disadvantaged backgrounds.

The policy envisions providing quality early childhood development, care and education by 2030. Therefore, they have envisaged new pedagogical curricular structures.

Table 1 (Annexure) reflects that out of 21,059 Primary Schools, 8,552 schools have AWC on the school campus; 20,525 schools have Pre-Primary Sections on the school campus. Out of the total lot of 21,059 Primary Schools, 7,552 Private/Unaided Schools have a provision for Pre-Primary Sections. The Government Aided Schools have a negligible number of AWC and Pre-primary Section's whereas about 97.5 percent of Unaided Schools have Pre-Primary and AWC Sections.

According to the new policy, little more than 36 percent of schools will have to have AWC Schools on the campus to fulfil the requirement of the new structure of education.

Challenges of School Education

The state has conducted two main primary research studies along with an in-depth analysis of the secondary data available. These studies are the Systems Diagnostic Study using the RISE Framework and a diagnostic study using the Education Systems Framework. Multiple challenges, bright spots, and improvement areas have been identified during the studies which have been classified in the next section.

Priorities and Goals setting

- Quality education is a commonly used term but its understanding is broad and varied. There needs to be alignment across the system on its definition to ensure effective action and common understanding by all stakeholders.
- The state sets goals related to improving learning outcomes and learning levels are measured through assessments but specific year-on-year targets for the learning progression of children are not clear or communicated for all stages of school education. Further, there are not many documents/guidelines available on the breaking down of these at the district or school level.
- While the state continues to work on schemes and initiatives aligned with policies suggested by the centre, it does not currently have a policy document for school education.

- Teachers highlighted that they spent a significant amount of time on non-academic duties, such as administrative tasks. According to the NAS report 2021, 69% of teachers feel overburdened and spend significant time on non-academic tasks. 47% of school leaders feel the need for more non-administrative support at school.

Infrastructure and ICT

- While there are adequate resources, there is an opportunity to focus on better utilization of both physical resources and digital technologies to aid holistic student development.
- While most schools have ramps and a bigger toilet for children with special needs (CwSN) students, these are neither appropriately built nor properly maintained.
- While most of the upper primary and secondary schools have computer and science labs, the resources are underutilised for students learning. Most of the computers in the schools are non-functional and need immediate upgradation.
- Primary schools not covered in the *Samagra Shiksha Abhiyaan* have received limited ICT infrastructure. In order to inculcate 21st century skills where digital literacy is a must, ICT infrastructure must be prioritised in primary schools.
- Adequacy of Infrastructural Requirements in Schools according to Teachers assessed by NAS 2021: According to NAS data, 69-72% of teachers in all the Classes (Class III, V, VIII, X) reported the adequacy of instructional materials in schools. Similarly, adequacy of the workspace was found to be 71-79% by Primary School teachers and 84 -85% by Upper Primary and High School teachers.
- Physical facilities (buildings, toilets, drinking water) are adequate in 91-94% of schools.
- The pandemic has brought the usage and importance of digital tools for learning to the forefront. The need of the hour is to formulate a strategy/policy framework for Edtech implementation in the state.

Curriculum, Pedagogy and Assessments

- There is clarity at the state level on the alignment of Parho Punjab Paraho Punjab materials and the syllabus, but it seems to get muddled as it reaches the ground because of multiple and changing priorities. The program has been aligned with

NIPUN Bharat (national FLN Mission) which was launched in 2021 to create an enabling environment to ensure the universal acquisition of foundational literacy and numeracy.

- Teachers shared that their success in improving learning primarily seems to be determined by an increase in exam scores and syllabus completion. There is an opportunity to make learning more experiential, hands-on, and holistic.
- Vocational education is currently ongoing in a few senior secondary schools but its scope and implementation are very limited. There is no vocational education exposure for students in upper primary.
- Re-structuring of all Primary, Upper Primary and Secondary Schools to align with the new pedagogical and curricular structure according to the NEP.
- **ASER 2022 (Provisional Jan 18, 2023)**: The Annual Status of Education Report (ASER) 2022 is a nationwide citizen-led household survey that provides a snapshot of children's schooling and learning in rural India. Key findings of ASER 2022 are mentioned below-
    - **Punjabi Language**: 33% of Grade 3 students and 66% of Grade 5 students of Punjab can read Grade 2 level text. Trends over time (2012-2022) suggest a decline in the percentage of students in grades 5 and 8, who could read grade 2-level text. Over the years, the percentage of students in grade 5 who could read grade 2 level text have increased in the case of Private schools whereas it shows a declining trend in Govt schools.
    - **Numeracy:** Only 5.7% and 41.1% of students in Standard. 3 and Standard 5 (respectively) can do division whereas only 53.7% of students in Standard. 8 can do division. Trends over time (2012-2022) suggests a decline in the percentage of students in grade 5 and 8, who could do division. The declining trend has been observed across the genders (2018 vs 2022); more severe in the case of girls. A significant gap among students in terms of % of students who can do division across Private schools (51.8%) and Government schools (33.3%) in Grade 5 has been observed. The gap further widens in grade 8 - Private (69.5%) and Government (44.5 %).

- **English:** 70% of grade 3 and ~42% of grade 5 students could not read easy sentences. Over 63% of grade 5 students in Government schools could not read simple text whereas this figure is only 12% in Private schools. Over the years, Private school children have performed better than the Government schools both in case of grades 5 and grade 8.

- **Class VIII:** In Language, the scores of the Government and Private School Children are 67% and 68% respectively. In Mathematics, the scores are 61% and 45% and in Science, the scores are 57% and 48%; and in Social Science, the scores are 58% and 45% respectively.

- **Class X:** In Mathematics, the scores of Government and Private School Children are 55% and 41%, in Science, 50% and 44%, in Social Science, the scores are 49% and 48%, respectively. However, in English, the scores of Private School Children are 50% much higher in comparison to 39% attained by Government School Children (Refer to Target 4.4).

Human Resources - Leaders, Teachers and support staff

- To ensure good quality teaching in the classroom, there is currently no structure that clearly defines the competencies of good teachers and further helps in identifying and incentivising good teaching.
- While the state's PTR is as per standards, the issues of insufficient teaching staff such as multigrade classrooms and inadequate subject teachers persist due to challenges in the distribution of human resources across schools.
- Initiatives on teacher training have been undertaken but there is limited focus on structured planning for teacher professional growth and development .
- Training on classroom pedagogy is less prioritised pedagogy; experienced teachers find training to be less useful. No structured Training Need Assessment (TNA) conducted before the training.
- Though the teacher eligibility tests evaluate conceptual understanding, the practical component of teaching is still not evaluated such as in the form of classroom teaching demonstrations.

- The DIETs in the state are understaffed and pre-service training is theoretical with limited practical training components as part of the curriculum.
- Field officials reported facing high pressure, without adequate support, autonomy over funds, and power in decision-making.
- Teachers have very limited knowledge and skills of the process of inclusion of CwSN in education discourses.
- There is also a need to have trained subject teachers, particularly for Mathematics, Science, Languages and English. The instruction method in different subjects needs to be developed in sync with the activities such as fine arts and performing arts and crafts. Learning by doing and living the experience is irreplaceable and lasting.
- To have better administrative and academic outcomes, there is an urgent need to have head teachers in every primary and upper primary school.

Student Well-being, Equity and Children with Special Needs (CwSN)

- Gender and social equity in schools may exist in name while prejudicial attitudes persist at different levels with adverse effects on the overall environment in schools.
- There is a shortage of resource teachers for Special Education in all the districts, a lack of tracking system, a lack of education equipment and a lack of budget at the district level.
- Most parents and teachers are untrained and unaware of suitable ways to support children with special needs, in their academic and non-academic activities.
- While the schools have observed significant improvement in gender parity (male/female ratio) in enrolments in schools, the inclusion of the third gender is to be prioritised.

Parents and Community

- Discussions in PTMs revolve around exam scores and students' ranking in class and parents receive little information about the competencies mastered.
- Most SMCs were formed through nominations and they existed solely for signing off documents and expenses.

- There is an opportunity to increase parent engagement in their child's development and regularize SMC meetings along with the publication of meeting minutes.
- Close to 50% of students are still in private schools (UDISE, 2021). In fact, public opinion overwhelmingly favours enrolment in the latter. As per the 2021 Annual Status of Education Report, only 37% of children in Punjab with highly educated parents are enrolled in government schools (the national average being 62%).

Governance

- Due to differences in priorities of administrative and academic cadres, what needs to be evaluated during school visits varies. The absence of a consistent observation manual and proforma to capture and report data from visits has been highlighted by field staff.
- Field officials have highlighted the need for training on supporting, coaching, and providing detailed feedback to teachers.
- To keep track of all school-age children from 3 to 18 years (age and grade appropriate) and enrol them in schools as per the NEP requirements.
- Information on education has been gathered via both EMIS (ePunjab School) and ad hoc systems (Google Forms/Sheets). Teachers reported being overwhelmed with providing data to various departments and losing teaching time.
- It was reported that the EMIS doesn't capture data on student learning or outcomes (other than board exam marks on the PSEB portal), its use is largely limited to enrollment data for resource and fund allocation.
- In terms of financial planning, the budgeting process is largely top-down with limited on-ground consultation with the field officials or school heads.
- Delay in disbursement to schools and fund shortage is also frequent.
- Impact Analysis of spending on learning currently not undertaken in an institutionalised way.
- Schools in areas with strong Non-Resident Indian (NRI) presence typically can raise funds through community donations.
- To arrest the dropout rate at the Secondary stage.

THE VISION OF THE STATE

Following an understanding of national and global educational trends, the National Education Policy 2020, various education benchmarks, and the state's educational landscape across different parameters, the 2047 vision for school education in Punjab was framed. As detailed below, this is expressed in the form of key aspirational student attributes across different stages of schooling. The attributes are further classified into three categories – knowledge & skill, mindset & attitude and wellbeing-based; with the end goal of 'Nurturing our students to become 21st-century global citizens' by 2047. The model student shall develop diverse competencies across diverse stages of the schooling system.

Short-Term Targets: 2030

- To restructure 95% of schools with a provision of three years for Pre-School Education and two years (Class I – II) at the foundational stage. Class III-IV at Preparatory Stage. Class V – VIII at Middle Stage. Class IX, XII at Secondary Stage.
- Defining clear, measurable and realistic targets or goals for learning at least till the District Level.
- To enhance GER, from 82.1 percent at Higher Secondary to 100 percent per annum.
- To reduce the dropout rate to zero percent.
- Teachers to undergo 50 hours of hybrid training as per NEP recommendation.
- 80% of teachers proficient across all dimensions of teacher competency.
- 100% of DIETs hold at least 2 need-based school leadership support programs.
- 70% of schools have a school leader with excellence across all dimensions of leadership.
- 100% students are aware of opportunities/pathways available to them after school.
- 100% schools have active and functional SMCs.
- 50% teachers adapt non-traditional assessments alongside paper-pencil ones.

- 100% blocks provided with mental health counsellors with a 1:10 school mapping.
- 70% schools have access to a special mentor support for 'Children with special needs' (CWSN).
- A total of 50% of schools are to be equipped with digital technology, and 100% teachers ETT/JBT teachers are to be tech-savvy and have digital literacy by 2047.
- 100% middle schools to have integrated pre-vocational curriculum.

Long Term Targets: 2047

Structuring 100% schools as per the requirement of the NEP.

- 100 percent enrolment of all school-age children at all stages from the foundational stage to the Preparatory, Middle and Secondary Stages.
- To reduce the dropout rate to 0%.
- Provision of 100% of schools to be equipped with digital education.
- 100% teachers adapt non-traditional assessments alongside paper-pencil ones.
- 100% of schools have access to a special mentor support for 'Children with special needs' (CWSN).
- 100 percent of teachers are to be proficient in online and off-line teaching, using open source software.
- 100% of secondary and senior secondary schools to have the latest vocational integrated curriculum and facilities.
- 90% of students report sound social and emotional health.

Strategies For School Education (Short Term and Long-Term Targets)

Priorities and Goal setting

- The state will focus on having a state policy, which articulates the high-level goals and priorities of the government of Punjab for school education. The state will also

develop a roadmap towards achieving its policy objectives which may be reviewed every 3 years to keep pace with the latest development.

- The quality of even the science graduates has deteriorated to the extent that for any meaningful career they will have to unlearn all that they had at the school level. The issue of secondary schools not having laboratories, and if they have one it is ill-equipped for even some basic demonstrations.
- The State has a few KPI metrics for tracking key schemes and SDG goals to define clear, measurable and realistic targets or goals for learning at least till the district level.

Infrastructure and ICT

- Educationists everywhere advocate the need for introducing computer education right from the upper primary classes. Labs are also essential at every stage of education.
- Schools will have tech-enabled experiential classrooms with accessible infrastructure facilities (labs, parks, walkways, washrooms, purified water, etc.) .
- Students will have access to high-quality digital learning content through integrated digital engagement programs.
- The judicious use of technology in teaching and learning will play an important role in the improvement of the educational process and outcomes. Training of teachers to be for high-quality online content creators.
- All schools will be “Green Campuses” thus ecologically sustainable and lesser carbon footprint.

Curriculum, Pedagogy and Assessments

- Redesigning of the curricular framework and physical and instructional infrastructure to fulfil the requirements of the Foundational, Preparatory, Middle and Secondary stages of schooling. Making provision for Anganwadi/Pre-School, Bal vatikas (3-6 years) in all existing patterns of schools - Primary, Secondary and Higher Secondary Schools.

- Enhance schools with STEM (Science, Technology, Engineering, and Mathematics), Visual Arts, Music, AI and Coding resources.
- Integration of vocational/applied courses in upper primary and secondary schools.
- To provide Vocational Education from Middle to Secondary Classes in all schools (instead of the Higher Secondary stage) to give students exposure to vocations, and also skills linked with vocation, on the pattern of ancient Indian education system rooted in our culture and tradition. This will enable them to have a vast canvas of career options after secondary education.
- Revision of D.El.Ed course curriculum offered in DIETs to suit the need of the contemporary requirements in school education.

Human Resources: Capable Leaders and teachers

- While the Government schools have been fairly widespread in terms of their coverage of villages and localities in terms of the norms of educational facilities such as the number of classrooms and teachers per school, they remain remarkably deficient. Similarly, making provision for counsellors and social workers to connect with parents and teachers and to engage students in school activities for the socio-emotional development of the school children.
- The learning environment in schools is also connected with the availability of teachers with specialized training. The deployment of teachers with knowledge of local languages is also essential to make the curriculum more engaging and useful.
- Restructure and strengthen both academic (SCERT and DIETs,) and Administration divisions at all levels (state, district, block and cluster) through adequate staffing.
- In service training to keep the teachers, educators and administrators updated with the latest body of knowledge shall be given focus. DIETs-led training support programmes will be provided to school heads and teachers within the districts.
- Adequate qualified teachers in schools through regular recruitment, rationalisation according to emerging state needs, and ideal pupil-teacher ratio.

- Training and deployment of trained teachers with age/grade-specific training i.e., NTT, ETT and BEd as per requirements of a particular stage of teaching and learning.

Student Wellbeing, Equity and Children with Special Needs

- Strengthen Early Childhood Care and Education (ECCE) by convergence with Department of Women and Child Development and Health department where WCD providing health and immunisation services and education department focusing on academic aspects.
- Training of AWCs to serve at the Foundation stage (3-6 years) to cater to the physical, mental and social growth of children.
- Transportation and scholarship will be given to support children, for hurdle-free access, especially for girls, and need-based for other students as per feasibility.
- Curtailing the dropout rate to zero percent by ensuring universal access to education at all levels and also retention of students, particularly of girls and students from other socio-economically disadvantaged groups.

Parents and Community as Partners

- Schools as adult learning centres will be introduced.
- Periodical community-based initiatives to be part of the yearly planning.

Governance

- In the current arrangement under the initiatives of the SSA educational institutions in Punjab have been largely marginalised.
- The need of the hour is to strengthen the rural Government Schools as they tend to be less attractive in terms of providing a conducive academic environment to children. However, Government Schools continue to form the backbone of the educational scenario in the State as it significantly contributes to the educational aspirations of the socially and economically weaker and deprived communities.

- Initiatives such as the setting up of Adarsh Vidyalayas in every block with private partnership need to be examined afresh in terms of what impact it is likely to make on mainstream school education in the context of the growing educational divide.
- School complex model to be established with the *Schools of Eminence* as the model and mentor school for the creation of demonstrative spaces for innovative practices for other schools to learn and provide learning spaces for students to imbibe knowledge. Additionally, to grow in a safe and joyful environment and to nurture their intrinsic curiosity for their physical, cognitive, social and emotional development through progressive pedagogical practices. Engaging the community in contributing to enhance the quality of school development will be evidenced in these schools.
- Structured Classroom Observation and School Monitoring.
- Strengthening the EMIS ePunjab and its usage for pertinent progressive learning data on EMIS.

To Enhance Learning Outcomes

Skills of Language Learning: To enable the students to develop, listening, speaking and reading with correct pronunciation and recitation, use the word and spellings games; understand and write grammatically correct sentences and answers to questions posed; provide a model by the teacher to read, speak with correct pronunciation, dictation at primary stages and making students do the same in class.

At Primary and Upper Primary Stages: Providing model by the teacher by speaking, and reading aloud with correct diction, and intonation, and making students do the same.

At High School Stage: Developing habit of reading besides textbooks; attaining information and knowledge; critical thinking, asking and answering questions/discussion analytically and to develop creative thinking by writing stories/articles/e-mails, using appropriate vocabulary.

At Higher Secondary Stages: to train children to think, reason and analyse to learn abstract concepts as in Algebra, through the use of technology and also through discussion, to develop mathematical vocabulary and abstraction; use of open-source software such as Geogebra; developing mathematical communication skills by use of Tables/Graphs; incorporating problem-solving in maths appropriate in daily activities.

Use of an activity-oriented approach to link with the observation of natural phenomena to develop curiosity. To develop scientific inquiry by use of reasoning, critical thinking, problem-solving and experimentation to develop scientific temper, use of experiential learning at all stages.

Current Status of Higher Education

Higher Education

Punjab has several universities that offer general, professional, and technical education. Higher education institutions are rapidly growing in number. Ensuring quality in the context of higher education growth is a major challenge.

The future higher education eco-system should be able to address the various issues to ensure equity in education by reaching out to the educationally marginalized and economically deprived population of the country. There is need to provide a mixed blend of on-line and off-line learning. The major objective is to empower youth for gainful employment/ entrepreneurship.

To develop the higher education system in line with the three cardinals of accessibility, quality and equity. To make use of technology to deliver world-class content to all the stakeholders.

Enrolment in Higher Education

The enrolments of boys and girls in Universities and Colleges of Punjab, right from Graduate to Postgraduate level leading to MPhil and PhD courses reveal that there are 3,28,270 students on the rolls. Enrolment of Scheduled Caste students is 89,333 (Statistical Abstracts of Punjab, 2020). The overall enrolment of SC students is 23.07%. In terms of percentages, the overall enrolment is only 4.8% of students in the age group of 18-23 years pursuing Higher Education in Punjab. The gross enrolment ratio is 28.2% against 27.1% of All India Higher Education Institutions. Going by enrolment figures, accessibility in Higher Education, the number of girls both in the General as well as SC categories, is higher in all courses except in BE/BArch/BSc/BTech courses, where the percentage of girls is only 16.48% as compared to 83.52% in case of boys. In the rest of the courses, the accessibility of girls in Higher Education is at par with that of boys.

In the General category, GER is 25% in the case of males, 32% for females, and the total GER is 28.2%. In the SC category, in the case of males, the GER is 15.8%. In the case of females, it is 22.4% and the total GER is 18.8%. GER in the case of females in Higher Education both in General and SC categories is higher as compared to the GER of male students which is 25% and 15% in respective order. Source: AISHE (2019-2020).

There is a vast range of specialisations in Science, Social Science, Arts, and Humanities, Languages and Professional and Technical subjects. Table 1 (Annexure) portrays the data.

Status of Implementation of NEP in Punjab

Panjab University, Chandigarh, Guru Nanak Dev University, Amritsar, Jagat Guru Nanak Dev Punjab State Open University (JGNDOU) and Punjabi University, Patiala are multidisciplinary Universities and have almost completed the process of implementation of the NEP. Three Private Universities Chandigarh University, Lovely Professional University (LPU) and Chitkara University and affiliated colleges are on their way to completing the process. Implementation of multidisciplinary courses such as Bachelor of Vocational Education and Master's in Vocational Education has been initiated in Colleges, Panjab University and all State Universities of Punjab.

Clustering of colleges for resource sharing

The department of Higher Education is working on the concept of clustering colleges for resource sharing in terms of faculty, and physical resources to ensure optimum utilization of resources and to save revenue.

Sixteen New Government Colleges

The State has opened 16 New Government Colleges in rural areas and established State of Art infrastructure for these colleges to provide doorstep education to the rural masses.

Skill-based courses: Jagat Guru Nanak Dev Punjab State Open University (JGNDOU) has launched 16 new skill-oriented courses for students studying in Government colleges of the State. Around 8500 students were enrolled in these programmes in 64 Government colleges of the State.

Centralized Admission Process to ensure access and equity in Higher Education: Centralized Admission Process will provide access for the students to apply on one portal to reduce their hassle and provide transparency in the admission process. It will also ensure transparency in the payment of a fee to the colleges by the students.

MIS System for all Aided and Government Colleges: This system will ensure all information regarding aided and Government colleges at a place where there will be access to all information regarding grant-in-aid to colleges, its utilization, the fee structure of the colleges, and grievances portal for teachers and non-teaching staff.

Mechanism to check the exploitation of the teachers of Aided and Un-aided colleges: The State Government will prepare a road map to check the exploitation of the teachers of aided and un-aided colleges in terms of payment of salaries.

The formation of Higher Education Council: The State government has already passed a State Higher Education Council Act to establish a State Higher Education Council in the State with the following Objectives:

- Developing additional norms for its use, if it deems fit and recommending remedial measures for better performance.
- Taking appropriate steps for fulfilling the three cardinals of Higher Education namely: Quality, Equity and Access.
- Monitoring of Academic and Governance reforms in the State institutions of Higher Education.
- Directing the State institutions of Higher Education to ensure that standards of admission, teaching, examinations, research, extension programmes, qualified teachers and infrastructure are maintained in accordance with the guidelines issued by the appropriate authorities of the Central and the State Government from time to time; and
- Associating with it any person whose assistance or advice, in its opinion, is required for carrying out the functions of the Council.
- State Quality Assurance Cell: The Government of Punjab has already established a State Quality Assurance Cell to monitor the reports of Internal Quality Assurance

Cells of various colleges. This Cell will monitor the quality activities of the Institutions and ensure that every activity of the Institutions is justified and in the interest of students.

Academic Bank Credits

All the State Universities, Private Universities and Panjab University are registered on National Academic Depositary and DigiLocker and uploaded their degrees on NAD and DigiLocker. All State Universities are working to amend rules and regulations regarding students seeking admission to universities via transfer of credits. The process of offering courses with multiple entry and exit systems has been initiated in the universities.

Choice Based Credit System (CBCS)

- All the Universities have been instructed to convert their courses to CBCS. At present, Guru Nanak Dev University has started the programmes under CBCS. The process of introducing CBCS in affiliated colleges has been started to be implemented in the next academic session. All the courses which are five-year integrated programmes are with CBCS.

- **SWAYAM, MOOCS, ODL and Online Programme**

  Panjab University is already giving recognition to MOOC courses. All State Universities have dedicated SWAYAM Cell and the coordinator is helping in introducing MOOCs in every programme.

Apprenticeship Embedded Degree Programme

- All the Institutions have been instructed to register on National Apprenticeship Training Portal. All the professional programs in the State Universities have an internship industrial training component.

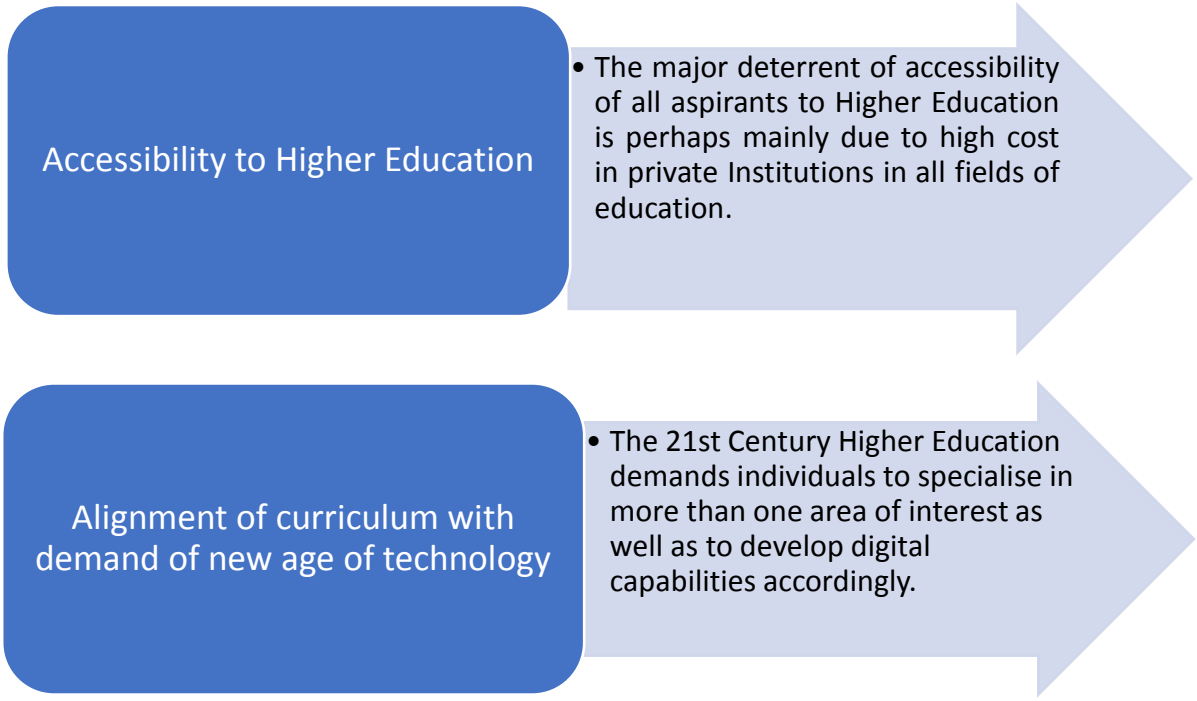
Academic Collaboration between Open Indian and Foreign Education Institutions

- The draft regulations have been prepared by the UGC but these have not been finalised. The Private Universities in the State have signed more than 100 Academic MoUs with educational institutions within the country and abroad during the last five years. JGNDOU has got an MoU signed with the Commonwealth and education

media and is in the process of signing an MoU with Oakland University, Michigan, USA to promote academic exchange between the two institutions.

Challenges of Higher Education

- Accessibility to higher education is hindered due to several factors: Particularly the overall high cost of pursuing Higher Education in terms of financial and human resources.



The potential of many Higher Education Programmes is delimited due to several factors:

- Limited seats per course in State/Government Institutions;
- Lack of appropriate student support mechanism; in addition to lack of quality;
- A very high fee structure in Higher Education Institutions run by Private Organisations is another reason that many aspirants can't pursue Higher Education with no provision for the scholarship for economically disadvantaged students;
- Poor employability due to lack of market-oriented skills as part of the course curriculum;
- Little or no emphasis on the development of cognitive, technical and vocational skills, and or subject-specific skills to enhance the employability of the graduate;

- Lack of adequately qualified subject specialist teachers. There are 29,214 teachers (against the required numbers) employed in colleges.
- The major challenges of new age technology in education: To integrate technology in teaching pedagogy and to improve the skilling of the students according to upcoming new skills to be an integral part of the curriculum and to promote soft skills, communication and problem-solving skills among the students.
- Curricular framework with a provision for subject-specific skills required as per market demands.

Strategies For Addressing the Access to Higher Education (2030, 2047)

- To open State-of-the-Art Government/State Universities/ Colleges in **districts with fewer lesser quality educational** facilities.
- Scholarships for economically disadvantaged students.
- Provision for digital infrastructure: Enhancing e-learning platform and digital repository for addressing the digital devices, virtual labs and teacher training for blended models of learning.
- **To promote soft skills, communication and problem-solving skills among students:** Making provision in the curriculum for earning credits through undergoing training programmes in soft skills; in the form of short courses, MOOCS or as extension activities as part of the student development programme. As per the need for the rapidly changing curricular requirements due to the explosion of knowledge and technology.

For Teaching

- **Digital Push:** Offer Open and Distance Learning (ODL) Education.

FOR CAPACITY BUILDING OF THE TEACHERS: TRAINING OF TEACHERS THROUGH FACULTY DEVELOPMENT PROGRAMMES ENRICHED WITH ICT, AND APPLICATION OF ARTIFICIAL INTELLIGENCE IN TEACHING AND LEARNING. 100 PERCENT COVERAGE BY TECHNOLOGY ENHANCED IN PRE-SERVICE AND IN-SERVICE TEACHING TRAINING PROGRAM BY 2030 AND STATUS QUO IN 2047.

Entrepreneurship and Employability

- Curriculum to be in sync with current need of individual and society.
- Teacher capacity building to connect with environment outside classroom.
- Ecosystem for individual internship and apprenticeship.
- Opportunity for mobility to skill education from general education.

For Learning/Courses

- Accept online and ODL credits.
- Local Language in Learning.
- Smooth movement from skill education to regular courses.
- Banking of all credits.
- Flexibility of Learning.
- Multiple entry and exit.
- Focus on capacity building of faculty.

Roadmap to achieve Quality in Higher Education needs:

- Curriculum Reforms.
- Adopting Multidisciplinary Approach.
- To reduce the mismatch between the demand and supply of 21st century skills, new age skills and skills required for the industry.
- Access to ICT Infrastructure and devices.

CURRENT STATUS OF TECHNICAL EDUCATION

The Department of Industrial Training, Punjab is presently implementing the following flagship schemes for training the youth in upgrading their skills: Craftsman Training Scheme (CTS), Apprenticeship Training Scheme (ATS) and Modular Employable skills/skill Development Initiatives (MES/SDI).

CURRENT STATUS OF POLYTECHNICS AND ART AND CRAFT INSTITUTES

Out of 163 Polytechnics, there are only 8 (40.91%) institutes for girls. Similarly, there are only 61 out of 337 Art and Craft Institutes for girls which comes to 18.1%. The lack of girls' institutions debars girls to have access to Technical/Vocational Education.

CURRENT STATUS OF VOCATIONAL EDUCATION

Education is not always about nurturing the young mind to achieve excellence in terms of examination results. Not every child will have the motivation and circumstances to dream big. Some may have the inclination to learn skills that could help them earn a livelihood much before their other classmates who choose to enrol for higher degrees. One of the fundamental problems of the Indian education system has been the lack of integration of vocational training with the mainstream education system. The goal of introducing vocational education at the secondary and higher secondary levels is to improve employability through demand-driven competency-based, modular vocational courses while also lowering the dropout rate at the secondary level. Implementation of Vocationalisation of Secondary and Higher Secondary Education initiatives across the country to provide secondary-level students with vocational education has been started. Vocational Education under the Rashtriya Madhyamik Shiksha Abhiyan (RMSA) has been matched to the National Skills Qualification Framework (NSQF) and is being implemented to prepare youngsters to be employable and competitive. National Skill Qualification Framework has been designed based on internationally approved qualification frameworks.

There are 989 Government Secondary and Higher Secondary Schools that provide vocational courses under NSQF (National Skill Qualification Framework) which is about 7% of schools only. As a direct result of the steps taken by the RMSA beginning in 2009, integrated science labs can now be found in every secondary school.

Challenges of Technical Education

- Lack of required number of quality ITI and Polytechnics to achieve the targets.
- Lack of adequately trained teachers.
- Lack of integration of vocational education in school education curriculum.
- Lack of provision for infrastructural facilities and linkage of vocational skills in each subject area at the high school stage.

Short-Term and Long-Term Strategies for Vocational Education: 2030 And 2047

- Vocational education to be made an integral component of the school curriculum with openings and opportunities for diversification and further development of skills in specific trades.
- To provide Vocational Education from Middle to Secondary Classes in all types of schools (instead of the Higher Secondary stage) to give students exposure to vocations, and also skills linked with the vocation as on the pattern of ancient Indian education system rooted in our culture and tradition.

  This is likely to make Secondary Education more attractive and serve as a launching pad for lower and middle-range technological manpower, which is urgently needed in the fast-changing economic and technological scenario.

- *Provision of Vocational Education in 50% schools by 2030*
  - *Provision of Vocational Education in 90% schools by 2047*

Short Term and Long-Term Strategies for Technical Education: 2030 And 2047

Targets (Set by Department of Technical Education and Industrial Training, Punjab)

To ensure equal access for all women and men to affordable and quality technical and vocational tertiary education by 2030/2047.

- **Opening Skill Development Centres in Un-serviced Block (SDC)**

  Four Multi-Skill Development Centres will be established in Amritsar, Ludhiana, Bathinda and Hoshiarpur, each with a capacity of 25,000 trainees. These MSDCs will serve as hubs for nearby ITIs, acting as spokes for inclusive growth as industrial clusters. The State is establishing MSDCs in the fields of health, construction, manufacturing and automobiles. Under the MES -Scheme, the States developed targets and action plans based on population and funding availability. The scheme anticipates a yearly increase of 25%. It is also planned to implement all National Skill Development Schemes through various departments.

- **Industry Institute Interaction**

  With the assistance of the TATA group, a Skill Training Academy is currently being established in Ropar. The academy will educate between 3,000 and 4,000 people per year to fill skilled labour positions. It is required of all ITIs, regardless of whether government or private, to operate in two shifts. According to the Institutional Development Plan (IDP), an additional 8,400 seats are going to be added to the PPP programme.

- **Involvement of Industry as partner**

  The department would encourage ITI Industry linkages and industry would play a role in ITI management. All ITIs are managed by Institute Management Committees (IMCs), which are chaired by Industry Partners. The State has also enlisted the help of major industrial conglomerates such as Tata, Maruti Suzuki, L&T, Toyota, LG, M&M, and Godrej, among others, for the adoption and ongoing support of skill development activities throughout the State. The IMC has been given complete financial and administrative autonomy.

- **Apprenticeship Programme**

  The State is utilising maximum seats assessed under Apprenticeship and has also conducted a survey for new apprenticeship training vacancies in the industry. The Apprenticeship Scheme in Punjab has a capacity of 8,166 seats. Already, 3,702 seats have been reserved. During 2012-13, the State added 726 new seats and 171 new businesses.

- **Incubation centres, career counselling and skill tracking centres**: Incubation centres, career counselling and skill tracking centres in every village and municipal ward may be opened. These would liaise and coordinate with schools and colleges.
- **Entrepreneurship Development Programme**: Industrial motivational campaign/EDP may be conducted in educational institutions with the provision for bank linkages to motivate students to go for start-up/entrepreneurial ventures.
- **Skill Enhancement**

  Upcoming new skills to be integral part of the curriculum: Making provisions for Digital, Cloud, Analytics and Artificial Intelligence as part of curriculum as well as value added courses to be offered at all levels of Higher Education to cater to the need of IT industry.

Targets by 2030

- **State Level Targets (Set by Department of Technical Education and Industrial Training, Punjab)**. There is a target to prepare around 24 lakhs skilled manpower by 2030 in different fields, under various schemes such as CTS, ATS, MES/SDI and MSDC to enable the Punjabi youths to seek meaningful employment/self-employment.
- To ensure equal access for all women and men to affordable and quality technical and vocational tertiary education by 2030.
- Opening of exclusive Institutes for women for enhancing their representation in Skill development and Entrepreneurship.

State-level Targets for Skill Development through ITIs for the next 15 years

Year	CTS	ATS	MES/SDI	MSDC
2016	72,041	8,000	15,000	7,500
2022	1,00,000	9,200	20,000	28,800
2030	1,40,000	11,000	27,000	35,000
2047	1,50,000	13,000	30,000	40,000

Source: Department of Technical Education and Industrial Training, Punjab.

ESTABLISHMENT OF MULTI-SKILL DEVELOPMENT CENTRES

Industry Institute Interaction

The department would encourage ITI-Industry connections and the industry would play a role in ITI administration. A skill gap survey was done in the State with the assistance of the CII, and another survey is being completed with the assistance of the Government of India's National Skill Development Corporation (NSDC).

Annexure

Table 1:
Enrolment, GER, Dropout, Transition and Retention Rate by Stages of School Education in Punjab and India, 2021-22

India/ State	Primary (1 to 5)			Upper Primary (6-8)			Secondary (9-10)			Higher Secondary (11-12)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
(1)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	A. Enrolment – All Types of Management											
Punjab	1252540	1071757	2324297	741390	633572	1374962	473876	394014	867890	426833	358064	784897
India	63517655	58324595	121842250	34511750	32278942	66790692	20071918	18456713	38528631	14747732	13831318	28579050
	B. Gross Enrolment Ratio (GER) – All Social Groups (Percent)											
Punjab	111.8	110.8	111.4	105.6	108.1	106.8	94.8	95.4	95.1	81.2	83.1	82.1
India	102.1	104.8	103.4	94.5	94.9	94.7	79.7	79.4	79.6	57.0	58.2	57.6
	C. Gross Enrolment Ratio (GER) – Scheduled Castes (Percent)											
Punjab	112.7	111.3	112.1	107.5	108.8	108.1	96.4	94.9	95.7	80.5	85.2	82.7
India	111.5	114.9	113.1	103.1	104.5	103.8	84.2	85.6	84.9	59.5	63.7	61.5
	D. Dropout Rate (Percent)											
Punjab	0.95	1.6	1.31	7.13	8.67	7.97	15.96	18.27	17.24			
India	1.6	1.4	1.5	2.7	3.3	3	13	12.3	12.6			
	E. Transition Rate (Percent)											
	Primary to Upper Primary (Class 5 to 6)			**Upper Primary to Secondary (Class 8 to 9)**			**Secondary to Higher Secondary (Class 10 to 11)**					
Punjab	95.6	96.5	96	84.9	87.3	86	77.5	81.4	79.2			
India	93	93.4	93.2	89.7	87.8	88.8	77.6	79.3	78.4			
	F. Retention Rate (Percent)											
	Primary (Class 1 to 5)			**Elementary (Class 1 to 8)**			**Secondary (Class 1 to 10)**			**Higher Secondary (Class 1 to 12)**		
Punjab	100	100	100	86.3	87.5	86.8	81.4	81.2	81.3	63.2	66.1	64.5
India	94.9	96	95.4	80.5	82.1	81.2	64.9	64.5	64.7	43.1	44.2	43.6
Source: U-DISE+, 2021-22												
	G. Enrolment – Scheduled Castes											

India/ State	Primary (1 to 5)			Upper Primary (6-8)			Secondary (9-10)			Higher Secondary (11-12)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
(1)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	(10+2 Pattern) Senior Secondary School			High/Post Basic School			Middle/Senior Basic School			Primary/Junior Basic School		
Punjab	457355	412628	869983	205200	172854	378054	99074	84919	183993	415510	400518	816028
	H. Enrolment – General											
Punjab	1684646	1371651	3056297	689638	557230	1246868	285636	236251	521887	659622	631752	1291375
	I. Percentage of Enrolment of Total Girls and SC Girls											
	Primary	Upper Primary	Secondary	Higher Secondary								
Girls (All)	45.91	45.50	44.51	45.96								
Girls (SC)	49.08	46.15	45.77	47.42								
	J. Net Enrolment Rate (NER)											
	Primary (Class 1 to 5)			Upper Primary (Class 6 to 8)			Elementary (1 to 8)			Secondary (9 to 10)		
Punjab	89.5	90	89.7	70.8	75.4	72.9	94.6	96.2	95.3	50.8	54.6	52.5
	Higher Secondary (11 to 12)											
Punjab	42.7	47.5	44.9									
	K. Adjusted Net Enrolment Rate (ANER)											
	Primary (Class 1 to 5)			Upper Primary (Class 6 to 8)			Elementary (1 to 8)			Secondary (9 to 10)		
Punjab	96.4	97.4	96.9	80.4	86.2	83	98.3	100	99.2	61.9	67.8	64.6
	L. Gender Parity Index (GPI) of GER											
	Primary (1 to 5)	Upper Primary (6 to 8)	Elementary (1 to 8)	Secondary (9 to 10)	Higher Secondary (11-12)							
Punjab	0.99	1.02	1.00	1.01	1.02							
	M. Percentage of all minority groups' enrolment to total enrolment											

India/ State	Primary (1 to 5)			Upper Primary (6-8)			Secondary (9-10)			Higher Secondary (11-12)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
(1)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Primary (1 to 5)			Upper Primary (6 to 8)			Elementary (1 to 8)			Secondary (9 to 10)		
Punjab	51.1	50.3	50.7	52.9	52.2	52.6	51.8	51.0	51.4	54.9	53.8	54.4
	Higher Secondary (11-12)			Primary to Higher Secondary								
Punjab	57.8	56.2	57.0	53.2	52.2	52.7						
	N. Percentage of Muslim minority enrolment to total enrolment											
	Primary (1 to 5)			Upper Primary (6 to 8)			Elementary (1 to 8)			Secondary (9 to 10)		
Punjab	2.7	2.7	2.7	2.3	2.4	2.4	2.5	2.6	2.6	1.9	2.0	2.0
	Higher Secondary (11-12)			Primary to Higher Secondary								
Punjab	1.7	1.8	1.7	**2.3**	2.4	2.3						
	O. Percentage of OBC enrolment to total enrolment											
	Primary (1 to 5)			Upper Primary (6 to 8)			Elementary (1 to 8)			Secondary (9 to 10)		
Punjab	14.8	15.2	15	**15.5**	16.1	15.8	15.1	15.5	15.3	16.4	17.3	16.8
	Higher Secondary (11-12)			Primary to Higher Secondary								
Punjab	16.8	17.8	17.2	15.6	16.1	15.8						

Source: Statistical Abstract of Punjab, 2020.

Table 2:
Higher Secondary Schools with Types of Laboratories in Punjab, 2014-15

Laboratory	School mgmt. type	Schools with labs	Total number of schools	Percentage of schools With labs
Physics Lab	Government	534	1687	31.7
	Pvt. Aided	89	269	33.1
	Pvt. Unaided	826	2081	39.7
	Total	1499	5364	27.9
Chemistry Lab	Government	558	1687	33.1
	Pvt. Aided	96	269	35.7
	Pvt. Unaided	828	2081	39.8
	Total	1531	5364	28.5
Biology Lab	Government	481	1687	28.5
	Pvt. Aided	73	269	27.1
	Pvt. Unaided	781	2081	37.5
	Total	1382	5364	25.8
Computer Lab	Government	1329	1687	78.8
	Pvt. Aided	195	269	72.5
	Pvt. Unaided	1083	2081	52.0
	Total	2670	5364	49.8
Mathematics Lab	Government	391	1687	23.2
	Pvt. Aided	48	269	17.8
	Pvt. Unaided	569	2081	27.3
	Total	1045	5364	19.5
Language Lab	Government	117	1687	6.9
	Pvt. Aided	5	269	1.9
	Pvt. Unaided	253	2081	12.2
	Total	396	5364	7.4
Geography Lab	Government	68	1687	4.0
	Pvt. Aided	5	269	1.9
	Pvt. Unaided	145	2081	7.0
	Total	231	5364	4.3
Home Science Lab	Government	51	1687	3.0
	Pvt. Aided	22	269	8.2
	Pvt. Unaided	152	2081	7.3
	Total	239	5364	4.5
Psychology Lab	Government	10	1687	0.6
	Pvt. Aided	2	269	0.7
	Pvt. Unaided	52	2081	2.5
	Total	69	5364	1.3

Source: UDISE,2014-15

ENSURING INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFE- LONG LEARNING OPPORTUNITIES FOR ALL

1. Ensure that all girls and boys have access to high-quality early childhood development, care, and pre-primary, primary, upper Primary, Secondary and higher secondary education.					
Indicator	**Current Status/Baseline**	**Target**			**Strategies**
		Target 2030	**Target 2 2035**	**Target 2047**	
Children receiving quality pre-primary education.	Percentage of Primary Schools having AWC or Pre-Primary Sections: 74.5%	Re-structure 80% of schools with a provision of three years for Pre-School Education and two years (Class I – II) at the foundational stage. Class (III-IV) at Preparatory Stage. Class (V – VIII) at Middle Stage. Class (IX–XII) at Secondary Stage.	Structuring 95% of Schools in accordance with the requirement of NEP.	Structuring 100% Schools in accordance with the requirement of NEP.	• Making provision for Anganwadi/Pre-School, Balwatikas (three to six years) in all types of existing pattern of schools. Primary, Secondary, Higher Secondary School. • Redesigning of the curricular framework and physical and instructional infrastructure to fulfil the requirements of the Foundational, Preparatory, Middle and Secondary stages of schooling. • Deployment of trained teachers with age/grade-specific training i.e., NTT, ETT and B.Ed. as requirements of a particular stage of teaching-learning. • Training of AWWs to serve at the Foundation stage (three-six years) to cater to the physical, mental and social growth of children.

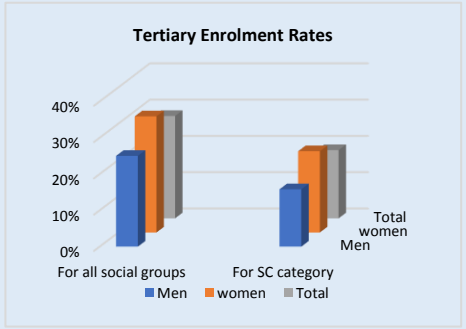
1. Ensure that all girls and boys have access to high-quality early childhood development, care, and pre-primary, primary, upper Primary, Secondary and higher secondary education.					
Indicator	**Current Status/Baseline**	**Target**			**Strategies**
		Target 2030	**Target 2 2035**	**Target 2047**	
Completion Rates Gross Enrolment Ratio (GER) for all social groups	Out of school children = (6-14 years) = 2327 (16-19 Years) = 3221 Never Enrolled = 1355 Completion Rates = 60-70% Attended Before=4193 Source: SCERT, Mohali, Punjab Primary education-113.7 Upper Primary-106.8 Secondary-95.06 Higher Secondary-82.02	Improvement by 5% of the baseline Improve by 5% At the rate of 5 percent per annum from the baseline data.	Improvement by 5% of the baseline Improve by 10% At the rate of 5 percent per annum from the baseline data.	Improvement by 5% of the baseline Improve by 20% 100% Coverage	• By merging early child care education (ECCE) with primary/secondary education gains made in ECCE will be sustained in child learning capacities and decrease 'never attended' and completion rates in schools. • Organizational continuity will help to pull in dropouts bridging ECCE – schooling, increasing enrolment in AWC and streamlining cash benefits and subsidies for girl children. • Strengthen access and delivery of attendance scholarships to SC, BC and EWS primary girl students and handicapped girl students. To make it possible for people from the margins to access education, public schools' infrastructure, teaching capabilities, and accountability should be strengthened. Promote gender safety in the classroom, on the way to and from school, and connect vocational and technical skill transition from school streams to encourage people to pursue education and skills for a living. To provide efficient and sufficient physical and instructional infrastructure so that all children/students have access to engaging school education at all levels from Pre-primary School to Grade XII.

1. Ensure that all girls and boys have access to high-quality early childhood development, care, and pre-primary, primary, upper Primary, Secondary and higher secondary education.					
Indicator	**Current Status/Baseline**	**Target**			**Strategies**
		Target 2030	**Target 2 2035**	**Target 2047**	
Dropout Rate at different levels of Education Primary Upper Primary Secondary Higher Secondary	 1.31 7.97 17.24 12.53	 To reduce the dropout rate to 0%. To reduce dropout rate upto 5%. To reduce dropout rate upto 10%. To reduce dropout rate upto 8%.	 To sustain the dropout rate to 0%. To reduce the dropout rate to 0%. To reduce the dropout rate to 5%. To reduce the dropout rate to 5%.	 To sustain the dropout rate to 0%. To sustain the dropout rate to 0%. To reduce the dropout rate to 0%. To reduce the dropout rate to 0%.	• Curtailing dropout rate by ensuring universal access to education at all levels. • Retention of students particularly girls and students from other socio-economically disadvantaged groups. • Deployment of teachers with knowledge of local languages, making curriculum more engaging and useful. • Ensuring appointment of school leaders with excellence across all dimensions of leadership • Make provision for transport for girls and economically-weaker sections to reach the school. • Pooling of teaching-learning resources. • Making provision for counsellors and social workers to connect with parents and teachers to engage students in school activities. • Empower DIETs to lead need-based school leadership support programs which will lead to overall improvement of the school • Active and functional SMCs which improve community awareness and participation

2. Ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy					
Indicator	**Current Status/Baseline**	**Target**			**Strategies**
		Target 2030	**Target 2 2035**	**Target 2047**	
Literacy Rates	**Male: 83.0** **Female: 75.5** **(Source: PFLS, 2020-21)**	Improvement by 5%	Improvement by 10%	100%	
Transition Rate	Transition rate is 100% from Primary and Upper Primary classes but at the secondary stage, it declines to 75%.	Improvement by 5%	Improvement by 10%	100%	
Retention Rate	Retention rate is 100% for Primary and elementary stages. It is almost 81.3% at the secondary stage and 64.5% at the higher secondary stage.	Improvement by 5%	Improvement by 10%	100%	

2. Ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy									
Indicator	**Current Status/Baseline**						**Target**			**Strategies**
							Target 2030	**Target 2 2035**	**Target 2047**	
Functional Skills in languages, Mathematics, EVS, Science and Social Science at primary, elementary and secondary level	**Class III**	**% of Scores**					**Improvement by 50%**	**80% Coverage**	**100% Coverage**	• Provision to be made for subject-specific teachers and subject-specific Labs for the teaching of the Languages; Maths and Science • Establish an integrated and strengthened teacher training programme to improve teaching quality, school infrastructure, learning resources, accountability and the replacement of the no-detention policy with regular evaluations against nationally set learning benchmarks. Ensure that teachers undergo 50 hours of hybrid training as per NEP recommendation • Restructure and strengthen both academic (SCERT and DIETs,) and Administration divisions at all levels (state, district, block and cluster) through adequate staffing • Ensure teachers adapt non-traditional assessments alongside paper-pencil one • Provide schools will lab facilities to ensure active learning • Enhance schools with STEM (Science, technology, engineering, and mathematics), Visual arts, Music, AI and Coding resources
				2021		National	**Class III**	**Class III**	**Class III**	
		2017	2021	Govt.	Pvt.	Govt.	Pvt.	80%	85%	90%
	• Language	66%	71%	86%	72%	63%	62%	77%	85%	90%
	• Mathematics	61%	68%	83%	66%	58%	57%	75%	80%	90%
	• EVS	62%	67%	87%	66%	58%	57%			
	Class V							**Class V**	**Class V**	**Class V**
	• Language	61%	68%	78%	67%	55%	57%	75%	80%	90%
	• Mathematics	59%	63%	70%	54%	45%	43%	70%	80%	85%
	• EVS	61%	68%	49%	48%	49%	48%	75%	80%	90%
	Class VIII							**Class VIII**	**Class VIII**	**Class VIII**
	• Language	59%	68%	67%	68%	48%	60%	75%	85%	90%
	• Mathematics	49%	59%	61%	45%	36%	38%	70%	80%	90%
	• Science	51%	57%	57%	48%	38%	43%	65%	70%	80%
	• Social Science	52%	57%	58%	45%	39%	41%	65%	70%	80%
	Class X							**Class X**	**Class X**	**Class X**
	• English	50%	66%	39%	50%	39%	50%	70%	75%	80%
	• Mathematics	50%	55%	55%	41%	32%	34%	65%	70%	80%
	• Science	51%	51%	50%	44%	34%	37%	50%	65%	70%
	• Social Science	49%	54%	49%	48%	35%	40%	60%	65%	75%
	• Nil	52%	58%	51%	50%	39%	43%	70%	75%	80%

3. Substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.					
Indicator	**Current Status/Baseline**	**Target**			**Strategies**
		Target 2030	**Target 2 2035**	**Target 2047**	
Digital Education Not being part of the School Curriculum.	Non-availability of digital infrastructure, e-learning platform; Digital content; and affordable devices.	50% of Schools to be equipped with digital technology. 50% Teachers ETT/JBT teachers to be tech-savvy and have digital literacy.	80% of Schools to be equipped with digital technology.	Provision for 100% of schools to be equipped with digital education. 100 Percent of teachers to be proficient in online and offline teaching, using open-source software.	• Integration of technology involving the use of AI, machine learning and computing devices for student development at the Middle and Secondary stages. • Enabling the teachers to handle educational software and hardware and help students not only what they learn but how they learn. • The judicious use of technology in teaching and learning will play an important role in the improvement of the educational process and outcomes. • Training of teachers should be of high-quality enabling them to be online content creators.

4. Ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university					
Indicator	**Current Status/Baseline**	**Target**			**Strategies**
		Target 2030	**Target 2 2035**	**Target 2047**	
Youth with Vocational education **Youth with ITI Skills**	**7%** **Male: 75%** **Female: 25%** Source: Statistical Abstract of Punjab, 2020.	**Improvement by 50%**	**Improvement by 80%**	**Improvement by 100%**	There is a need to make provision for new technology-related vocational subjects as part of the school curriculum. To start technology-based courses such as Machine learning, data analytics, Web-designing, Multimedia, Animation, Content writing, Digital marketing, Graphic designing and Application development. Enhancing infrastructural facilities such as labs curricular requirements. In order to ensure equal access for all women and men to affordable and quality technical and vocational tertiary education. There is a need to open exclusive Institutes for women for enhancing their skills. Vocational education should be made an integral component of the school curriculum with openings and opportunities for diversification and further development of skills in specific trades. Opening Multi Skill Development Centres (MSDS) (in Amritsar, Ludhiana, Bathinda and Hoshiarpur). To provide Vocational Education from Middle to Secondary Classes in all schools (instead of the Higher Secondary stage) to give students exposure to vocations, and also skills linked with vocation, on the pattern of ancient Indian education system rooted in our culture and tradition.
Tertiary Enrolment Rates		Improvement by 10% from the baseline	Improvement by 20% from the baseline	100% Coverage	• To open State-of-the-art Government/State Universities/Colleges in districts with lesser-quality educational facilities. • Scholarships for economically disadvantaged students. Infrastructure and quality material are available to all learners.

5. Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all					
Indicator	**Current Status/Baseline**	**Target**			**Strategies**
		Target 2030	**Target 2 2035**	**Target 2047**	
Instructional Material **Work Spaces** **Physical Facilities (Building, Toilets, Drinking Water)** **Participation in Professional Development** **Work Overload**	72% 80% 93% 84% 67% (Source: NAS Data, 2021)	80% 85% 90% 60%	90% 90% 95% 50%	100% 100% 100% 30%	All schools are being provided basic hygiene/toilet facilities, safe drinking water, instructional material and workspace. The ongoing efforts are to be completed by 2047. A 100 percent coverage by technology-enhanced in pre-service and in-service teaching training programmes by 2030 and status quo in 2047. There is a need to make a Budgetary provision for the creation of a clerical post for every Primary and Elementary School so that teachers get relieved from the clerical work and that they can do justice with the prime job of teaching and promoting learning. Provision to be made for subject-specific teachers and subject-specific Labs for the teaching of Languages; Maths, and Science. Ensure blocks are provided with mental health counselors with a 1:10 school mapping Transportation and scholarship will be given to support children, for hurdle-free access, especially for girls, and need-based for other students as per feasibility.

II
HEALTH INFRASTRUCTURE AND PROVISIONING

Health constitutes one of the important aspects of human well-being and the existing conditions of health and health outcomes reflect the 'real' socio-economic conditions in a society. The overarching objective of health policy is to ensure that no citizen is denied healthcare due to a lack of access and the capacity to pay. The State is committed to fulfill its responsibility for providing healthcare to its people. The present document analyzes health outcomes, infrastructure availability and issues of access to healthcare, along with challenges that need to be mitigated to deliver healthcare services to the people.

In a recent fourth edition of the health index released by the Niti Aayog with the reference year of 2019-2020[1], Punjab ranks eighth in the category of larger States with a value of 58.08.

Challenges

HEALTH STATUS IN THE STATE

Infant mortality rate (IMR)

The Infant Mortality Rate (IMR), is widely used as a crude indicator of the overall health scenario of a country or a region. It is defined as infant deaths (less than one year) per thousand live births in a given time period. IMR in Punjab in 2020 was 18, (18 for males and 19 for females). While in other developed States like Tamil Nadu, IMR was 13 (for both males and females), In Maharashtra 15 (for males and females). Kerala had the lowest IMR of 6 (10 for males and 3 for females. (SRS Bulletin, May 2022).

Life expectancy at birth

The life expectancy at birth measures the average number of years a person is expected to live under prevailing mortality conditions. All-India life expectancy at birth in 2014-18

[1]Health index is a weighted composite score incorporating 24 indicators covering key aspects of health performance in three domains viz., health outcomes, governance and information, and key inputs and processes.

has been 69.4 years, with 68.2 and 70.7 years for males and females respectively. Life expectancy at birth for Punjab is 72.7 years, with life expectancy for males being 71 years 74.8 years for females. Increased life expectancy and decreasing total fertility rate to below replacement level (TFR for Punjab is 1.63 according to NFHS 5) will have implications for the demography of the State, where the number of elderly (in numbers and as a proportion of the population) would increase by 2047.

Maternal mortality ratio (MMR)

Maternal mortality refers to fatalities due to complications that arise at the time of pregnancy and childbirth. Maternal Mortality Ratio (MMR) is calculated as the proportion of maternal deaths per 1,00,000 live births. Despite 98.5 per cent institutional deliveries (HMIS, 2019-20), as per the latest data with base year 2017-19, MMR in Punjab is 114, which is much higher than in some of the developed States like Maharashtra (38), Tamil Nadu (58) and Kerala (30) (SRS Bulletin, March 2022).

Anaemia

Anaemia is a major health concern in the State, especially among women and children. Nearly 71 per cent of children aged 6-59 months are anaemic, with 25 percent being mildly anaemic, 41 percent moderately anaemic, and 5 percent severe anaemic. It is alarming that the prevalence of anaemia in children has increased from 57 percent in NFHS-4 to 71 percent in NFHS-5. The prevalence of anemia among girls and boys is the same (71 per cent) in NFHS-5. About three-fifths (59 per cent) of women in Punjab have anaemia, including one-quarter with mild anemia, 31 percent with moderate anaemia, and three percent with severe anaemia. The rate of anaemia among women has increased by 5 percentage points since NFHS-4 (i.e. 53.5 to 59). While nearly twenty-three percent of men in Punjab are anaemic. The percentage of men with anaemia has declined from 26 per cent in NFHS-4 to 23 per cent in NFHS-5.

Adverse sex ratio at birth and child sex ratio

The skewed sex ratio, at least in more recent years, has been surmised to be driven

largely due to the use of medical technologies by physicians and prospective parents to determine the sex of fetuses followed by selective abortion of female fetuses.

Prevalence of illicit substance and alcohol use disorders

There are 27 lakh people in Punjab who need help for alcohol problems, as per report of MoSJ&E on the magnitude of substance abuse in the country and different States in 2019. Further, 5.7 lakh people need help for cannabis-related problems and 7.2 lakh people need help for opioid-related problems in the State. In addition, two lakh population need help for sedative-related problems. About 88,000 people in Punjab inject drugs, which is a primary cause for the spread of HIV and Hepatitis B and C. Alcohol and drug use not only have implications for the mental health of the people but also increase the risk of contracting other diseases.

Disease profile in the State

Though global disease pattern has shifted from communicable diseases to non-communicable diseases, mostly in the developed countries. The burden of communicable diseases, malnutrition, poor maternal health, and high fertility are still lurking the developing countries because of the large population size of these countries. Punjab continues to have a high incidence of communicable diseases, especially respiratory and diarrheal infections, and the incidence of various non-communicable diseases is also high. Incidence of cardiovascular diseases is the second highest cause of illness in the State, next only to respiratory infections (see Table 1 in Annexure)[2]. Non-communicable diseases account for 63 per cent of the total disease burden in the State. While accidental injuries and road accidents form about 5 percent of the total disease burden (Statistical Abstract, GoP2020). The risk factors that are driving most of the deaths and disability in the State are high blood pressure (15.3%); Dietary risks (14.6%); Air pollution (10.4%), high fasting plasma glucose (10%); malnutrition (8.9%), high body-mass index (8.8%); high cholesterol (6.6%); alcohol and drug use (3.6%)[3].

Inadequate health infrastructure

Punjab has a fairly good network of primary public healthcare infrastructure, but is still, short against norms. *Aam Aadmi Mohalla Clinics (AAMC)*- a flagship initiative of the Punjab government are primary health care centres. They offer a basic package of

[2]All tabulated data is in Annexure to this document.
[3] India: Health of the Nation's States (2017).

essential health services free of cost. There is a 17 per cent shortfall in the number of Sub-centres; 30 per cent shortfall in the number of PHCs and 40 per cent shortfall in the number of CHCs in the State (see Table 2 in Annexure).

	National norm	Punjab
Population covered by Sub-centre	3000-5000	Above 6000 (esti.)
Number of Sub-centres for each PHC	6 sub-centres	6 sub-centres
Number of PHCs for each CHC	4 PHCs	3PHCs

Source: Statistical Abstract, GoP, 2020 and Ministry of Health and Family Welfare, 2020-21

Health and Wellness Centers (HWCs)

Ayushman Bharat scheme (2018) aims to deliver comprehensive primary health care (CPHC) by increasing the health system's responsiveness to people, especially the most marginalized groups. For this existing Sub Centers and Primary Health Centers have been transformed into Health and Wellness Centers (HWCs). Assessment of 26 HWCs in the State after a year of operationalisation showed lags in service delivery with half of the centres not performing diabetes screening due to non-availability of testing kits, centres lacking private space and equipment to screen cervical cancer and not even doing follow up of screened positive cases. Most of these centres also lacked diagnostic services, and of the recommended list of 80 drugs only 23 drugs were stocked. These also lacked in the availability of human resources as per the laid norm[4].

Availability of beds in district hospitals

Though each district of the State has a district hospital, these hospitals have a shortage of capacities, human resources, utilization and service delivery and quality issues. According to IPHS norms 2012, there should be an average of 22 beds per one lakh population. Punjab fails to meet this standard with 18 functional beds per lakh population while Kerala and Tamil Nadu meet the norm, with exactly 22 beds. India's average is 24 beds per lakh population (see Table 3 in Annexure).

Inadequacy of health manpower:

Shortfall in the number of public healthcare facilities at the first point of contact for the villagers, and an increasingly higher proportion of shortfall at the higher level,

[4]https://timesofindia.indiatimes.com/city/chandigarh/trouble-plagues-ayushman-bharat-health-centres-in-pb/articleshow/90870243.cms(April16, 2022).

inadequate infrastructure in these facilities should be seen together as creating conditions in which villagers have to depend on private health facilities and a proliferation of private health sector over the years. The population served per doctor in India in 2019 was 1456, against the WHO standard of 1:1000. In Punjab this ratio stands at 1: 988 in the year 2020 (see Table 4 in Annexure). The percentage of district hospitals that met the norm for doctors was 45 per cent in the State, higher than that in Kerala, Tamil Nadu and Maharashtra. Likewise, the percentage of district hospitals in Punjab that meet the norms for nurses in position was very low at 9 percent, whereas that for paramedical staff in position was high at 82 per cent[5].

Low health expenditure in the State

Punjab has the lowest spending on health (0.7 per cent of GSDP) as a percentage of GSDP; In the last three years for which data is available i.e. 2015-16 to 2017-18, health expenditure of the government as a percentage of State gross domestic product has declined from 0.8 per cent to 0.7 percent, and as a percentage of total expenditure has declined from 6.1 percent to 5 per cent. On the other hand, Government of India expenditure as % of GDP was 1.35 per cent in 2017- 18 which was an increase from 1.2% in 2016-17 ; and as the percentage of total government expenditure was 5.12 per cent in 2017-18, an increase from the of 4.4 per cent in 2016-17 (see Table 5 in Annexure).

High out-of-pocket expenditure

Today, self-financing is the largest source of financing for healthcare in the country, which is both regressive and iniquitous. This is a substantial burden, especially for the poorer households. Further, many households are forced to finance these expenses through debt and the sale of assets.

Out-of-pocket expenditure in the State in per capita terms has declined from Rs 4608 in 2016-17 to Rs 2935 in 2017-18. India's average is Rs. 2,097. As a result, OOP expenditure as a percentage of total health expenditure has declined from 77 percent to 69.4 per cent, which is still much higher than the all-India average of 48.8 percent (see Table 6 in Annexure).

[5] Best Practices in the Performance of District Hospitals. NITI Aayog, 2021

Over-reliance on the private sector

Reliance on the private sector –hospitals or private doctors is very high in the State, higher than the other developed States like Tamil Nadu, Kerala and Maharashtra. NSSO data for the year 2017-18 shows that 81 per cent of the cases of ailments being treated in the State are in private institutions while all India average is about 66 per cent and in Tamil Nadu and Kerala it is much less (45 per cent and 51 per cent, respectively). Reliance on informal health providers is also relatively higher in Punjab than in any of these States (see Table 7 in Annexure). The primary reason for not accessing government facilities by the households is dissatisfaction with the quality of services provided in public institutions and the absence of doctors, while other reasons are the preference for a trusted doctor or an institution and long waiting time (see Table 8 in Annexure).

High expenditure on accessing healthcare in private facilities

Medical expenses incurred for treatment during the stay at a public hospital are the highest in the State in rural areas and urban areas. In the case of private hospitals, average expenses incurred are almost three times higher than that in public hospitals. Moreover, rural people in the State end up spending more than urban people in public as well as private hospitals. (see Table 9 in Annexure).

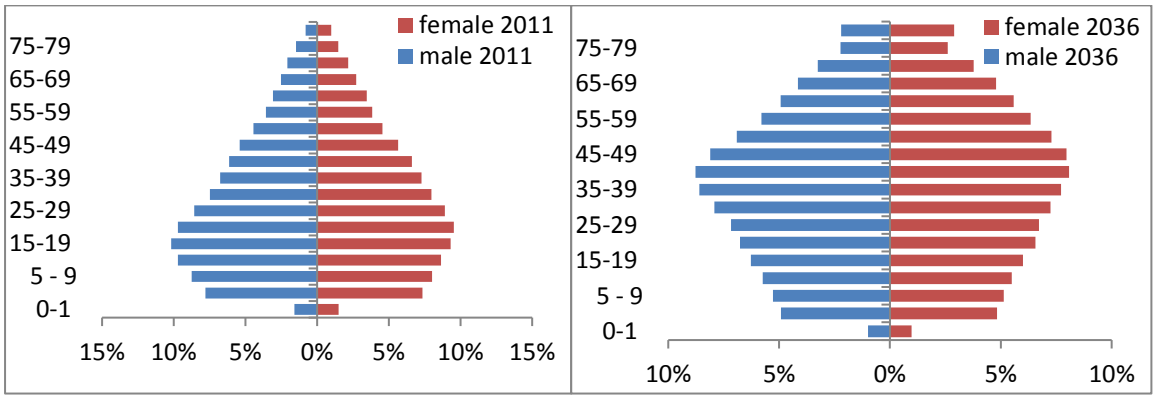
An intriguing aspect of the break-up of hospitalization expenses in rural areas is that the package component forms about 16 per cent of the total expenditure in public hospitals, which is much higher than the national average. Medicines constitute the largest share of about 36 percent. In private hospitals in rural areas, the package component constitutes 29 per cent of the expenditure which is also the highest category of expenditure and higher than the national average (see Table 10.a in Annexure). In urban Punjab, again package component of expenditure during hospitalization in the public sector is the highest, much higher than in rural areas and also higher than the all-India average. In private hospitals also, the package component constitutes about 49 per cent of the total expenditure, again higher than the national average (see Table 10.b in Annexure).

Universalisation of health care

In August 2019, the State launched 'Mahatma Gandhi Sarbat Sehat Bima Yojana' incorporating Pradhan Mantri Jan Arogya Yojana (PMJAY), the Centre's health insurance scheme for the poor, as State's own scheme to cover 46 lakh families which is about 76 per cent of the State's population. Under the scheme, cashless health insurance cover of Rs 5 lakh per year is provided. The Centre and the State government bear the cost of the scheme in the ratio of 60:40. The scheme is implemented through both public and private hospitals.

LONG-TERM HEALTH CHALLENGES: CHANGING DEMOGRAPHIC PROFILE

Population Pyramid for Punjab



Punjab, 2011 Punjab, 2036

Change in demography: implications for the State

India as well as Punjab are undergoing demographic transition. By 2036, there would be a bulge in the population in age groups 25 to 54 years, especially in the age groups 35-45 years. The proportion of the population above 60 years will also be large. By 2047, it is expected that the bulge in the pyramid would shift further up, and there would be a large proportion of the population in the age group of 60 years and above.

Ageing population and its healthcare needs

One of the challenges would be an increasing share of the dependent population, i.e., an increase in dependency ratio. This is also going to be due to low birth and death rates in the State. With the decline in birth rates and death rates, the State will have to focus on geriatric health and diseases related to lifestyle, non-communicable diseases.

There will be an increase in the demand for healthcare workers, healthcare infrastructure and healthcare financing. The State would require health workforce with varied specialization, skills in the use of technology and a high level of elderly care. Additionally, the State has to deal with the increasing cost of health care which is now mostly in the private sector. With a large section of the population employed in the unorganized sector, without any form of social security, the financial implications of providing healthcare to the elderly will be a challenge for the State.

Increasing prevalence of mental health problems

In India, persons with mental illness and their situation are aggravated by socio economic and cultural factors, such as lack of access to healthcare, superstition, lack of awareness, stigma, and discrimination. Among the young and especially, the adolescents' depression, anxiety and behavioural disorders are on the rise. There are various social and environmental determinants of mental health issues among the youth. Similarly, an increasing population of older persons, who are vulnerable to impaired mental health, such as depression, anxiety or dementia, mental health issues are on the rise which requires a pool of trained mental health professionals.

Short-term Strategies: 2030

1. Reduce Maternal Mortality to less than 70/100000 live births, reduce anaemia among women and children: Increase the quality of maternity care, clinical identification of high-risk pregnancies, counselling on the benefits of healthy food and nutrition, increase iron and folic acid supplementation, improve the percentage of births attended by skilled health personal from present 96 (2019-21) to 100%; ensure inclusion of all eligible women for Janani Suraksha Yojana (JSY), to ensure safe deliveries of women from weaker sections; Launch State campaign on nutrition to end severe anaemia; improve health facilities at all levels, to ensure safe delivery of children.
2. Reduce infant mortality rate, under five mortality rate and Neonatal mortality rate: ensuring hospital care available for any emergency; exclusive breastfeeding of newborns and up to 6 months; to enhance capacity for early recognition, management and referral of neonatal and childhood ailments; strengthen the

Rashtriya Bal Swasthya Karyakram (RBSK) so that each child born is examined by a trained person for Defects at birth, Deficiencies, Diseases, Development delays including disability; strengthen ICDS and its various components; ensure free treatment for girl child upto five years of age; increase the % of children (12-23 months) who receive all age appropriate vaccination from 70.5% to 100%; popularize IAP-Immunize India app to send vaccination reminders to parents; free treatment in public hospitals for girls and boys registered at Anganwadi Centres and State Schools.

3. For better health outcomes the State to formulate its health policy that resonates well with the health needs of its people.
4. Strengthen the Jan Aarogya Samitis, Rogi Kalyan Samitis, Village Health Sanitation and Nutrition Committees (VHSNCs), and Mahila Arogya Samitis (MASs), for community participation in management, governance and ensuring accountability, with respect to the provision of healthcare services and amenities; and to promote action on social and environmental determinants of health in communities.
5. Rationalise various components of expenditure in public as well as private hospitals.
6. To facilitate doctors and patients, IT solutions to be introduced and strengthened in government hospitals and health centres like Artificial intelligence, telemedicine, etc. Patients would be referred to specific physician they need, regardless of location. Remote analysis and monitoring services; and electronic data storage to significantly reduce healthcare service costs, save money of patients and insurance companies. Telemedicine hubs are already planned under the hub and spoke model at various medical colleges and district hospitals. This would be expanded to include primary health care centres/Aam Aadmi Mohalla Clinics (AAMC) as well.
7. Institutes of expertise and centres of excellence to be set up at various government medical colleges to provide specialised services in the fields of geriatrics, nephrology, cardiology, urology, ophthalmology etc. Under ECRP scheme, Paediatrics Centres of excellence are being set up at Amritsar and Patiala.
8. Strengthen health management information system to feed into policy making, to capture health information on all health facilities including availability of

manpower, equipment, infrastructure, hospital beds; and services provided, mortality and health surveillance, trainings imparted to medical and paramedical staff etc using IT solutions.

9. Strengthen implementation of eSushrut, an HMIS solution, to provide accurate, real time electronic medical records (EMR) of patients to streamline patient care and perform administrative functions. Such online hospital management solutions shall enhance public perception, transparency, inventory management, appointment management and consultations with doctors.
10. Regulate and organise allied health courses in the State to meet health care needs of the people as well as make youth of the State employable. Allied healthcare council to be set up as per the directions of the GoI.
11. The State to fill vacant positions in public health institutions.
12. Setting up new medical colleges, upgradation of existing colleges and establishment of tertiary cancer care centres.
13. To give further boost to research and development in the field of health care, medical research units have been set up, conducting intra mural and extra mural research projects, post-graduate research projects and international research projects at government medical institutes. These initiatives are to be strengthened to regulate quality research work.
14. Internal and external quality assurance of services like obtaining accreditation from national agencies like NABH, NABL, green ratings of buildings etc.
15. Grievances redressal mechanism to be strengthened with online platform available to citizens 24x7 to lodge grievances related to service delivery.
16. State to increase health expenditure from current 0.7 % of GSDP to 2.5 % in 2025 as proposed in National Health Policy,2017. By 2030, the State will increase its expenditure to 3% of GSDP. Likewise, government sector spending on health to total spending in a year is about 5 % which is to be increased to 8% or more by 2030.
17. Effective management of water-borne and other communicable diseases and to strengthen the capacity of the State health institutions to deal with pandemics like

COVID-19. The State to ensure availability of vaccines and drugs; strengthen community-based monitoring system for outbreak reporting of diseases; strengthening of Integrated Disease Surveillance Project; ensure availability of testing and diagnostic facilities in at each HWC and, ensure better functioning of primary health institutions.

18. Reduce the prevalence of non-communicable diseases through prevention and treatment and promote mental health and well-being: Promotion of physical activity by providing facilities to the community; open space, parks and open gyms; health education for reducing salt, sugar and fat intake, and increasing vegetable and fruit intake; health and nutrition education to become part of school and college education.
19. Reduce the number of deaths and injuries from road traffic accidents: Effective implementation of the Road Safety Policy; availability of ambulance services in each district and block to save on time; improvement in Emergency Services for trauma in all health institutions; adequate walking paths for pedestrians; foot-over bridges; re-designing of certain sections of roads and highways that are black spots for accidents; adjustment of Traffic Aid Post at identified Black Spots in areas; special emphasis on controlling violations like over speeding, Seat Belt, Drink and Drive and not wearing of Helmet.
20. To control substance abuse among people, village level drug control set up to be formed, with Sarpanch, Patwari, Anganwadi worker, community influential, police post-in charge and school principal, with a role in identifying addicts locally, and their suppliers; organize awareness camps; motivate families and addicts to seek treatment; evaluate the performance of de-addiction Centres, PHCs, and Aam Aadmi Mohalla Clinics (AAMC) in the village.
21. Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all; provide health insurance to all eligible households and members.

Long-term Strategies [2047]

1. By 2047, the State to increase its health expenditure to 8-10 percent of its State income. Likewise, government sector spending on health to total spending in a year to be increased to 10 to 12 % by 2047.
2. The State to increase coverage of insurance schemes to include ageing and dependent population and their related diseases and procedures under the scope of the eligible procedures.
3. The State to enhance its capacity in the areas of genomics that has the potential to cure mental illness, Parkinson's disease, cancer etc.
4. Community-based approach to address mental health disorders and health needs of the elderly:
5. In addition to in-patient treatment or hospitalization mode of treatment of substance abusers, the State is to focus on the outpatient mode of treatment by the trained personnel, involving civil society and the non-government sector, and ensure social re-integration of the substance abusers after their treatment.
6. Restructuring of Government Health Institutions has been suggested for a very long time to include only three categories of Primary care centres, First referral units and hospitals and super-speciality hospitals. However, with the launching of Ayushman Bharat health and wellness scheme, comprehensive primary health care, with wider set of services, have been conceived. Sub centres and primary health centres are being converted into HWCs. State to ensure that these are developed according to the norms. In particular, infrastructure facilities and staff for CPH services and medicines to be available at the Primary Care Centres. There should be an emergency ambulance service. Screening and monitoring of mental health issues and issues related to elderly care should be available at this level so that they get treatment close to their home.

   First Referral Units (FRUs): FRUs to be full-fledged diagnostic centres with a range of specialties. Current CHCs and district hospitals are now being converted to act as FRUs. The facilities should follow IPHS code for norms and other facilities.

7. Keeping the future demographic changes and changing disease profile in mind, gaps and vacancies in recruitment of doctors and specialists to be filled effectively. The requirement for additional staff and health care manpower to be met effectively.
8. Various agencies – PHSC, DHS, NHM, State Health Agency are involved in health provisioning in the State. For a holistic approach, to avoid duplication of services, segmentation of treatment and dilution of technical capacity, institutional arrangement of Central and State Ministries which are spread to departments of Health, Family Welfare and Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) to be revamped.
9. Advance the implementation of digital health strategies: The State to promote use of technology in screening, consultation, treatment or referral and follow-up of various diseases, through the development of easy, inexpensive and time-efficient technologies; to develop a strategy based on the principle of all-inclusive, sustainable and multi-stake holder approach, with focus on people and their demands.

Annexure

Table 1:
Institutional cases and deaths due to non-communicable/communicable diseases in Punjab, 2020 and 2019

	2020			2019
Non-communicable	**Total cases**	**Total deaths**	**Cases per lakh pop**	**Cases per lakh pop**
Cardio Vascular diseases	469878	138	1487.06	1279.66
Diabetes Mellitus	297891	52	942.76	811.03
Lungs Disease	244990	47	775.34	681.03
Psychiatric Disorder	66714	6	211.13	191.55
Accidental Injuries	50965	21	161.29	140.27
Road Traffic Accidents	37300	33	118.05	103.3
Neurological Disorders	8766	59	27.74	23.9
Renal Failure	4328	38	13.7	11.91
Obesity	2964	0	9.38	8.85
Snake Bite	1160	5	3.67	3.34
Cancer (Malignant & Benign)	725	2	2.29	1.99
Total	1185681	401	3752.41	3256.83
Communicable Disease				
Acute Respiratory Infection	482968	16	1528.48	1312.47
Acute Diarrheal Diseases	147145	24	465.68	413.42
Enteric Fever	56549	1	178.96	301.25
Viral Hepatitis-C,D,E	11633	1	36.82	33.16
Pneumonia	7423	13	23.49	19.40
Viral Hepatitis-B	2631	0	8.33	6.72
Viral Hepatitis-A	1429	0	4.52	3.96
Chicken Pox	51	0	0.16	0.00
Diphtheria	0	0	0	0.12
Total	709829	55	2246.44	2090.50

Source: Statistical Abstract of Punjab, 2020& 2019

Table 2:
A Shortfall in Health Infrastructure Against the Requirement, 2019

Table. Selected State-wise Sub Centres, Primary Health Centres, and CHCs in position against the requirement, as on 1st July, 2019												
State/ UT	Sub Centres				PHCs				CHCs			
	Required	In Position	Shortfall	% Shortfall	Required	In Position	Shortfall	% Shortfall	Required	In Position	Shortfall	% Shortfall
Haryana	3460	2604	856	25	576	379	197	34	144	115	29	20
Himachal Pradesh	1366	2089	*	*	225	586	*	*	56	87	*	*
Odisha	8382	6688	1694	20	1345	1288	57	4	336	377	*	*
Punjab	3562	2950	612	17	593	416	177	30	148	89	59	40
Karnataka	8028	9758	*	*	1318	2127	*	*	329	198	131	40
Kerala	2340	5380	*	*	388	848	*	*	97	227	*	*
Maharashtra	14112	10668	3444	24	2299	1828	471	20	574	364	210	37
Tamil Nadu	7355	8713	*	*	1222	1422	*	*	305	385	*	*
Uttar Pradesh	34726	20782	13944	40	5781	2936	2845	49	1445	679	766	53
West Bengal	13226	10357	2869	22	2177	908	1269	58	544	348	196	36
All India	**189765**	**157411**	**43736**	**23**	**31074**	**24855**	**8764**	**28**	**7756**	**5335**	**2865**	**37**

Notes: The requirement is calculated using the prescribed norms on the basis of rural population estimation for mid year for the year 2019. All India shortfall is derived by adding State-wise figures of shortfall ignoring the existing surplus in some of the States. Mid-year Tribal population for the year 2019 calculated based on the percentages of Tribal population in the Rural areas in Census 2011) R: Required; P: In Position; (S: Shortfall; *: Surplus. N App- Not Applicable
Source: https://pib.gov.in/PressReleasePage.aspx?PRID=1606704, accessed on 6.11.2020.

Table 3:
Number and percentage of best practices in the performance of district hospitals in states, meeting IPHS norms for medical and paramedical staff

State/UT	Total number of district hospitals assessed	District hospitals that met IPHS norms for positioned doctors		District hospitals that met IPHS norms for positioned staff nurses		District hospitals that met IPHS norms for positioned paramedical staff	
		Total hospitals	Percentage of hospitals	Total hospitals	Percentage of hospitals	Total hospitals	Percentage of hospitals
Punjab	22	10	45.45	2	9.09	18	81.82
Tamil Nadu	32	6	18.75	0	0	14	43.75
Maharashtra	25	11	44.00	7	28.0	15	60.00
Kerala	21	6	28.75	1	4.76	7	33.33
All India	707	189	26.73	88	12.45	399	56.44

Source: Best Practices in the Performance of District Hospitals. NITI Aayog (2021).

Table 4:
Health facilities across Districts of Punjab

Districts	Population served per institution	Population served per bed	Population served per Doctor	Population served per Midwife	Population served per Nurse
Gurdaspur	6331	1848	999	260	256
Pathankot	8339	2001	3558	5015	7603
Amritsar	11254	894	644	679	439
Tarn Taran	6915	1915	11608	777	352
Kapurthala	7071	1429	1082	1090	145
Jalandhar	8636	1733	688	583	441
S.B.S. Nagar	5151	1646	2148	1453	230
Hoshiarpur	5456	1352	952	540	385
Rupnagar	6394	1212	808	320	288
S.A.S. Nagar	11337	2301	1873	699	429
Ludhiana	10820	3057	741	475	345
Firozpur	7349	2297	1036	353	244
Fazilka	8267	2192	4879	1039	2327
Faridkot	8096	828	486	218	213
Shri Muktsar Sahib	7633	1941	3009	1055	377
Moga	7077	2438	3079	489	303
Bathinda	8327	1935	849	534	714
Mansa	6711	2130	2104	238	319
Sangrur	7335	1943	1318	494	649
Barnala	7179	1526	2674	740	304
Patiala	8298	920	535	1068	63
Fatehgarh Sahib	6512	1559	3004	1999	301
Punjab	7916	1595	988	537	347

Source: Statistical Abstract of Punjab, 2020

Table 5:
Government health expenditure (GHE) as a percentage of State income and total government expenditure

	As % GSDP			as % of Govt. Expd.		
	2015-16	**2016-17**	**2017-18**	**2015-16**	**2016-17**	**2017-18**
Assam	1.5	1.3	1.6	7.5	6	7.5
Andhra Pradesh	1.0	1	0.9	5.3	5.4	5.3
Bihar	1.2	1.4	1.4	4.4	4.7	5.0
Gujarat	0.8	0.8	0.8	6.5	7.2	7.0
Haryana	0.6	0.7	0.6	4.6	4.8	4.6
Karnataka	0.8	0.8	0.7	6	5.7	5.5
Kerala	1.0	1.2	1.1	6.6	7.4	7.3
Madhya Pradesh	1.1	1	1.1	4.9	4.3	4.9
Maharashtra	0.7	0.7	0.7	6.3	6.2	6.1
Odisha	1.0	1.3	1.2	4.4	5	5.7
Punjab	0.8	0.8	0.7	6.1	5.7	5.0
Rajasthan	1.2	1.1	1.2	6.2	5.9	6.3
Tamil Nadu	0.8	0.8	0.8	5.9	5.7	6.5
Uttar Pradesh	1.3	1.3	1.2	5.2	5.5	5.8
West Bengal		1	1		6	6.5
Source: NHA, MoHFW, various years						

Table 6:
Per capita Out-of-pocket expenditure (OOPE) and as a percentage of total health expenditure in Punjab

	per capita (in Rs)			As% of THE		
	2015-16	2016-17	2017-18	2015-16	2016-17	2017-18
Assam	1315	1378	883	55.1	53.8	35.9
Andhra Pradesh	3097	3322	3102	74.7	72.2	67.0
Bihar	1776	1830	808	79.9	77.6	58.2
Gujarat	1681	1781	1551	50.4	48.1	43.9
Haryana	2427	2564	2181	59.5	56.6	50.4
Karnataka	2447	2548	1549	49.6	49.2	34.2
Kerala	5111	5419	6363	71.3	67.0	68.7
Madhya Pradesh	1879	1944	1364	70.1	68.9	56.3
Maharashtra	2788	2956	2570	58.9	56.7	49.1
Odisha	2693	2796	1750	71.5	68.9	55.9
Punjab	4332	4608	2935	77.4	77.3	69.4
Rajasthan	1818	1934	1688	56.4	56.7	49.6
Tamil Nadu	2829	2938	1817	65.2	62.1	45.9
Uttar Pradesh	2469	2597	2393	76.5	74.8	72.6
West Bengal		3169	3115		74.1	69.8
Source: NHA, MoHFW, various years						

Table 7:
Percentage break-up of ailments treated on medical advice by the healthcare service provider, separately for a few States and all-India

	Healthcare service provider	% of ailments receiving care		
		rural	urban	All
Punjab	Government/public hospital	13.2	16.9	14.5
	Charitable/trust/NGO-run hospital	2.4	1.7	2.2
	Private hospital	24.8	30.7	26.8
	Private doctor/in private clinic	56.3	49.6	54.0
	Informal health care provider	3.1	1.1	2.5
Kerala	Government/public hospital	51.8	41.7	47.5
	Charitable/trust/NGO-run hospital	1.5	1.3	1.4
	Private hospital	31	31.8	31.4
	Private doctor/in private clinic	15.7	24.7	19.5
	Informal healthcare provider	0	0.4	0.2
Maharashtra	Government/public hospital	29.1	22.1	25.2
	Charitable/trust/NGO-run hospital	1.9	1.9	1.9
	Private hospital	27.7	22.7	24.9
	Private doctor/in private clinic	41.1	53.0	47.7
	Informal healthcare provider	0.2	0.2	0.3
Tamil Nadu	Government/public hospital	63.3	40.6	54.0
	Charitable/trust/NGO-run hospital	0.1	1.5	0.7
	Private hospital	27.1	44.9	34.3
	Private doctor/in private clinic	8.8	13.0	10.5
	Informal healthcare provider	0.7	0.1	0.4
All India	Government/public hospital	32.5	26.2	30.1
	Charitable/trust/NGO-run hospital	0.9	1.3	1.1
	Private hospital	20.8	27.3	23.3
	Private doctor/in private clinic	41.4	44.3	42.5
	Informal healthcare provider	4.3	0.9	3.0
Source: NSS 75th round				

Table 8:
Reasons for not availing government facility for hospitalization cases, 2017-18

	Rural			Urban		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
Required specific services not available	18.67	11.89	13.99	11.67	9.00	10.05
Service available but quality not satisfactory/doctor not available	33.24	43.72	40.47	27.42	27.17	27.27
Quality satisfactory but facility too far	8.61	3.82	5.31	5.46	3.50	4.27
Quality satisfactory but involves long waiting	9.67	8.66	8.97	22.81	16.38	18.91
Financial constraint	0.96	0.00	0.30	-	-	-
Preference for a trusted doctor/hospital	25.78	25.70	25.72	22.54	34.07	29.53
Others	3.08	6.20	5.23	10.10	9.87	9.96
	100	100	100	100	100	100
Source: NSS 75th round, unit records						

Table 9:
Average medical expenditure incurred for treatment during the stay at the hospital per case of hospitalization, for major States, (excluding hospitalisation for childbirth), 2017-18

	hospitalization in								
	Public hospitals			Private hospitals			All (incl. NGO, trust-run)		
	Rural	**Urban**	**All**	**Rural**	**Urban**	**All**	**Rural**	**Urban**	**All**
Andhra Pradesh	1453	1208	1358	22415	32847	25692	16717	22479	18665
Bihar	4064	4027	4061	16479	25052	17518	11595	17861	12298
Gujarat	1151	3529	1936	25027	29281	27361	14924	22418	18530
Haryana	7242	7215	7236	26346	34109	29458	19177	30337	23107
Karnataka	3445	4195	3624	17085	31462	23149	12768	26575	17900
Kerala	4395	4589	4469	25949	32746	28775	17054	22123	19109
Madhya Pradesh	2093	2030	2073	25086	31094	27037	14325	17365	15278
Maharashtra	5606	7189	6177	23821	42540	32566	19383	36612	27096
Odisha	5098	6698	5283	29974	33935	30947	11159	18748	12295
Punjab	15093	10293	13277	40303	37502	39208	31805	29338	30869
Rajasthan	7332	6707	7174	25788	35228	28226	16268	20824	17435
Tamil Nadu	520	433	485	28412	41566	35581	12362	23260	17570
Uttar Pradesh	6914	10239	7765	29768	40706	33071	23144	33339	26089
West Bengal	2726	3954	3061	45023	57549	50380	13310	25235	17141
All-India	4290	4837	4452	27347	38822	31845	16676	26475	20135
Source: NSSO 75th round report									

Table 10.a:
Percentage break-up of hospitalization expenses incurred for treatment during the stay at the hospital, by major States, for public and private hospitals, Rural Punjab, 2017-18

Type of hospital	Public						Private					
	Package component	doctor's/ surgeon's fee	medicines	Diagnostic Tests	Bed charges	other	Package Component	doctor's/ surgeon's fee	medicines	Diagnostic Tests	Bed charges	other
Andhra Pradesh	16.5	6.4	46.6	15.7	2.1	12.7	14.4	23.4	25.9	14.4	14.6	7.3
Haryana	9.2	7	48.7	13.8	2.1	19.2	21.7	16.8	24.3	11	15.7	10.6
Kerala	7.4	7.6	41.2	23.7	5.8	14.3	17.1	19.5	25.4	11.5	12.8	13.6
Maharashtra	7.9	8.5	41.5	21.6	8.6	11.8	15.6	23.7	28.5	9.5	14.2	8.5
Punjab	15.8	3.8	35.6	26.6	5.6	12.6	29.2	19.7	22.3	9.5	10.9	8.3
Tamil Nadu	1.8	0.8	26.5	32.1	3.6	35.2	20.7	27.7	21.3	8.7	13.8	7.8
All-India	9.9	4	51.8	18.6	2.7	12.9	24.2	19.5	24.9	10.2	12.3	8.7

Source: NSSO 75th round report

Table 10.b:
Percentage break-up of hospitalization expenses incurred for treatment during the stay at the hospital, by major States, for public and private hospitals, Urban Punjab, 2017-18

Type of hospital	Public						Private					
	package component	doctor's/ surgeon's fee	medicines	diagnostic tests	bed charges	other	package component	doctor's/ surgeon's fee	medicines	diagnostic tests	bed charges	other
Andhra Pradesh	0	4.3	53.9	23.9	1.7	16.2	23.6	23.3	21.8	13.2	12.2	5.8
Haryana	21.7	2.9	37.2	13.4	4.3	20.4	34.1	17.1	16.9	9.6	13.5	8.7
Kerala	4.3	2.8	47.4	23.2	4.6	17.7	16.7	16.8	23.6	12.1	17.7	13.1
Maharashtra	35.4	5	35.2	10.9	3.8	9.7	29.5	22.5	17.4	9.9	14	6.7
Punjab	39.9	2.2	27.2	14.5	2.3	13.8	48.7	11.8	16.3	7.5	8.4	7.3
Tamil Nadu	0	2	23.4	38.5	0.3	35.8	47.9	17.2	16.4	5.9	8	4.6
All-India	17.9	4.1	43.4	15.9	3.1	15.6	39.6	16.2	18.1	8.8	10.8	6.6

Table 11:
Health Sector schemes in Punjab

Sr. No.	Schemes	Grant Released by FD (2019-20) Rs. In lakhs		
		SS	CS	Total
1	Grant - in -aid to State Health Society AYUSH (AY12)	400.00	600.00	1000.00
2	Grant - in -aid to State Health Society AYUSH (HM21)	160.00	240.00	400.00
3	National Rural Health Mission (NRHM)	37494.69	28743.89	66238.58
4	Implementation of Emergency Response Services in the State	4100.00	0.00	4100.00
5	Matching Grant to State Blood Transfusion council under the AIDS Control Society	220.00	220.00	440.00
6	National Urban Health Mission (NUHM)	3163.42	4745.13	7908.55
7	Punjab Urban Health Infrastructure (DHS-0-0 10,11,13,15 and 25) (Civil works +Equipment) (ACA2011-12)	1088.75	0.00	1088.75
8	Seed Corpus of Cancer Relief Fund	5000.00	0.00	5000.00
9	Up gradation / Strengthening of Nursing Services in the State	1.00	0.00	1.00
10	National Programme of Health Care of Elderly	460.00	690.00	1150.00
11	National Programme For Prevention and Control of Cancer Diabetes, Cardiovascular Disease and Strokes (NPCDCS)	460.00	690.00	1150.00
12	Bhagat Puran Singh Medical Insurance Scheme for poor people	1.00	0.00	1.00
13	Creation of Cancer and Drug addiction Treatment Infrastructure	1000.00	0.00	1000.00
14	Opreationalization of State Radiation Safety Agency in the State	15.00	0.00	15.00
15	Setting up of food and drug authority	1.00	0.00	1.00
16	Manpower development under national mental hospital Amritsar	1.00	277.76	278.76
17	National health protection Scheme	6000.00	0.00	6000.00
18	Setting up of health and wellness clinics	2250.00	0.00	2250.00
19	Setting up of Trauma Care Center on Important National Highways in the State	2000.00	0.00	2000.00
20	Sarbat Sehat Bima Yojana	10000.00	15000.00	25000.00
21	Upgradation of infrastructure in Government Medical College and Hospital (Patiala)	17168.05	0.00	17168.05
22	Upgradation of infrastructure in Government Medical College and Hospital (Amritsar)	2973.21	0.00	2973.21
23	Setting up of AIIMS like institute in the State	937.91	0.00	937.91
24	Upgradation of Existing State Government Medical College for Increasing MBBS Seats (Amritsar)	299.78	400.00	699.78
25	Upgradation of Existing State Government Medical College for Increasing MBBS Seats (Patiala)	0.00	418.09	418.09
26	Burn Unit at Government Medical College Patiala and Faridkot	166.26	249.41	415.67
27	Upgradation of Infrastructure in Govt Dental Colleges and Hospital(Amritsar and Patiala)	601.00	0.00	601.00
28	Establishment of Guru Ravi Das Ayurvedic University (Hoshiarpur)	170.00	0.00	170.00
29	Tertiary Care Cancer Center	1691.76	2473.64	4165.40
30	Nutrition ICDS (50%of actual expenditure reimburses by GoI) (SNP)	7000.00	7000.00	14000.00

Sr. No.	Schemes	Grant Released by FD (2019-20) Rs. In lakhs		
		SS	CS	Total
31	Rajiv Gandhi Scheme for Empowerment of Adolescent Girls (RGSEAG) (SABLA)	306.98	348.02	655.00
32	Integrated Child Development Services Scheme (Shifted from Non Plan)	40549.36	18778.29	59327.65
33	Integrated Child Development Services Scheme (Shifted from Non Plan)	109.16	163.74	272.90
34	National Nutrition Mission	2132.40	8529.56	10661.96
35	National Creche Scheme for the Children of Working Mothers	70.76	106.14	176.90
36	Swach Bharat Abhiyan (Gramin)	0.00	3000.00	3000.00
37	Swach Bharat Abhiyan (Gramin) (Incentive Fund)	0.00	7000.00	7000.00
38	Swach Bharat Mission (Urban)	2869.20	5179.80	8049.00
39	Setting up of spinal Injuries Centre at Mohali	200.00	0.00	200.00
40	Niramaya - State Govt's Contribution towards Health Insurance Scheme for the Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disability	1.00	0.00	1.00
41	Mission Tandrust Punjab	1200.00	0.00	1200.00
42	Construction of 8 New Maternal and Child Health wings at Sub -Divisional hospitals of Talwandi Sabo, Nabha, Patti and Derabassi, District Hospitals of Muktsar and Gurdaspur and CHC's of Bhawanigarh and Raikot	6500.00	0.00	6500.00
43	Completion of the construction work of the 9 Maternal and Child Health Wings	5700.00	0.00	5700.00
44	Additional beds at the existing MCH wings at District Hospital of Ludhiana, Faridkot, Hoshiarpur, Bathinda and Barnala with a target of completing atleast 50% by March 2022	5500.00	0.00	5500.00
45	Construction of 3 new Drugs warehouses of 1500 sqm each of the MCH Wings in Hoshiarpur, Ferozpur and Sangrur	1100.00	0.00	1100.00
46	Mukh Mantri Punjab Cancer Rahat Kosh Scheme	15000.00	0.00	15000.00
47	Upgradation of Health Infrastructure	10000.00	0.00	10000.00
48	New Medical College and Hospital namely sri Guru Nanak Dev State Institute of Medical Sciences at Kapurthala and shaheed Udham Singh State Institute of Medical sciences at Hoshiarpur	8000.00	0.00	8000.00
49	Poshan Abhiyan	5300.00	0.00	5300.00
50	Maternity Benefit Programme	2741.73	572.60	3314.33
	TOTAL	**212104.42**	**105426.07**	**317530.49**

Source: Punjab 2030 - SDG wise Strategic Roadmap, UNDP

HEALTH INFRASTRUCTURE AND PROVISIONING: TARGETS AND STRATEGIES

1. Reduce maternal mortality rate and anemia among women				
Indicator	**Current status/Base line**	**Target 2030**	**Target 2047**	**Strategies**
Maternal mortality ratio	114	70	20	Increase the quality of maternity care, clinical identification of high-risk pregnancies; counselling on the benefits of healthy food and nutrition, increase iron and folic acid supplementation, improve the percentage of births attended by skilled health personal from present 96 (2019-21) to 100%; ensure inclusion of all eligible women for Janani Suraksha Yojana (JSY), to ensure safe deliveries by women from weaker sections; Launch State campaign on nutrition to end severe anemia; Improve health facilities at all levels, to ensure the safe delivery of child.
Percentage of women of reproductive age (15 – 49 years) with anemia	58.70%	30%	5%	
Source: SRS Bulletin, March 2022; National Family Health Survey -5 (2019-21)				

2. End preventable deaths of new borns and children under 5 years of age				
Indicator	**Current status /Base line**	**Target 2030**	**Target 2047**	**Strategies**
Neonatal mortality rate	21.8	12	5	Every birth to be attended by a skilled provider (from present 96 %); ensuring hospital care available for any emergencies; exclusive breastfeeding of newborns and up to 6 months; to enhance capacity for early recognition, management and referral of neonatal and childhood ailments; strengthen Rashtriya Bal Swasthya Karyakram (RBSK) so that each child born is examined by a trained person for Defects at birth, Deficiencies, Diseases, Development delays including disability; strengthen ICD and its various components; ensure free treatment for girl child upto five years of age; increase the % of children (12-23 months) who receive all age appropriate vaccination from 70.5% to 100%; popularize IAP-Immunize India app to send vaccination reminders to parents; free treatment in public hospitals for girls and boys registered at Anganwadi Centres and State Schools.
Infant Mortality rate IMR	28	Reduce by 30 %	Reduce by 70 %	
Under 5 mortality rate U5M	33	25	10	
Source: National Family Health Survey -5 (2019-21)				

3. Manage and reduce prevalence of non - communicable diseases through prevention and treatment and promote mental health and well being				
Indicator	**Current status/Base line**	**Target 2030**	**Target 2047**	**Strategies**
Prevalence of hypertension among women age 15-49 years	18.8	Reduce by 1/3	Reduce and manage	Promotion of physical activity by providing facilities to the community; open space, parks and open gyms; Health education for reducing salt, sugar and fat intake, and increasing vegetable and fruit intake; Health and nutrition education to become part of school and college education; establishing NCD clinic and Critical Care Unit in each district hospital; Capacity building for the early management of complications; strengthening HWCs at SC and PHC/Aam Aadmi Mohalla Clinics (AAMC) level to promote wellness among population; drug availability at all health facilities including at sub-centre; IT enabled patient-based records at HWCs; to strengthen referral linkages between SC, PHC/ Aam Aadmi Mohalla Clinics (AAMC), CHC, DH, and MC; improve monitoring and follow up services to deal with non-communicable diseases.
Prevalence of hypertension among men age 15-49 years	26.9	Reduce by 1/3	Reduce and manage	
Prevalence of hypertension among men age 15-54 years	29.9	Reduce by 1/3	Reduce and manage	
Prevalence of diabetes among women (age 15-49) %	2.18	Reduce by 1/3	Reduce and manage	
Prevalence of diabetes among men (age 15-49) %	1.40	Reduce by 1/3	Reduce and manage	
Mental Health issues	Database to be generated at the level of each HWC	Screening and treatment to be functional in each HWC	screening and management	The State to promote a community-based approach to promote mental health and handle mental health disorders. Community members to be trained in providing care in homes and in close coordination with the specialised health professional at HWCs. Along with allopathy, other systems of medicine like Ayurveda to be promoted; setting up Ayurvedic wellness centres.
Geriatric health	Database to be generated at the level of each HWC	Screening and treatment to be functional in each HWC	screening and management	
Source: National Family Health Survey -5 (2019-21)				

4. Prevalence of injuries from road traffic accidents				
Indicator	**Current status/ Base line**	**Target 2030**	**Target 2047**	**Strategies**
Road traffic accidents incidence per 1,00,000 population	118.05	Reduce by 5%	Reduce by 20%	Effective implementation of the Road Safety Policy; availability of ambulance services in each district and block to save on time; improvement in Emergency Services for trauma in all health institutions; procurement and maintenance of Road Safety Gadgets for the State Police; Strengthening of Highway Patrolling; maintenance of road infrastructure; Strengthening public transport; adequate walking paths for pedestrians; foot-over bridges; re-designing of certain sections of roads and highways that are black spots for accidents; adjustment of Traffic Aid Post identified Black Spot in areas; special emphasis on controlling violations like over speeding, Seat Belt, Drink and Drive and Helmet. For detailed strategy on road safety see section on Infrastructure.
Source: Statistical Abstract, Govt. of Punjab, 2020				

5. End the epidemics of AIDS, tuberculosis, and other communicable diseases				
Indicator	**Current status/Base line**	**Target 2030**	**Target 2047**	**Strategies**
New HIV infections	1350	Reduce to 1/2	No new infections	Continuation of awareness generation programmes to bring a change in knowledge, attitudes and behaviour
AIDS prevalence rate among 15-49 years (adult prevalence rate	0.27%	Reduce by 1/2	No new case	Strengthening NACP in the State through intensifying and consolidating prevention services; increasing access to and promoting comprehensive care, support and treatment; building capacities at district and facility level; Strengthening testing facilities and maintaining data base.
Tuberculosis incidence per 1,000 population	196	Reduce by 1/2	No new case of T.B	Increased testing and detection of TB, HIV and Co-infection; The State to ensure availability of vaccines and drugs; strengthen community-based monitoring system for outbreak reporting of diseases (Alert Villages); strengthening of Integrated Disease Surveillance Project; Strengthen the capacity of the State health institutions; ensure availability of testing Laboratory and diagnostic facilities in each HWC , Availability of hospital beds and infrastructure in district hospitals ; Well integrated information system on availability of beds, medicines, manpower and infrastructure.
Acute Respiratory infections per 1000 population	15.28	Reduce by 1/2	Manage to reduce mortality	
Acute Diarrheal infections per 1000 population	4.66	Reduce to zero	Manage to reduce mortality	
Other epidemics like Covid-19	Data to be maintained at the district level			
Source: Sankalak : Status of National AIDS Response (2021); UNDP, 2021-22; and Statistical Abstract, GoP, 2020				

6. Prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol				
Indicator	**Current status/Base line**	**Target 2030**	**Target 2047**	**Strategies**
Alcohol consumption/ dependency ,Men	27.50%	Reduce by half	Reduce by 3/4th	To control substance abuse among people, village level drug control set up to be formed, with Sarpanch, Patwari, Anganwadi worker, community influential, police post-in charge and school principal, with a role in identifying addicts locally, and their suppliers; organize awareness camps; motivate families and addicts to seek treatment; Database to be maintained at the community level. Evaluate the performance of de-addiction Centres and PHCs/ Aam Aadmi Mohalla Clinics (AAMC) in the village. Rehabilitation and reintegration into the society.
Alcohol consumption/ dependency ,Women	0.10%	Reduce by half	Reduce by 3/4th	
Dependency on cannabis	12.55%	Reduce to half	Reduce to negligible	
Dependency on Opioids	9.69%	Reduce to half	Reduce to negligible	
Dependency on Sedatives	4.25%	Reduce to half	Reduce to negligible	
Dependency on Cocaine	0.66 %	Reduce to half	Reduce to negligible	
People who inject drugs	88165	Significantly reduce	Reduce to negligible	
Source: National Family Health Survey -5, 2019-21 and MoSJ&E, GoI,2019.				

7. Ensure universal access to sexual and reproductive healthcare services including family planning				
Indicator	**Current status/Base line**	**Target 2030**	**Target 2047**	**Strategies**
Unmet need for family planning	9.9%	5%	0%	State to undertake social and behavioural change campaigns with State's peculiarity in mind, to address social norms, harmful practices like son preference and female deselection; and increase male engagement in family planning.
Total fertility rate	1.6	2.1	2.1	
Couple protection rate	50.5	75	100	
Source: National Family Health Survey -5 2019-21.				

8. Health expenditure, Health Infrastructure and manpower				
Indicator	**Current status/Base line**	**Target 2030**	**Target 2047**	**Strategies**
Per capita health expenditure	Rs. 1086 (2017-18)	Corresponding to budget &GSDP	Corresponding to budget &GSDP	
Government health expenditure as a percentage of GSDP	0.7 %	2.5 %	5%	The State to have its own Health Policy with emphasis on its own needs
State sector health spending to total spending	5%	8%	12%	The State to rationalize hospitalization expenses, medicine, and user charges
Doctors / 1000 population	1.02	2	4	The State to increase the number of MBBS seats in medical colleges; State to devise recruitment and promotion policies to fill in vacant positions.
Nurses/1000 population	2.79	4	11	
Pharmacists/ 1000 population	1.57	2	Four times	
Ancillary health workers/1000 population	1.92	Double	Four times	allied health courses to be regulated and organized
Sub centres (shortfall in %)	17 (2019)	Reduce to zero	Maintain and upgrade	To minimize the burden on secondary and tertiary health infrastructure, State to construct Primary health centres at the community level, so that services are provided close to the community and free of cost
Public Health Centres (shortfall in %)	30 (2019)	Reduce to zero	Maintain and upgrade	State to upgrade SC and PHC/ Aam Aadmi Mohalla Clinics (AAMC) into HWC to provide CPHC services.
Sources: NHA, MoHFW, 2021; Statistical Abstract, GoP, 2020 and National Health Profile, 2021.				

SECTION VI

WELFARE

I. Achieving Gender Equality

ACHIEVING GENDER EQUALITY

Gender equality is essential for human rights since it provides equal rights, life prospects, opportunities, and power to protect human life and build human capability. Gender relations based on male dominance manifest itself in the social, political, cultural and economic institutions, with unequal distribution of resources, opportunities, roles and responsibilities between men and women. Due to their cultural and social placement, women are confronted with threats of violence across their life cycle, in both domestic and public arenas. Inequalities faced by women can begin right at birth and haunt them all their lives. In many societies, girls are deprived of access to health care or proper nutrition, leading to a higher mortality rate.

Further, females are expected to take care of the domestic chores and live under social controls, while men are expected to be the breadwinners. 'A higher proportion of females than males are malnourished, underpaid, and abused (95.6 per cent of GBV is targeted at women in Punjab' (Dagar 2015)[1]. Domestic violence remains the most pervasive form of violence, having an enormous impact on women's physical and psychological health. At work, women face sexual harassment, property inheritance by daughters results in a backlash, and exercising choice in conjugal ties against family or identity norms may result in honour killing.

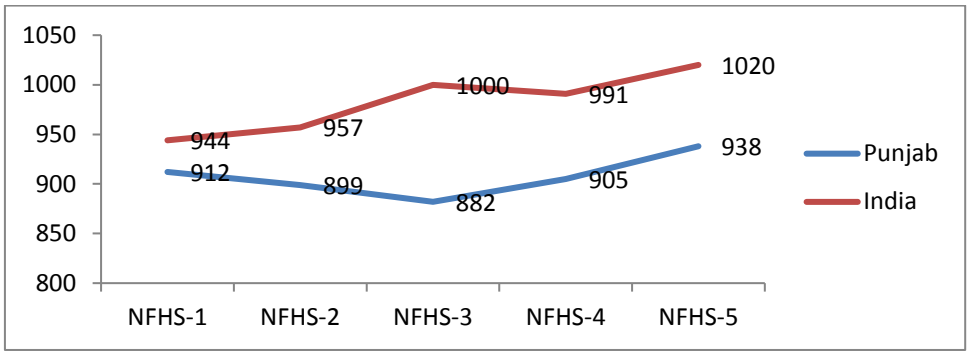
Most often, gender is defined by a dichotomous variable as binary (male/female or man/woman); however, it also includes categories outside this binary, i.e., non binary, an umbrella term for gender identities that lie outside the gender.

Current Status

Adverse Sex and Child Sex Ratio: Census data reflects that there have been lesser number of women than men in Punjab, divergent to the biological pattern. Whilst some States in India have recorded fewer women in different age groups over the century, Punjab has been consistent in this imbalance since the first census in 1881, with a sex ratio of 844. In 2011 census, it remained among the lowest at 895, with the Indian average at 943. NFHS-5 data reflects an improved sex ratio in Punjab, i.e., from 912 to 938;

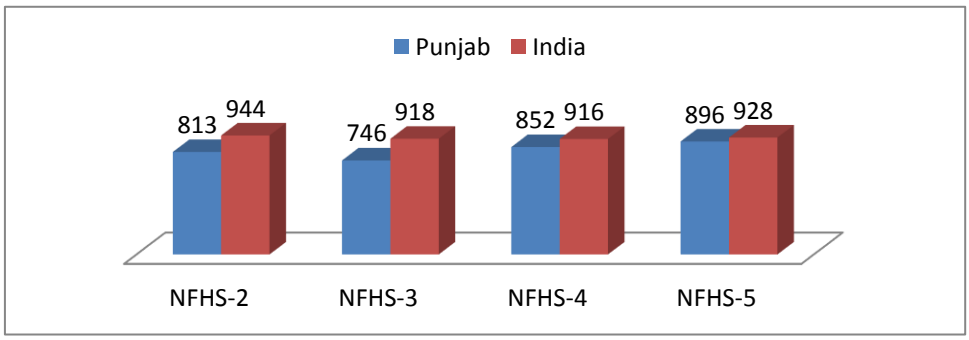
[1]Dagar, R. (2015). *Culturally sensitive gender responsive: Indicators on gender-based violence.* International Development Research Centre (IDRC) and Institute for development and Communication (IDC) Chandigarh.

Figure 1: Sex Ratio



Source: Compiled from NFHS for the various years

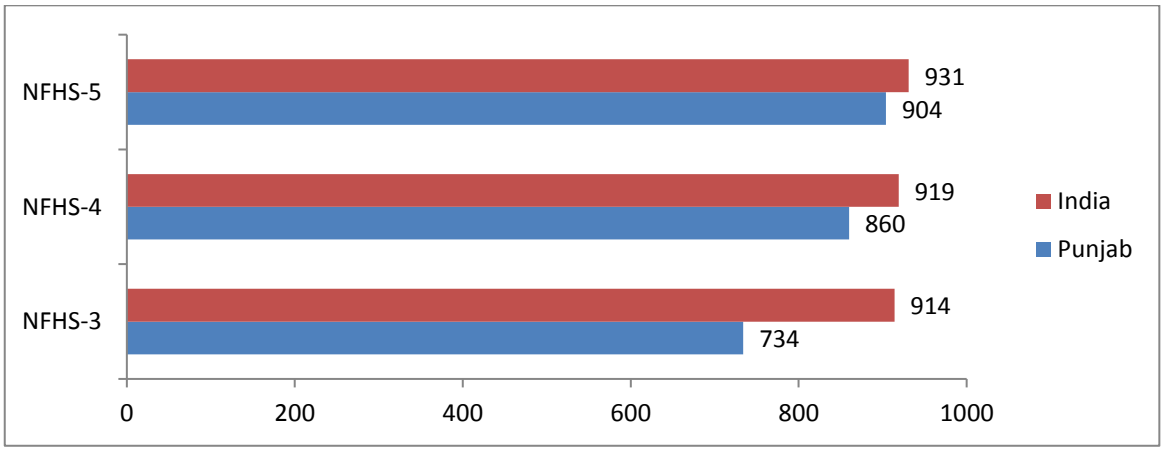
Figure 2: Child Sex Ratio



Source: Compiled from NFHS for the various years

Undoubtedly, the campaign for the girl child protection, social security schemes and improved health facilities have enhanced the survival chances of the girl child as attested by better SRB, decrease in gap in Infant Mortality Rates (IMR) and higher female immunization rates. The child sex ratio of Punjab has increased from 813 to 896; however, it is still low as compared to the national average. Similarly, low trends can be observed in the Punjab sex ratio at birth, i.e., 904 (NFHS- 5).

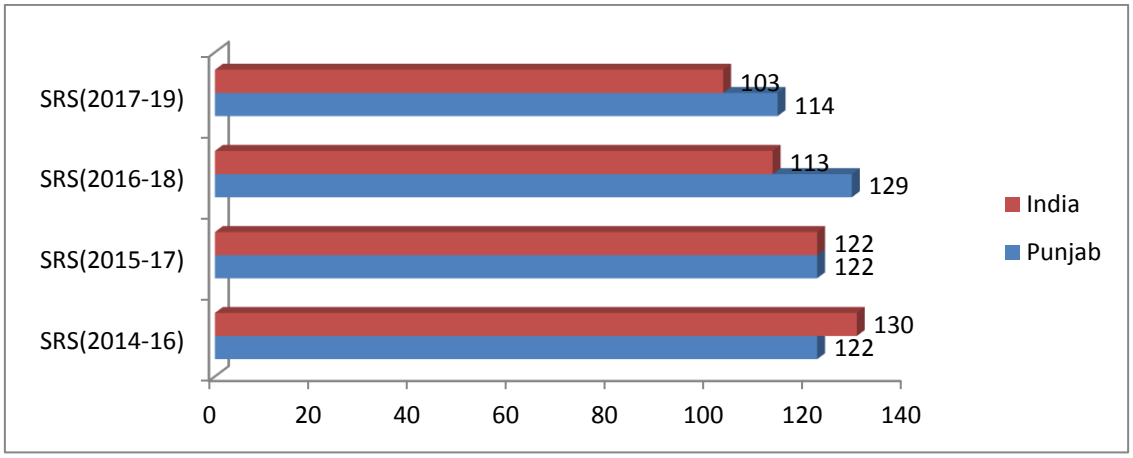
Figure 3: Sex ratio at Birth



Source: Compiled from NFHS for the various years

Health Challenges in Punjab

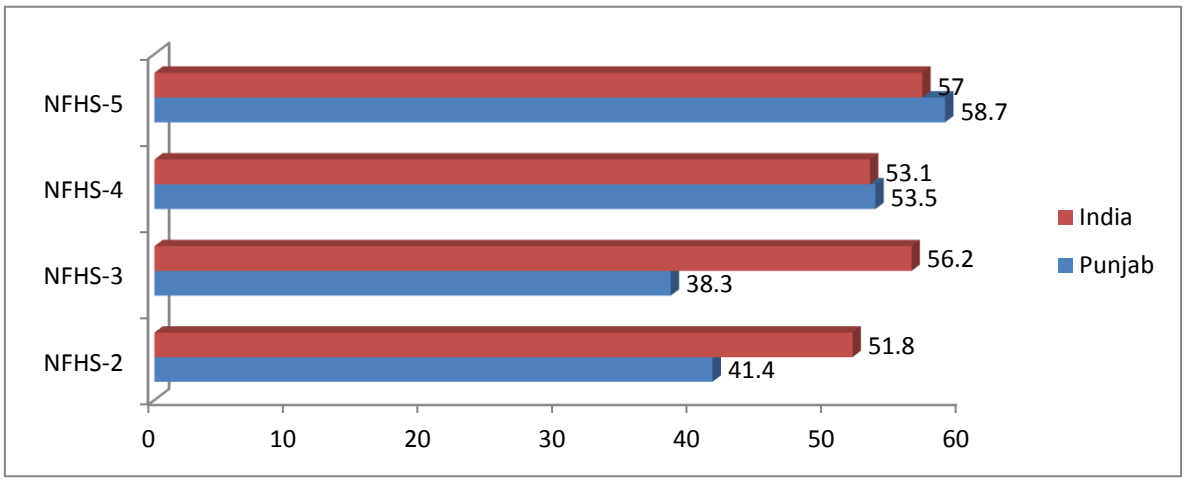
Figure 4: Maternal Mortality Ratio



Source: Sample registration survey, census of India for the various years

Maternal mortality ratio in Punjab is 114, which is much higher than the rate in some of the other developed States. (SRS Bulletin, March 2022). One of the major impediments for high maternal mortality ratio is the early marriage of girls. NFHS data reflect that 8.70% of girls are married before the age of 18 years. Anaemia is another major health concern in the State. Anaemia among women has increased by five percentage points since NFHS-4 (i.e., 53.5 to 58.7).

Figure 5: Anaemia among women in the age group 15-49



Source: Compiled from NFHS for the various years

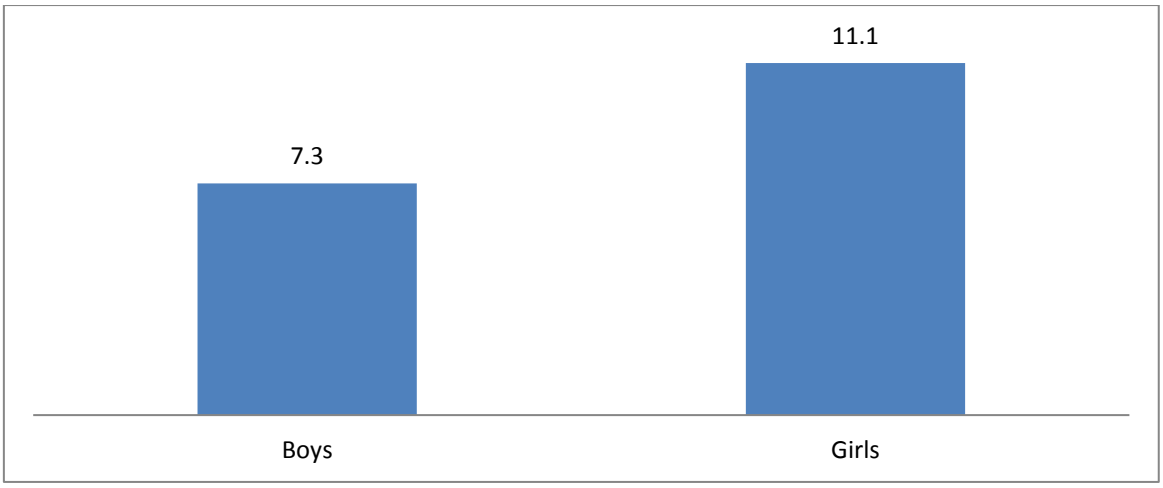
Development in various sectors have improved living conditions, education and women's wellbeing in the State. Punjab is among the top few States having access to safe drinking water, where 99.9 per cent of households have access to safe drinking water (NSS 76th

round). Women have to draw water from a distance in a few areas. 6.2 % of the women in both rural and urban Punjab have to draw water from a distance of 0.2 km to more than 1.5 km (NSS 76th round). Access to toilets is another issue faced by the people in rural areas. About 6 % of women in rural areas still struggle to access basic toilet facilities. Lack of access to essential amenities affects women.

Educational Outcomes in Punjab

Female literacy levels have progressively improved, with Gender Parity Index (GPI) at 1.04 for higher secondary education (UDISE+2020-21). However, dropout among both boys and girls is still the main challenge in Punjab. Data shows that dropout rate is high in higher secondary education, for girls, 11.1 (UDISE+2020-21).

Figure 6: Dropout rate by level of education at secondary level



Source: UDISE+2020-21

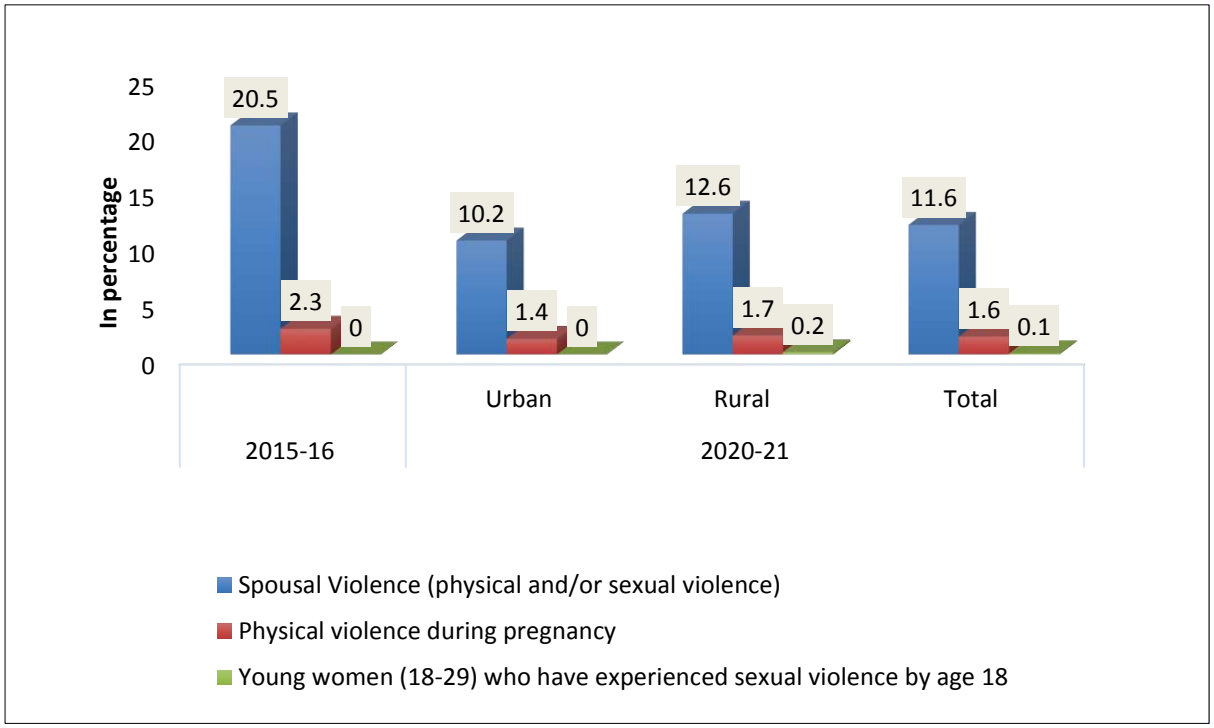
Poor workforce and political participation

The trend of poor female work participation rate (FWPR) continues in Punjab, which remains among the lowest in the country at 21.8%, much below national average of 28.7%. In contrast, the male work participation rate (MWPR) at 71.7 is higher (Periodic labour force survey, 2019-2020). Among those employed, a significant percentage of rural women are employed in the agriculture sector, but only a few women own and operate land. Percentage of land operated by women in Punjab is very low as compared to all-India average. Ownership of assets has an immense impact on the livelihood security of women. Women's presence in politics also remains wanting.

Crimes against Women

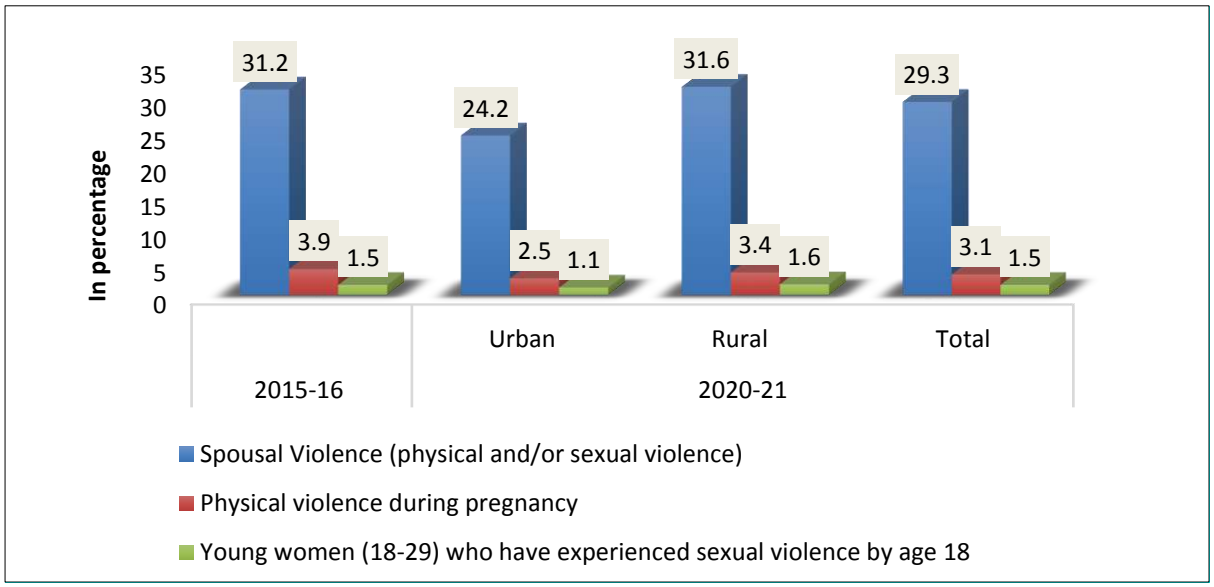
Crimes against women and girls are one of the major indicators which determine the status of women in society. In India, the number and extent of culturally acceptable forms of discriminations are high. Moreover, a large proportion of violence is not perceived as a crime. Male child preference manifests itself in the cultural neglect of the girl child, and female foeticide/infanticide, which ultimately affect the child sex ratio (CSR). Heinous acts like infanticide and prenatal sex selection are considered crimes under different laws. While cultural neglect of the girl child prevalent in a hidden form cannot be pinpointed as an act of willful negligence and, therefore, crime – discrimination against women in our patriarchal society is built into our cultural rites, rituals and customary discrimination of health and maternal care for the girl child. Son preference exists due to various cultural and social reasons and provides social acceptability to the practice of female infanticide/foeticide.

Figure 7: GBV: Prevalence of violence against girls and women in Punjab (18-49 years)



Source: NFHS-IV (2015-16) and NFHS-V (2020-21)

GBV: Prevalence of violence against girls and women in India (18-49 years)

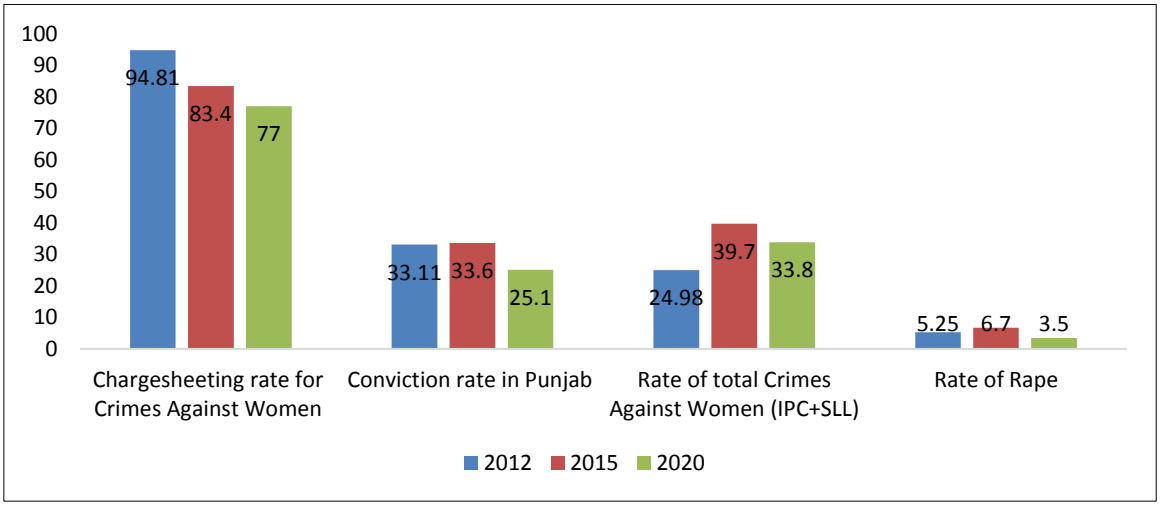


Source: NFHS-IV (2015-16) and NFHS-V (2020-21)

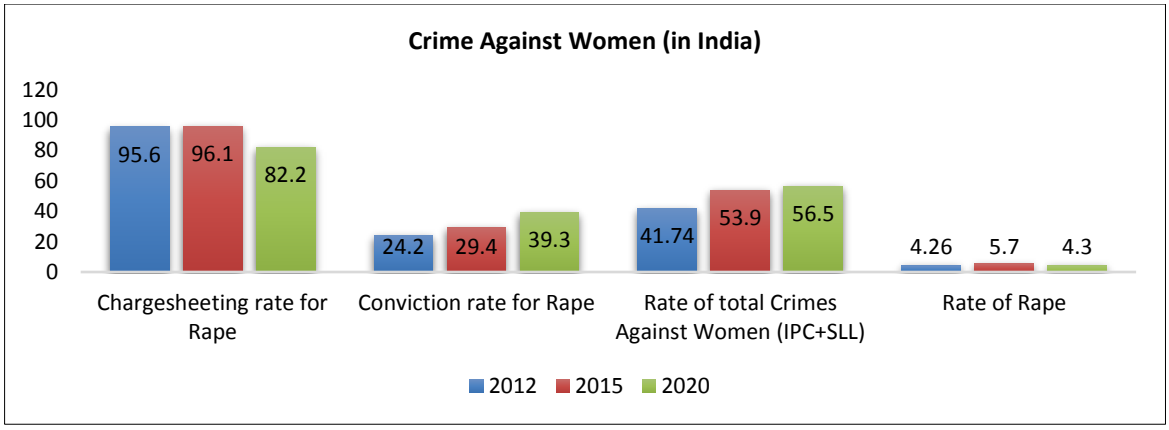
Moreover, due to socialization, covert form of violence, i.e., verbal and economic violence, is neither accepted nor recognized in Indian society. Spousal violence is the most common form of violence all over the world.

Honour killings target male and female couples for marrying against family considerations. Contrary to popular belief, Gender Based Violence (GBV) is directed at men and women to exercise control over 'acceptable' behaviour within the given social order, which is patriarchy.

Figure 8: Crime Against Women (in Punjab)



Source: NCRB, Crime in India for 2012, 2015 and 2020



Source: NCRB, Crime in India for 2012, 2015 and 2020

Sexual harassment at the workplace has gained legal recognition in recent years. Still, harassment in public spaces to which women have increasing access is rising phenomenally, creating unsafe conditions and hampering women's travel, education and general mobility. Reporting of violence against women and girls remains low, though it is found to be improving in certain domains such as dowry harassment, rape and molestation.

NRI disputes

Amidst the craze of settling abroad and having a better standard of living, many young Punjabi brides and groom end up being abandoned and cheated by their husbands and wives, respectively. As per the data provided by the NRI Cell Punjab, in the year 2021 Punjab witnessed 1022 NRI matrimonial disputes out of a total of 4039 complaints that were received.

Stigmatisation and lack of inclusion of the other gender:

There are other gender identities that do not fall under the binary of men and women, but very little data exists on these gender identities. Supreme Court of India has recently recognized transgender people as the “Third Gender” and directed the State to take affirmative action to ensure that they equally enjoy the fundamental rights given under the constitution. The ruling comes in the background of unfair treatment that they are subjected to. They are stigmatized for reasons such as non-binary identity, inability to produce a child, sex work, etc. They are, therefore, denied their civil rights, such as dignified access to education, health services and employment. Similarly, other gender identities are not socially accepted by the society due to existing gender norms.

APPROACH

To promote gender inclusive and rights-based development the document suggests strategies based on the following considerations:

Gender not women

Gender is a social construct that defines the differential and often unequal rights, roles and responsibilities, and access to resources and opportunities between men and women. Due to power dynamics, women are restricted to domestic spheres, live under more social controls and are targeted for violence. Women face discrimination in various spheres for instance, malnourishment is higher among women, their wage rates are lower, and the prevalence of violence against women is much higher than among men. It needs to be emphasised that it is not only women who are the target of violence or face discrimination. Gender-based violence is a wider term, where men too face violence, for instance, when they fail to fulfil the role of a breadwinner for the family and, as a result, commit suicide; or in the case of honour killings, both male and female partners face violence. Therefore, the policy focus has to be on gender and differential positioning of men and women in expected roles, responsibilities, opportunities and resources, and not just on women.

Change in institutions and individuals

The position of men and women in family, religion, work and education needs to be changed. Women's overwhelming presence in unpaid care work, the practice of dowry, limited opportunities and acceptance for education and work, limited role of women in public spheres, concept of honour, and marriage with prescribed social groups all need to be changed. In pursuit of achieving gender equality, the focus has often been on women, for instance, how to remove barriers for the inclusion of women, how to empower women, how to ensure that women gain access to resources and so on. As discussed earlier, inequities are often created by unequal power dynamics; therefore, efforts have to be focused on shifting these dynamics.

The short-term strategy needs to focus on the inclusion of individuals to resources, opportunities and safety, and the long-term strategy has to focus on the processes that lead to inequities and prevention of GBV (Gender based Violence)/discrimination.

Similarly, other gender identities need to be recognized and accepted by the people by making institutional arrangements. Inclusion with dignity in public spaces could be the first step for change, and further, individuals can be sensitized by constant awareness programmes.

Integrate schemes into reform

Government has made many modest efforts to minimize gender disparities through schemes and legislations targeting women and the girl child. For instance, economic incentives have been provided to family members on the birth of a girl child, to change the mindset of people regarding sex- selective abortions. Similarly, the third gender faces numerous issues due to lack of inclusion and welfare measure. Even when facilities are available, they may not be equally accessed due to the highly unequal society. It is therefore required that gender responsive infrastructure and services be provided with active participation of the community. This approach needs to be institutionalized in the administrative structures and community-State partnership, by building capacity of officials, staff, civil society groups, local leaders and individuals.

Short-term Strategies: 2030

To promote gender-inclusive and rights-based development the document suggests strategies based on the following considerations:

- **To address the adverse sex ratio "three-pronged strategy" to be strengthened through schemes and initiatives**
- **Change in approach to deal with anaemia and maternal mortality:**
    - Provide diet supplements through primary health care and *anganwadis*.
    - Aggressive campaign on anaemia and programme on a supplementary diet.
    - To improve the maternal mortality ratio, the quality of maternity care and medical consultations in each pregnancy will be enhanced.
    - ASHA workers may be incentivised for reporting of early marriage of girls in their respective areas.

- To promote use of contraceptives among men. Further, incentives to the ASHA workers for convincing people to use family planning methods.
- Sex education will be made compulsory in education institutions

- **Provision of economic opportunities for women:**
  - Support SRLM (State rural livelihood mission) more micro and nano enterprises at the village level.
  - Special crèche services.
  - Women cooperatives will be strengthened to enhance women's economic participation.
  - The State to award gender credits to employers and businesses by providing easy access to credit, tax incentives and other incentives based on proportion of women employees and gender fair practices.
- **Work participation:** Non-conventional and upcoming trades will be promoted via training and skill-building programmes. Further, the State will strengthen women's cooperatives, especially for rural women.
- **Education:**
  - Incentivize monthly cash transfers.
  - Merit-based scholarship for young girls.
  - Introduce career-counselling sessions for girls in senior-secondary classes to explore their avenues after school.
  - Continuation of transport aid
- **Eliminate all forms of violence against all women and girls:** To eliminate all forms of violence against women following strategies will be adopted:
  - A multi-sectoral strategy shall be beneficial to eliminate violence against women.
  - To identify crime spots that are more prone to crimes committed against women and adequate measures will be taken up with utmost urgency.
  - Sex education to be made a part of the school and higher education curriculum;

- Schools to seek parents as volunteers to participate in sex education sessions.
- Fast track courts for all molestation/rape/dowry death cases.

- **Improvement in conviction rates:** Appropriate administrative measures shall be taken to increase the charge sheeting rate and conviction rate.
- **Gender Disaggregated data**: Collection and analysis of gender-disaggregated statistics will be strengthened for a wide range of indicators for guiding policy and decision-making processes**.**
- **To address women specific issues, the State to create Gender Hubs**: Gender Hub is an institutionalized integrative approach responsive to all gender irrespective of caste, class and religion through a partnership between State administration, community members and other stakeholders. Gender Hub (see figure III in Annexure) will function as a centre of oversight, ensuring better access to various services and schemes and maintaining a gender data bank. To do so, the Gender Hub will closely work with the concerned departments and agencies involved in planning and implementation of various laws/schemes.
- **Utilising women cooperatives to address gender concerns:** State to utilize the existing infrastructure of the cooperatives to address gender concerns by creating women's groups within the cooperatives. This will provide women productive employment, build their capacity to work with a professional system and these groups will provide a forum to address a large number of gender issues such as female foeticide, poor health status and differential development resources for women.
- **Special welfare measures:** Special welfare measure will be taken to enhance the opportunities for people with different gender identities that will include:
  - Campaigns and sensitization programs on dismantling gender binaries and stereotypes.
  - For the protection from violence, district-level One Stop Centers to provide integrated range of services to work closely with Gender Hubs.
  - Upgrade skills and entrepreneurship development.

- Legal aid, counseling and guidance.
- Access to educational institutions with dignity.
- Separate wards in hospitals.
- Training and sensitizing teachers about challenges faced by gender-diverse children.
- Gender expression/identity through curriculum change at the school level as well as in higher education.

Long-term Strategies: 2047

Gender equality has to be addressed as a goal in itself as well as a means to achieving better development outcomes. In the long run the State will emphasize on the following strategies to achieve gender equality.

- **Health**
  - Awareness campaigns at the ground level to be launched to make people aware of non-communicable diseases,
  - Anaemia management will be given due importance.
  - To Improve the maternal mortality ratio, the quality of maternity care and medical consultations in each pregnancy will be strengthened.
- **Education:**
  - Incentives or scholarships, and innovations in teaching –learning methods, to take up science and technology courses right from school education.
  - To make women future-ready for employability, training and skill-building programmes in non-conventional and upcoming trades shall be introduced.
  - The students will be trained in skills such as computers, artificial Intelligence and coding in both rural and urban settings.
- **Shift from role extension towards role fluidity:** The State will create such enabling conditions, through sensitisation programmes, incentives, dialogues and legislations

for role fluidity. The State created gender centres, civil society, NGOs and academia will work closely to bring about this change.

- **Eliminate all forms of violence against women and girls:**
  - To drive gender safety, a three-tiered strategy will be adopted. To protect women and girls hot spot mapping of sites, identification of population-specific groups victims shall be done.; Further, provision of safety mechanisms for all in public institutions and a community-engaged prevention programme will be introduced.
  - Strengthening family courts, women/gender cells (CPRC) special courts, rape compensation services and delivery of provisions for SC/ST by building associated institutions' capacities.
  - The criminal justice system will be made gender responsive to strengthen the confidence of public especially, women.
  - Forms of GBV are population group and site-specific. Disaggregate data on forms to include population groups (caste, religion, clans) and sites (conflict/post-conflict).
  - In order to deliver services in a gender just manner, it is essential to institutionalize gender capacities by involving different stakeholders, community, build State capacity, and develop institutions of oversight.
- **Strengthening Gender Hubs:** These Gender Hubs would operate in four spaces – *at State, district, block and village level.* There will be a four-tiered vertical administrative structure. Horizontally, each tier will have multisectoral linkages with government departments and community structures. Required permissions and clearances, if any, from concerned government agencies would be obtained by units at Gender Hub (see Figure III in Annexure).
- **Gender equality in political participation and decision-making process and equal rights to economic resources:** To achieve this objective State will work towards encouraging women and girls to participate in decision-making. Along with CSOs, NGOs, schools and colleges build the capacity of girls and women to participate both

in public life and politics. At workplace, women will be included in various committees and boards where they can voice their concerns and be involved actively in decision-making. Provisions through legislations and sensitisation to provide women equal rights to economic resources, as well as access to ownership and control over land and property.

- **Social Inclusion of different gender identities:** The literature suggests that people with different gender identities have been discriminated against in availing basic services.
  - Education regarding the other gender will be made a part of the school and higher education curriculum.
  - Vocational training programs.
  - Special committees at the workplace to listen to the problems, discrimination or assault faced by them.

Annexure

Figure I. Discrimination throughout the life cycle

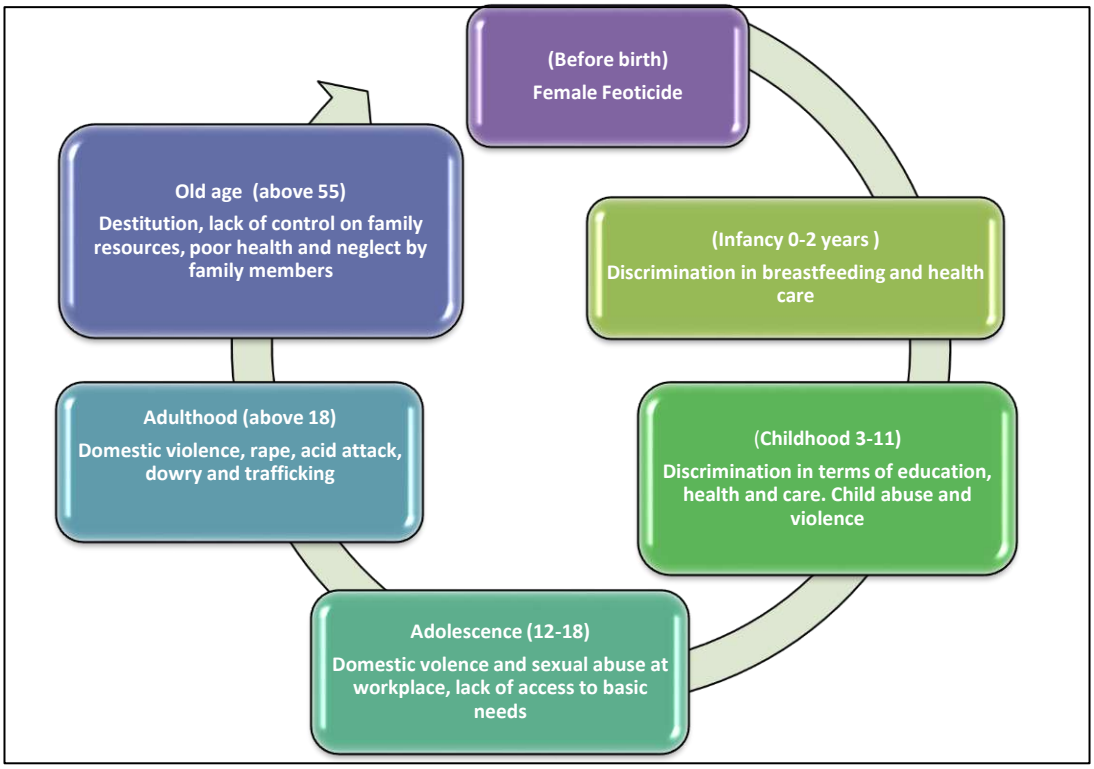


Figure II. Fundamental Objectives of Gender Hub

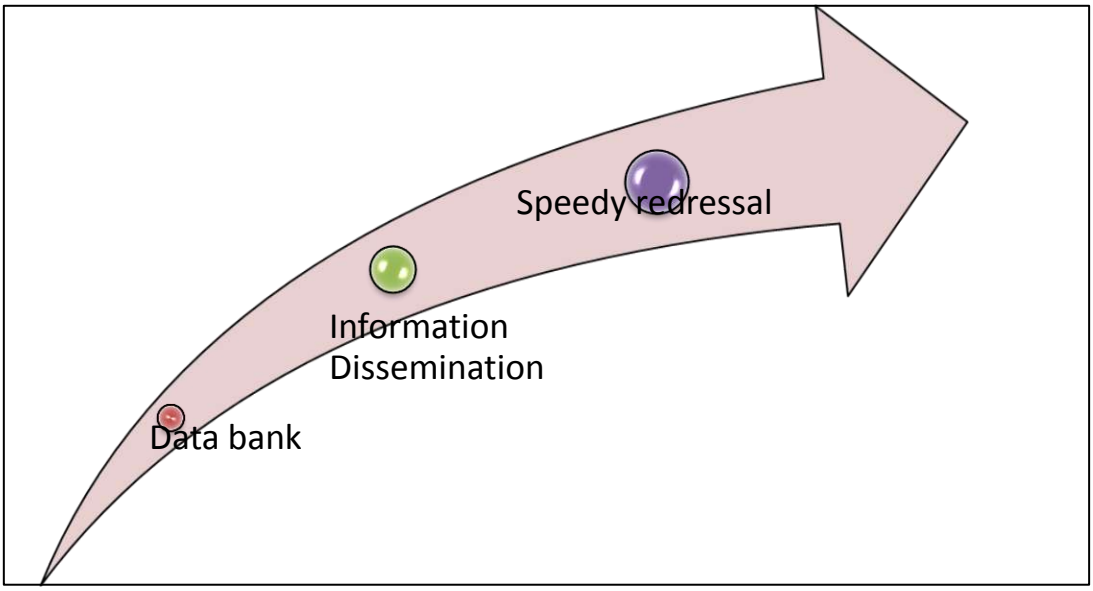
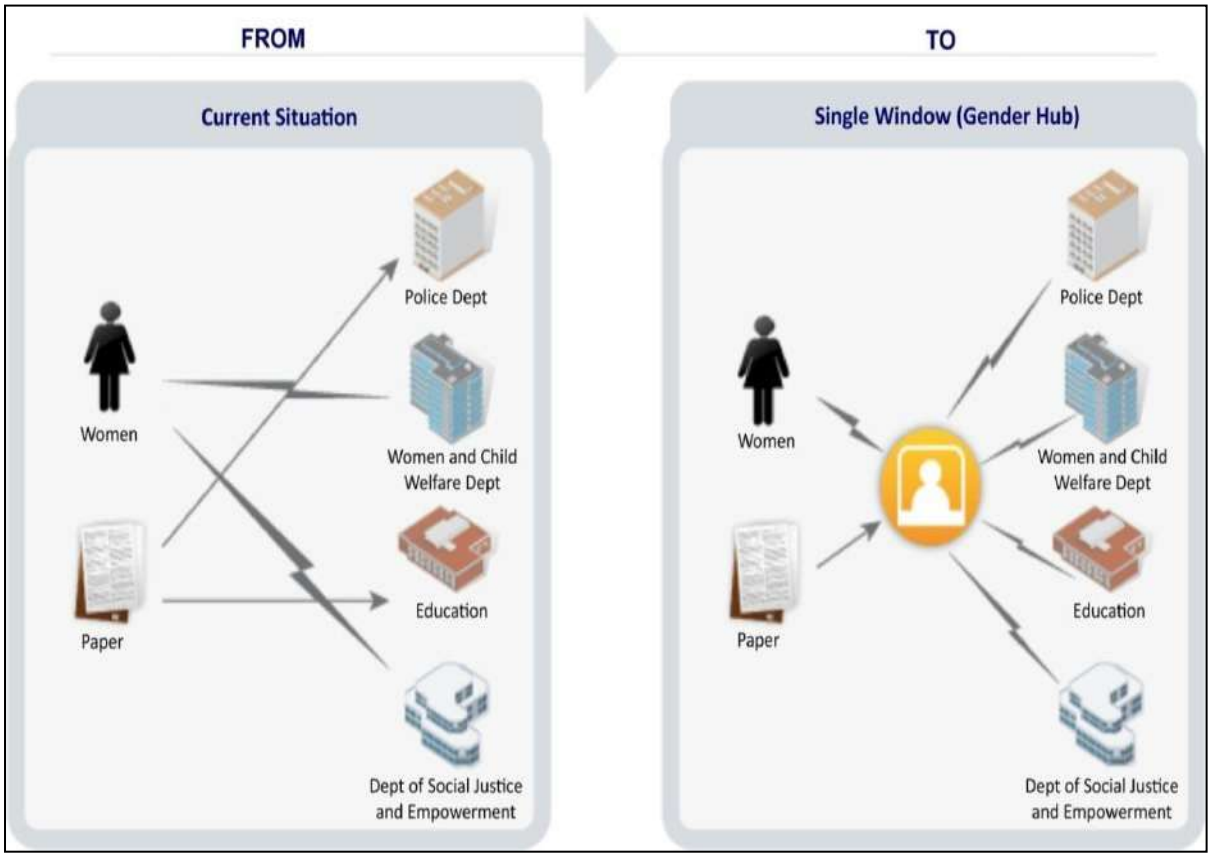


Figure III. Gender Hub: Single Window clearance to facilitate women



GENDER: VISION 2047
TARGETS, SHORT- AND LONG-TERM STRATEGIES

<table>
<tr><th colspan="5">VISION 2047: END ALL FORMS OF DISCRIMINATION AGAINST WOMEN AND GIRLS</th></tr>
<tr><th>Indicators</th><th>Current Status/Baseline</th><th>Target/s 2030</th><th>Target/s 2047</th><th>Strategies</th></tr>
<tr><td colspan="4">Percentage of Women Suffering Poor Health</td><td rowspan="8">Change in approach to deal with anaemia and Maternal mortality
By providing diet supplements through primary health care and anganwadis.
Aggressive campaign on anaemia and programme on a supplementary diet.
To improve the maternal mortality ratio, the quality of maternity care and medical consultations in each pregnancy will be enhanced.
ASHA workers will be incentivised for reporting early marriage of girls in their respective areas.</td></tr>
<tr><td>Anaemia</td><td></td><td></td><td></td></tr>
<tr><td>Women</td><td>58.60%</td><td>Reduce to 40%</td><td>Reduce it to the minimal</td></tr>
<tr><td>Adolescent girls</td><td>60.30%</td><td>Reduce to 35.6%</td><td>Reduce it to the minimal</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Maternal Mortality Ratio</td><td>114</td><td>Reduce upto 70</td><td>Reduce it to 20</td></tr>
<tr><td>Percentage of women aged20-24 who were married or in a union before age 18 (Child Marriage)</td><td>8.70%</td><td>Reduce upto 5%</td><td>Reduce to 0 %</td></tr>
<tr><td colspan="4">Source: For anaemia among women, adolescent and child malnourishment NFHS-5, 2019-21;
For Maternal mortality Ratio, MMR Special Bulletin, March ,2020</td></tr>
<tr><td colspan="4">Percentage of Women with Livelihood</td><td rowspan="5">To support State Rural Livelihood Mission (SRLM) more micro and nano enterprises at the village level will be set up.
Awareness creation around agri-based businesses and handholding of women to become entrepreneurs.
Special crèche services will be provided in both rural and urban areas to facilitate working women.
Creation of Women cooperatives
Non-conventional and upcoming trades will be promoted via training and skill-building programmes.</td></tr>
<tr><td>Work participation rate (15 years & above)</td><td>21.80%</td><td>Improve to 10%</td><td>Improve up to 40%</td></tr>
<tr><td>Female operated land holdings as percentage of total operated landholdings</td><td>1.55%</td><td>Expand to 4%</td><td>Expand to 15%</td></tr>
<tr><td colspan="4">Source: Agricultural Census 2015-16</td></tr>
<tr><td colspan="4">Working Women</td></tr>
</table>

<table>
<tr><th colspan="5">VISION 2047: END ALL FORMS OF DISCRIMINATION AGAINST WOMEN AND GIRLS</th></tr>
<tr><th>Indicators</th><th>Current Status/Baseline</th><th>Target/s 2030</th><th>Target/s 2047</th><th>Strategies</th></tr>
<tr><td>Gender gap in wages of casual wage workers</td><td>Rs 78</td><td>Reduce to Rs 50</td><td>Equal wages irrespective of gender</td><td rowspan="2">• The State to award gender credits to employers and businesses by providing easy access to credit, tax incentives and other incentives based on proportion of women employees and gender fair practices.
• By Improving data collection on land ownership of women and their livelihood through land.
• State to deliberate, amend legislations and facilitate women's ownership of land to increase access to assets and livelihood.
• Awareness generation and sensitization programs to sensitize them towards women legal provisions in property.
Shift from role extension towards role fluidity
• The State will create such enabling conditions, through sensitisation programmes, incentives, dialogues and legislations for role fluidity. The State created gender centres, civil society, NGOs and academia will work closely to bring about this change.</td></tr>
<tr><td colspan="4">Source: Periodic Labour Force Survey,2019-20</td></tr>
<tr><td colspan="4">Literacy Rates</td><td rowspan="8">• Career-counselling sessions for girls in senior-secondary classes to explore their avenues after school.
• Incentives or scholarships, and innovations in teaching – learning methods, to take up science and technology courses right from school education.
• Continuation of transport aid of cycles under Mai Bhago Vidya Scheme.
• To make women future-ready for employability, training and skill-building programmes in non-conventional and upcoming trades shall be introduced.
• The students will be trained in skills such as computers, artificial Intelligence and coding in both rural and urban settings.</td></tr>
<tr><td>Male</td><td>80.90%</td><td>Increase to 95 %</td><td>Universal coverage</td></tr>
<tr><td>Female</td><td>71.40%</td><td>Increase to 90 %</td><td>Universal coverage</td></tr>
<tr><td>Gender gap</td><td>9.50%</td><td>Reduce to 5.5%</td><td>Reduce to 0%</td></tr>
<tr><td colspan="4">Dropout Rate by Level of Education at Secondary Level</td></tr>
<tr><td>Boys</td><td>7.3</td><td>Reduce to 3%</td><td>Reduce to 0%</td></tr>
<tr><td>Girls</td><td>11.1</td><td>Reduce to 5%</td><td>Reduce to 0%</td></tr>
<tr><td>Gender gap</td><td>3.8</td><td>Reduce to 2%</td><td>Reduce to 0%</td></tr>
<tr><td colspan="4">Source: For Literacy Rates, Periodic Labour Force Survey (2019-20), For dropout UDISE+ 2020-21</td></tr>
</table>

VISION 2047: END ALL FORMS OF DISCRIMINATION AGAINST WOMEN AND GIRLS				
Indicators	**Current Status/Baseline**	**Target/s 2030**	**Target/s 2047**	**Strategies**
Gender Parity Index (GPI) of GER by level of education				• Incentivize monthly cash transfers • Merit-based scholarship for young girls.
Primary	0.99	Increase to 1	Maintain	
Upper Primary	1.01	maintain	Maintain	
Elementary	1	maintain	Maintain	
Secondary	0.98	Increase to 1	Maintain	
Higher Secondary	1.04	maintain	Maintain	
Source: UDISE+, 2020-21				

SRB	904	Improve to 930	1000	• **To address the adverse sex ratio "three-pronged strategy" will be strengthened through schemes and initiatives that focus on:**
				  ◦ Provision of nutrition to pregnant women, lactating mothers and young girls;
				  ◦ Provision of quality education and employment so that they can become part of an active labour force; and
				  ◦ Ensuring a safe environment for women to work, to venture out of homes and there is no violence inside the home.

CSR (0-6)	896	Improve to 918	1000	
SR	938	Improve to 950	1000	
Source: NFHS-5(2019-21)				
Prevalence of girls and women 18-49 who have experienced spousal violence	Spousal violence Urban:10.2	Rate will increase with reporting access	Decrease to 6 %	• A multi-sectoral strategy will be beneficial to eliminate VAW. • Identification of crime spots. • Sex education will be made as a part of school and higher education curriculum • Fast track courts for all molestation/rape/dowry death cases. • Forms of GBV are population group and site-specific.
	Spousal violence Rural:12.6	Rate will increase with reporting access	Decrease to 7 %	
	Spousal Violence: 11.6	Rate will increase with reporting access	Decrease to 5 %	

<table>
<tr><th colspan="5">VISION 2047: END ALL FORMS OF DISCRIMINATION AGAINST WOMEN AND GIRLS</th></tr>
<tr><th>Indicators</th><th>Current Status/Baseline</th><th>Target/s 2030</th><th>Target/s 2047</th><th>Strategies</th></tr>
<tr><td>Violent Injuries and deaths per 100,000 population (measured as rape and dowry deaths rates)</td><td>22%</td><td>Increase rate with increase reporting</td><td>Decrease to 5 %</td><td rowspan="2">Disaggregate data on forms to include population groups (caste, religion, clans) and sites (conflict/post-conflict).
• To drive gender safety, a three-tiered strategy will be adopted
• In order to deliver services in a gender just manner, efforts shall be made to institutionalize gender capacities by involving different stakeholders, community, build State capacity, and develop institutions of oversight.</td></tr>
<tr><td colspan="4">Source: NFHS-IV (2015-16) and NFHS-V (2020-21) and NCRB, Crime in India for 2012, 2015 and 2020</td></tr>
<tr><td colspan="5">Eliminate all forms of violence against all women and girls by fast trail</td></tr>
<tr><td>Charge sheeting rate</td><td>77%</td><td>Increase to 86%</td><td>Above 95%</td><td rowspan="3">• The implementation of the Domestic Violence Act, 2005 will be strengthened with the help of gender hubs and the involvement of NGOs.
• Strengthening family courts, women/gender cells (CPRC) special courts, rape compensation services and delivery of provisions for SC/ST by building associated institutions' capacities.
• The criminal justice system will be made gender responsive to strengthen the confidence of public especially, women.</td></tr>
<tr><td>Conviction rate</td><td>25.1%</td><td>Increase by 15%</td><td>Above 80%</td></tr>
<tr><td colspan="4">Source: NCRB, Crime in India for 2012, 2015 and 2020</td></tr>
<tr><td colspan="5">Ensure universal access to sexual and reproductive health</td></tr>
<tr><td>Current use of family planning methods (currently married women age 15-49 years)</td><td>66.60%</td><td>Improve to 88.5%</td><td>Improve to 95%</td><td>• Efforts will be made to promote societal acceptance of contraceptive use by men to overcome cultural and societal barriers to use of contraceptive
• Better incentives to the ASHA workers for convincing people to use family planning methods.</td></tr>
<tr><td>Percentage of young people receiving comprehensive sex education</td><td>Data to be generated</td><td></td><td></td><td>• Make sex education compulsory in higher school/education institutions.</td></tr>
<tr><td colspan="5">Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property</td></tr>
</table>

VISION 2047: END ALL FORMS OF DISCRIMINATION AGAINST WOMEN AND GIRLS				
Indicators	**Current Status/Baseline**	**Target/s 2030**	**Target/s 2047**	**Strategies**
Women who worked in the last 12 months and were paid in cash (age group 15-49)	84%	Universal	Maintain full coverage	• Increase knowledge about rights through training and workshops.
Women owing a house or land (alone or jointly with others) (In %)	64%	increase to 80%	Universal	• Constant Gender sensitization programs for men.
Women having a bank or saving account that they themselves use (in %)	82%	increase to 91.6%	Universal	• Offering incentives to women to open bank account
Source: NFHS-5,2019-21				

SECTION VII

RESOURCES

I. Natural Resources

II. Affordable and Clean Energy

III. Climate Action and Natural Resource Conservation

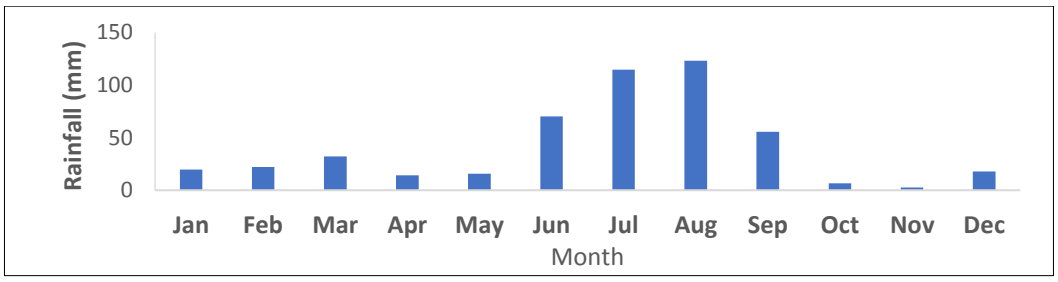
I
NATURAL RESOURCES

Natural resources especially water, soil and air are of utmost importance for the survival of human, animal and plant populations. The soil, air and water together constitute a biosphere supporting all forms of life. In fact, Nature has provided us with water, carbon and other cycles so as to sustain these resources. The degradation of natural resources is now being increasingly felt in Punjab. This chapter aims to present the status, challenges and strategies for the sustenance of water, soil and air resources.

Current Status (Water)

- The available utilizable water in Punjab is 56 BCM against the demand of 66 BCM, thereby leaving a deficit of 10 BCM, which is met through the over-extraction of groundwater.
- The surface waters are also decreasing in the State. The average annual rainfall in the catchment area of Bhakra dam decreased from 1124 mm (1983-2018) to 1056 mm (2014-2018). The average annual rainfall in Punjab has decreased from 490 mm (1970-2020) to 444 mm (1998-2020), coupled with its ill distribution in time and space with prolonged dry spells. (Fig. 1).

Figure. 1 Monthly average (2013-2021) annual rainfall (mm)



- The energy subsidy in 2021 is reported to be around Rs 7,000 crores, which is expected to increase further in future. In addition, the farmers spent about 620 crores on diesel-based generators to pump out groundwater.
- Of the net irrigated area of 41.3 lakh hectares in the State, just 1.0% area is under micro-irrigation.

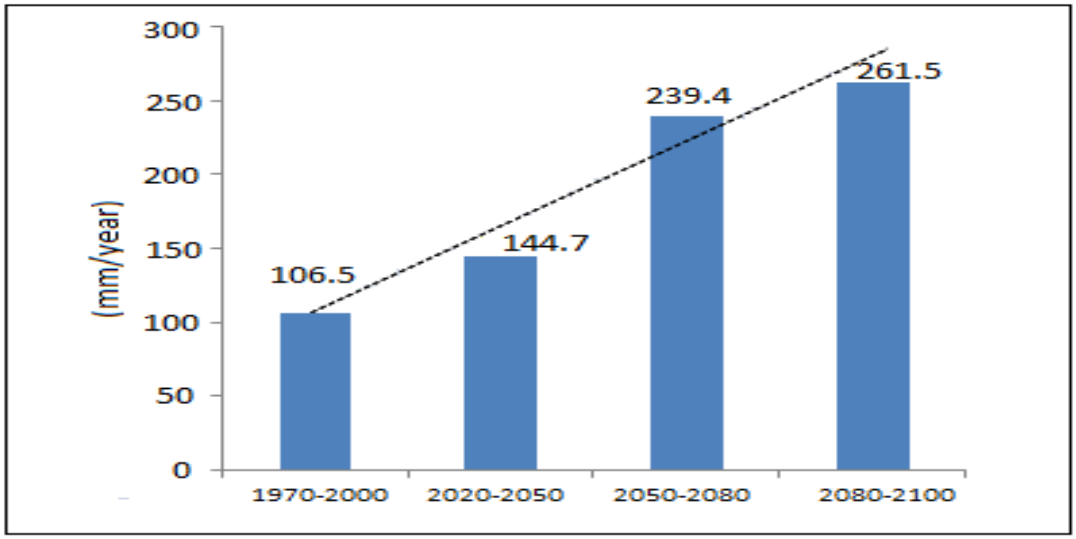
- Huge gap in the generation, treatment and use of wastewater
    - **Domestic:** Sewage water treatment capacity in the State is 1827 MLD of the total sewage generated. Out of this only 1355 MLD is actually treated and just 280 MLD (21%) is being used.
    - **Industry:** Industrial effluents flowing in '*ganda nallas*' are loaded with heavy toxic metals that are polluting the groundwaters in the adjoining areas, before polluting the river waters.
    - Water logging In South-west Punjab, it mainly occurs in Sri Muktsar Sahib (37.1% area of the district), Firozpur (23.3% area) and Faridkot (12.4% area) districts.
    - Marginal sodic groundwater (low EC and high RSC) occupies 42.1% of the total geographical area of the State. The sodic water occupies the highest area in Faridkot district (43.2 % area of the district) followed by Firozpur district (13.5% area of the district) in SW-Punjab.
    - Poor quality groundwater (high EC, >6 dSm^{-1}) and high RSC, >7.5 me L^{-1} or both) occupy 7.7 % of the total geographical area of the State.
    - The marginally suitable groundwater spatially covered 46.1% of the central alluvial plain and south-western alluvial plain of Punjab and the unsuitable groundwater covered 8.2% of the State, in the central alluvial plain and south-western alluvial plain of Punjab.

Future Challenges

- The groundwater in the 8% area (covering 10 blocks in Barnala, Moga, Patiala and Sangrur districts) is expected to deplete beyond 50-m depth by 2030 and 19% of the area by 2040.

- Even without any change in rainfall amount, the actual evapo-transpiration rate is expected to increase by 5% in 2030, 6% in 2040 and 8% in 2050 (WRD, 2020[1]) due to global warming.
- The water demand in the State is expected to increase from present 66.0 BCM to 70 BCM in 2030 and 72 BCM by 2050 (WRD, 2020).
- The treated water potential for re-use is expected to increase from 0.8 BCM in 2020 to 1.1 BCM in 2030 to 1.8 BCM in 2050 (WRD, 2020).
- The increase in standard deviations of projected rainfall over time (Fig. 2), indicates a higher number of extreme wet years along with dry years in future leading to higher flood and drought magnitude.
- The average temperatures are projected to increase by 0.5-2.0^{o}C in different regions of the State in 2030, 2040 and 2050 (see table 1 in Annexure). The total runoff is expected to increase by 5% and 7% in 2040 and 2050 respectively, in the north and central districts of the State.
- The surface waters are expected to decrease from 14.8 BCM in 2021 to 14.6 BCM in 2030 and 14.0 BCM in 2050 (WRD, 2020).

Figure. 2 Seasonal (June to September) decadal standard deviation trend of rains in Punjab



[1]WRD. 2020. Water Conservation and Management Plan, Part II. Water Resources Potential and Projections. Department of Water Resources, Punjab.

Challenges

- *Increasing number of dry spells during monsoon season:* It is being observed that the occurrence of dry spells has been increasing in Punjab (see table 2 in Annexure). The data shows that despite the otherwise normal rainfall years, the higher number of dry spells are leading to higher extraction of groundwater and hence more fall. (Dr PK Kingra[2]).

- *Inadequate utilization of rainwater:* Punjab State on average receives about 550 mm of rain which is quite variable over time and space. The northern part of the State receives about 900 mm of rain, central part receives about 650 mm and the southern part receives 300 mm. About 75-80% of annual rain is received in a short period of 2 and half months (July-September). Based on a runoff coefficient of 90% in urban areas and 15% in rural areas, around 5.3 BCM of rainwater goes as runoff into streams and rivers and ultimately out of State boundaries.

- *Prevailing mono-cropping system:* Rice-wheat is the major cropping system in the State with rice occupying more than 30 lakh hectares.
    - Replacing a sizeable area of cotton with rice crops in the cotton belt of SW Punjab has increased incidences of white fly and pink bollworm in cotton fields due to the local effect of higher relative humidity.

- *Non-judicious and inefficient use of water:* It has been observed that people in every sector (agriculture, industry, domestic) use water non-judiciously. Irrigation efficiency at the national level has been reported to be just 38%, in comparison to 65% and 80% in domestic and industrial sectors.

- *Provision of free electricity in agriculture:* Punjab farmers are highly (100%) subsidized for electricity irrespective of the size of land owned. This has led to the over-exploitation of groundwater resources by the farmers.

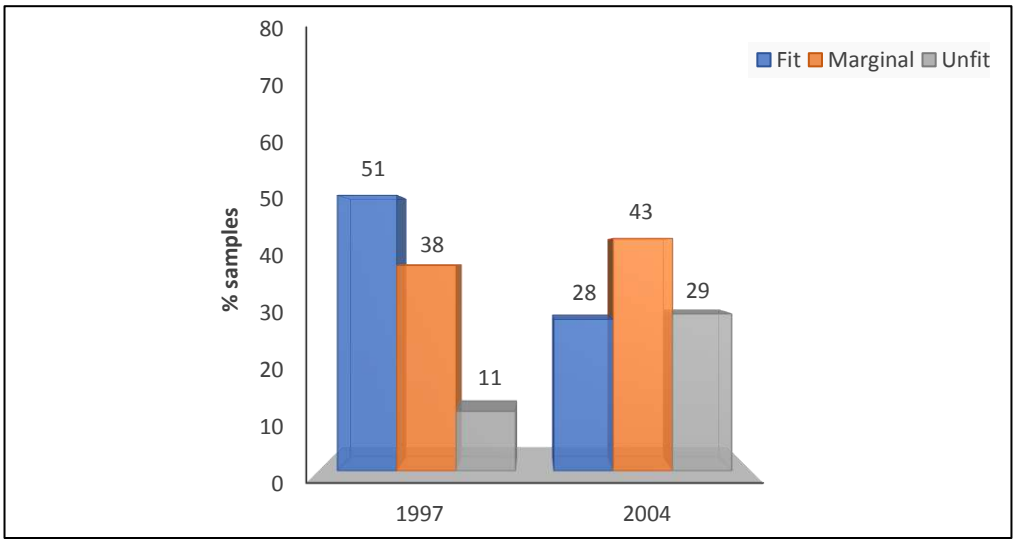
- *Quality issues of deeper groundwaters:* The quality of groundwater deteriorates as the water table goes down (Fig. 3). It has been observed that the area with unfit

[2] Source: P.K. Kingra, Panjab Agriculture University, Ludhiana.

waters has increased from 11% to 29% within a period of seven years in certain areas.

- *Under-utilization of canal water in central Punjab:* It is a common observation in some canal command areas, especially in central Punjab that farmers prefer using tubewells for irrigation to canal water allocated to them, perhaps due to ease of irrigation.
- *Taming canal/river waters during the rainy season (July-Sep):* As per the records of the Water Resources Department of Punjab, about 1.8 BCM of surface water goes out of State boundaries every year. This could be higher during higher rainfall years.

Figure. 3: Changes in groundwater quality with depth



Source: Dr GS Hira, Personal Comm.

Short and Long-term Strategies: 2030 and 2047

Agricultural sector

- *Three-pronged Strategy for Crop diversification at the micro-level*: A robust strategy needs to be developed and executed so that the diversification of crops may happen on its own.
    - A 3-pronged strategy at the micro-level (a block or a cluster of blocks as a unit) is being proposed in this direction based on:
        - Water budget in a particular unit

- Niche crops (other than paddy and wheat) prevail in that unit including fruits and vegetables.
- Value addition coupled with strengthening/creating of market infrastructure including assured procurement at MSP.

- Based on the above strategy, a unit-specific crop diversification plan needs to be developed and executed with certain timelines.
- The target for such a diversification plan could be as under:
  - By 2030, 35% area of paddy to be replaced with alternate crops.
  - By 2040, 60% area of paddy to be replaced with alternate crops.
  - By 2047, 75% area of paddy to be replaced with alternate crops.
- *Judicious use of water*: For ensuring judicious use of water in different sectors following measures are to be taken:
- *Water metering*
  - By 2030: Installation of tubewell water/electricity meters on all tubewells of individual farms >12 ha.
  - By 2040: Installation of tubewell water/electricity meters on all tubewells of individual farms >4 ha.
  - By 2047: Installation of tubewell water/electricity meters on all tubewell of individual farms.
- *Water rationing*
  - The consumption of ground- or surface water should be rationed, based on good irrigation practices as recommended by Punjab Agricultural University. The quantity of water consumed above the recommended one be charged at the following rates:
  - Farms >12 ha be charged @400% of the nominal rates
  - Farms 4-12 ha be charged @300% of the nominal rates
  - Farms < 4 ha be charged @200% of the nominal rates

- *Water credits*
    - All farmers who save upon irrigation water out of that allocated as per recommended irrigation practices, either through innovative techniques like micro-irrigation or through crop diversification be credited for such savings @ Rs 2/m3 with capping as per the following scheme:
    - Farms >12 ha be credited @Rs 2/m3with a capping of Rs 3750/ha
    - Farms 4-12 ha be credited @Rs 2/m3 with a capping of Rs 5000/ha
    - Farms up to 4 ha be credited @Rs 2/m^3 with a capping of Rs 6250/ha.
- *Micro-irrigation – drip and/or sprinkler*
    - Micro-irrigation seems to be the best practice for highly efficient irrigation systems However, the area presently under micro-irrigation is 0.40 lakh hectares (from 2006-07 to 2021-22) as against potential area of 10.40 hectares as per the report of the Department of Soil and Water Conservation, Govt. of Punjab.
    - Total potential area for Micro Irrigation has been estimated as 10.40 lakhs hectare in Punjab. Progress from 2006-07 to 2021-22 for Micro Irrigation is o.40 lakhs hectare. Up 2030 it is expected to cover 59291-hectare area under micro irrigation. Up to 2040 it is expected to cover 84291-hectare area under micro irrigation. Up to 2047 it is expected cover to 264291-hectare area under micro irrigation. At present, Gol is promoting Micro Irrigation under 'Per Drop More Crop' (PDMC) component under Rashtriya Krishi Vikas Yojana (RKVY). Subsidy @45% has been approved on Gol: State 60:40 Sharing pattern as per unit cost norms of PMKSY guidelines. State Govt. of Punjab is providing additional top-up subsidy out of NABARD-MIF so as to provide benefit of 80% subsidy to farmers, with additional 10% subsidy to Small/Marginal/Women/Schedule Cast Farmers.

- The above-said suggestion of water rationing and water crediting may lead farmers to show interest in micro-irrigation. The following scheme may be adopted to increase the area under micro-irrigation:
    - ◊ By 2030: A target of having 20% area under micro-irrigation.
    - ◊ By 2040: A target of having 35% area under micro-irrigation.
    - ◊ By 2047: A target of having 50% area under micro-irrigation.
- To start with, the following roadmap could be followed. However, this must be accompanied by the above-suggested schemes of water metering, water rationing and water credits.
    - ◊ All existing and new orchards of about 1.0 lakh ha are to be brought under drip irrigation.
    - ◊ About 1.0 lakh ha area under sugarcane, 3.0-4.0 lakh ha area under cotton, 1.5-2.0 lakh ha area under spring maize and area under vegetables should be drip irrigated.

- *Revival of drains:* The networks of drains, most of which are presently defunct, need to be desilted and provided with gabion-type of structures so as to ensure natural recharge through these drains. The village ponds could be connected to the nearby drains through the underground pipeline system. By 2030, 40% of all the drains and by 2047 all the drains in the State to be revived and provided with gabion structures.
- *Canal water recharge during monsoon*: A large amount of canal water during monsoon season remains unutilized due to little or no demand for irrigation and this water goes out of the State boundaries. This water could be diverted for groundwater recharge. 40% and 80% of the total feasible length of canals be linked to recharge structures by the years 2030 and 2047 respectively.

- *Capping of land-lease amount for cultivation:* The feedback from the working farmers (especially those who cultivate the land on lease) indicates that they shirk from water-saving practices due to fear of losing on crop yields as they have to pay

exorbitant lease amounts (Rs 60-65 thousand per acre at some places) to the proxy farmers. The following points can be considered for any such mechanism.

- The lease amount should not be on the basis of the current rate as per current practice.
- The lease amount should be based on such a mechanism that a farmer should at least be able to get 15-20% profit over and above the expenditure on inputs estimated strictly as per the best-recommended practices of cultivation by PAU.

Industrial and commercial sector

- *Water conservation*: The Punjab Water Regulation & Development Authority (PWRDA) may direct each industrial and commercial unit to conserve/harvest rain/runoff water (off-site) with immediate effect, as per the following scheme:
  - Units extracting >1000 m^3/day should conserve/harvest rain/runoff water equivalent to 300% of the water being extracted.
  - Units extracting 100-1000 m^3/day should conserve/harvest rain/runoff water equivalent to 200% of the water being extracted.
  - Units extracting 10-100 m^3/day should conserve/harvest rain/runoff water equivalent to 100% of the water being extracted.
- *Rooftop rainwater harvesting*: Harvesting the monsoon season (80% of the annual rain) rain/runoff water is a big challenge. The PWRDA should make rooftop rainwater harvesting mandatory for all such units seeking permission to extract groundwater, otherwise, the defaulting units should be penalized heavily. This could be achieved with immediate effect.
- *Green belts*: The green belts not only make the rain/runoff water infiltrate into the soil (and hence recharging the groundwater) but also help in moderating air pollution if planted with shrubs and trees. This could be achieved by 2030.
  - 4-m (or higher) wide green strip on all 4 sides of the industrial unit (or an equivalent area) extracting groundwater >100 m^3/day

- 2-m wide grass strip on all 4 sides of the industrial unit (or an equivalent area) extracting groundwater 10-100 m^3/day
- 1-m wide grass strip on all 4 sides of the industrial unit (or an equivalent area) extracting groundwater <10 m^3/day

- *Reuse of treated wastewater:* Most industries treat the wastewater either individually or collectively. The treated waste water could be utilized for irrigation and/or domestic non-drinking purposes through the underground supply pipeline system.
  - By 2030: Laying 40% of the total underground pipeline based on the potential of treated wastewater.
  - By 2047: Laying 100% of the total underground pipeline based on the potential of treated wastewater.
- *Improving water use efficiency*: The PWRDA should get the life cycle assessment (LCA) of industrial final products done in comparison to best practices/technologies. The LCA-based WUE may be used as a criterion for the star rating of the end product. A policy could then be evolved to rate the product and decide on its MRP. This could be very easily achieved by 2030.

Domestic sector

- *Roof-top rainwater harvesting and its use*: It should be made mandatory for the new and existing household units in the designated local bodies to harvest roof-top rainwater. A policy needs to be developed as per the following timeline:
  - By 2030: All existing and new houses with a plot area of 100 sq meters or higher; all educational and official buildings (public or private sector); all housing societies, etc.
  - By 2040: Community-based roof-top rainwater harvesting in the PPP mode in all existing houses with plot areas lesser than 100 sq meter.
- *Water metering*: As mentioned above the non-judicious use of water can be prevented only if water supplied to the households is metered. Any quantity of water used above the prescribed limits could be charged as suggested below:

- Households with a 500 sq meter plot area be charged as:
  - For the first 2 kilo litres @Rs 500 per kilo-litre
  - From 2-5 kilo litres @Rs 1000 per kilo-litre
  - From 5-10 kilo-litres @Rs 2000 per kilo-litre
  - For >10 kilo-litres @Rs Rs 5000 per kilo-litre
- Households with 250-500 sq meter plot area be charged as:
  - For the first 2 kilo-litres @Rs 300 per kilo-litre
  - From 2-5 kilo-litres @Rs 750 per kilo-litre
  - From 5-10 kilo-litres @Rs 1500 per kilo-litre
  - For >10 kilo-litres @Rs Rs 4000 per kilo-litre
- Households with 100-250 sq meter plot area should be charged as:
  - For the first 2 kilo-litres @Rs 200 per kilo-litre
  - From 2-5 kilo-litres @Rs 400 per kilo-litre
  - From 5-10 kilo-litres @Rs 800 per kilo-litre
  - For >10 kilo-litres @Rs Rs 3000 per kilo-litre
- Households up to 100 sq meter plot area be charged as:
  - For first 2 kilo litres @Rs 100 per kilo-litre
  - From 2-5 kilo litres @Rs 200 per kilo-litre
  - From 5-10 kilo-litres @Rs 400 per kilo-litre
  - For >10 kilo-litres @Rs Rs 2000 per kilo-litre
- This must be initiated and executed immediately and the work should be completed by 2030.

- *Green belts*: The houses and apartments should have green belts in and outside their premises. The task of creating green belts in all the houses needs to be achieved immediately as per the following roadmap:
  - By 2030: All new and existing houses with a plot area of 500 sq meters or higher should ensure at least 25% of the plot area is a green belt apart from the designated green belt area outside the boundary wall.

- By 2030: All multi-storey housing societies should maintain 5-m green belt all around the building or an equivalent area at one place, including a park.
- By 2040: All houses with a plot area of 250-500 sq meters should ensure 15% of green belt area within their premises, apart from the designated green belt area outside the boundary wall.
- By 2040: All houses with a plot area of 150-250 sq meters should ensure 10% of the plot area as green belt within their premises, apart from the designated green belt outside the boundary wall
- By 2047: All houses with a plot area of <150 sq meters should maintain the designated area as a green belt outside the boundary wall and not concretize the same.

- *De-concretization of pavements in towns and cities:* It is a general trend in urban areas to concretize all the pavements and make these impervious, with the result that even a small amount of rain inundates the streets. This can be achieved very easily within a short period of time as per the following scheme:
  - All pavements/strips in all major cities and towns should be laid with perforated tiles and/or green grass for 90% infiltration of rain/runoff water. These could also be planted with quick-growing and shade-providing small trees.
- *Sewage water treatment and reuse:* The State has a potential of 2 BLD (Minimum Liquid Discharge) of sewage water, which needs to be treated and reused for non-drinking purposes. The sewage-treated water could either be diverted for irrigation or non-drinking purposes in the domestic sector.

  According to the Department of Soil and Water Conservations, Govt of Punjab, there are 245 existing and new Sewage Treatment Plants (STPs) in Punjab. Out of 245 existing and new STPs in Punjab, the department has already commissioned irrigation projects from 57 STPs benefitting an area of 8326 ha utilizing 305 MLD million litres of treated waste water from 2013 to 2022. Up to 2030, it is expected to cover irrigation projects from 30 more STPs. Up to 2040 it is expected to cover 30

more STPs. Up to 2047 it is expected to cover 25 more. STPs. At present, NABARD funded schemes are being implemented with 100% financial and technical assistance for laying of underground pipelines from the Sewage Treatment Plants (STPs) of cities/towns to provide treated sewage water for irrigation at the farmers' fields. However, this requires setting up a separate network of pipelines, which could be carried out as per the following timeline:

- By 2030, 35% of total sewage water generated to be treated along with the laying of a pipeline system for its distribution.
- By 2040, 75% of total sewage water generated to be treated along with the laying of a pipeline system for its distribution.
- By 2047, 100% of total sewage water generated to be treated along with the laying of the pipeline system for its distribution.

Dedicated mass awareness campaigns

- The majority of the people are not aware of the increasing scarcity and quality degradation of water and they need to be made aware of its implications in near future. It is thus the need of the hour to launch dedicated campaigns in rural and urban areas through NGOs, Religious organizations and government institutions to make the people aware of the importance, scarcity and quality degradation of water.

Current Status (Soils)

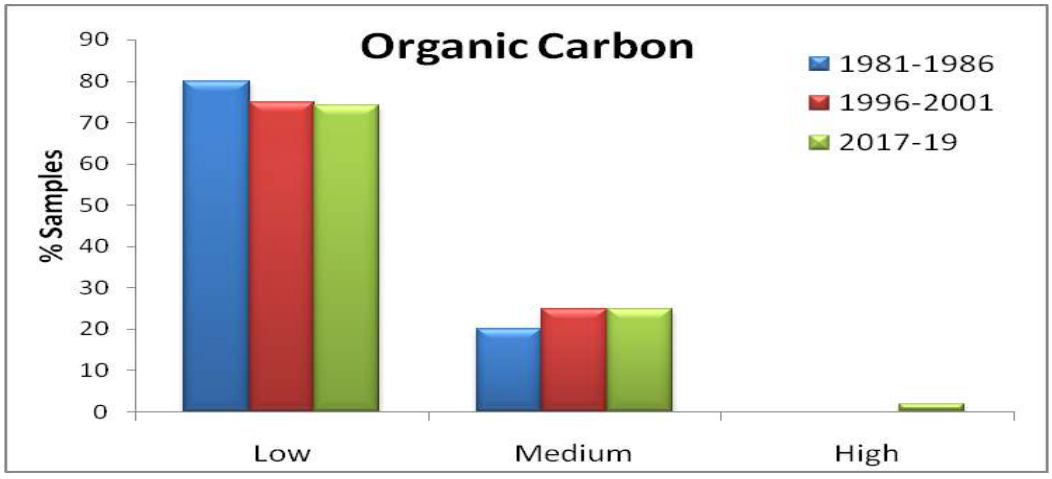
Soil fertility

- *Soil organic carbon*: Among all the nutrients, soil organic carbon is the most important component in maintaining soil quality due to its crucial role in improving the soils' physical, chemical and biological properties and crop productivity. As per the Indian standards, soils with ≥0.75% organic carbon in the soil are considered sufficient, but international standards suggest having around 2-3% organic carbon in soils.

- Temporal analysis of organic carbon concentration in soils of Punjab showed that the number of samples in the low category of organic carbon (<0.4%) decreased from 80% during 1981-86 to 75% during 1996-2001 (Benbi et al., 2006[3]) and 74.1% during 2017-19 (Soil Health Card Scheme, Government of India) (Fig. 4).
- Compared with the number of samples in the medium (0.4-0.75%) and high category (>0.75%) of organic carbon during 1981-86, there was an increase in organic carbon in soils of Punjab under medium and high categories during 2017-19 (Fig. 4).
- Soil organic carbon data from Soil Grids (spatial resolution of 250 m) of International *Soil* Reference and Information Centre(ISRIC) analyzed for the three zones of Punjab (Poggio et al., 2021[4]) showed that soil organic carbon content in 0-5 cm layer is highest in North-east Zone followed by Central and South-west Zones (Fig. 5).

- The organic carbon content decreased from 0-5 cm to 5-15 cm depth in the soils of these three zones and the decrease was 1.42 times in the soils of the North-east and Central Zones, and 1.53 times in the soils of the South-west Zone (Fig. 5).

Figure. 4: Temporal variations in organic carbon concentration in soils of Punjab

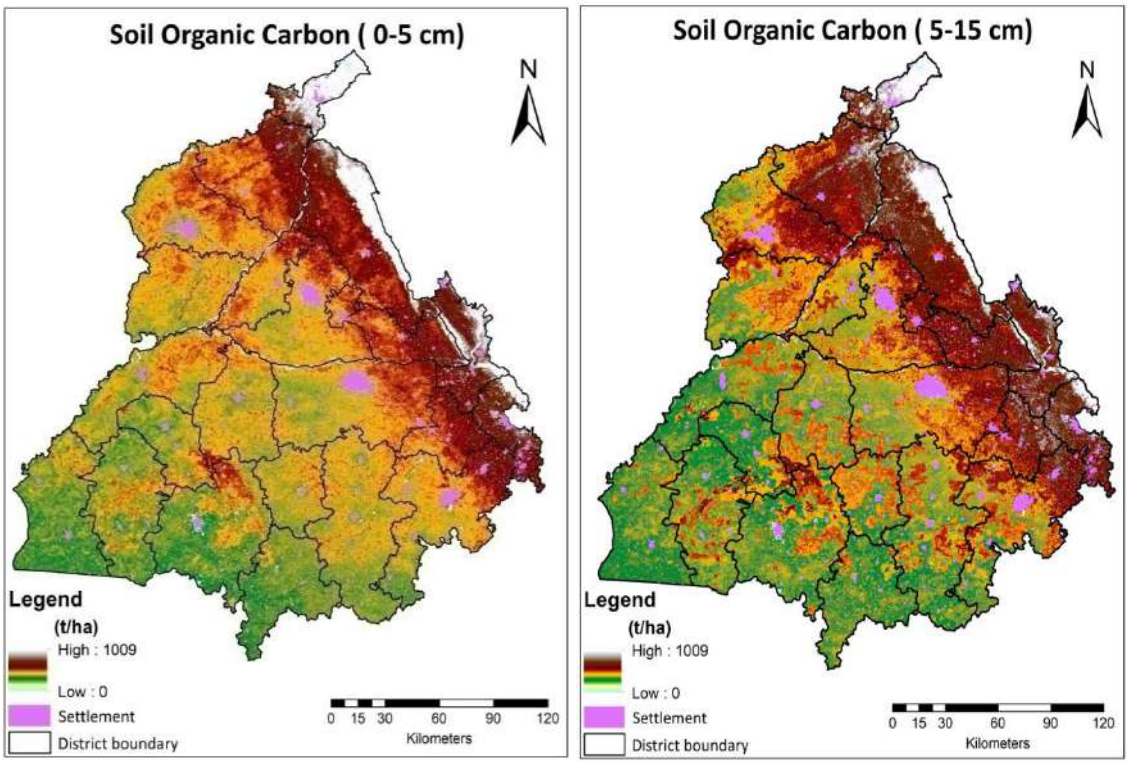


[3]Benbi D, Nayyar V, Brar J (2006). The green revolution in Punjab: impact on soil health. Indian Journal of Fertilisers 2 (4):57

[4]Poggio L, De Sousa LM, Batjes NH, Heuvelink G, Kempen B, Ribeiro E, Rossiter D (2021). Soil Grids 2.0: producing soil information for the globe with quantified spatial uncertainty. Soil 7 (1):217-240

- Nitrogen (N), phosphorus (P) and potassium (K) are three major fertilizer elements essential for plant growth. The number of samples in the low category of available P (<12.5 kg ha^{-1}) increased from 45% during 1981-186 to 70.7% during 1996-2001 (Benbi et al., 2006), but the number of samples collected under Soil Health Card Scheme, in the low category of available P was 54.4% during 2017-19 (Figure. 6). Compared with the number of samples in medium (12.5-22.5 kg ha^{-1}) and high category (>22.5 kg ha^{-1}) of available P during 1981-86, there was an increase in available P concentration in soils of Punjab under medium category during 2017-19, but the number of samples decreased in high category of available P during 2017-19.

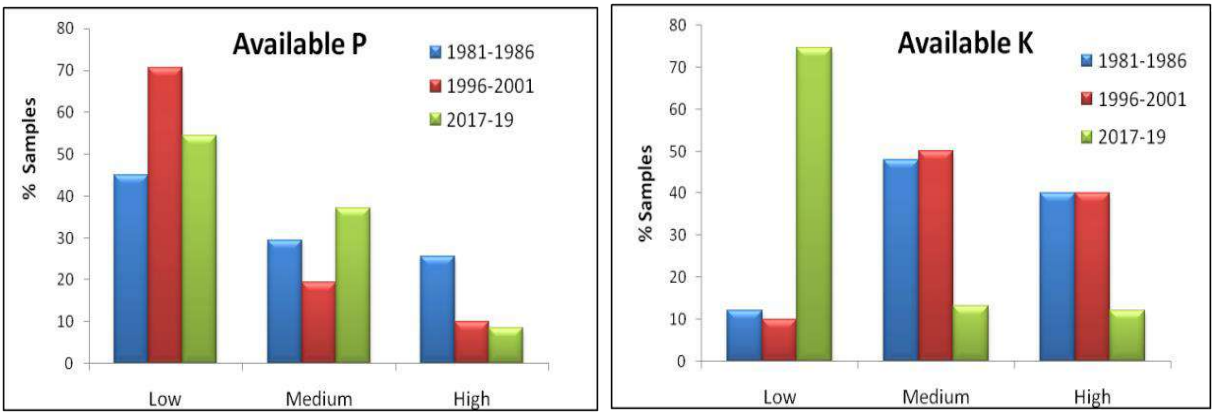
Figure. 5: Spatial distribution of organic carbon content in soils of Punjab



  - The K deficiency has increased in the soils of Punjab over the years (Fig. 6). Compared with the number of samples in the medium and high categories of available K during 1981-86, the number of samples decreased in these two categories of available K during 2017-19.

- The Zn deficient soils being 49% during 1990 (Nayyar et al., 1990[5]), decreased to 13.5% during 2017-19 (Soil Health Card Scheme of Government of India) (Fig. 7).
- The deficiency of copper (Cu), iron (Fe) and manganese (Mn) were also reported during 1990 to the extent of 2, 17 and 3%, respectively (Fig. 7). As per the information from Soil Health Card Scheme of Government of India, the deficiency of Cu, Fe and Mn in soils of Punjab has been reported in 0.5, 11 and 46% of the soils, respectively (Fig. 7).

Figure. 6: Temporal variations in available P and K content in soils of Punjab

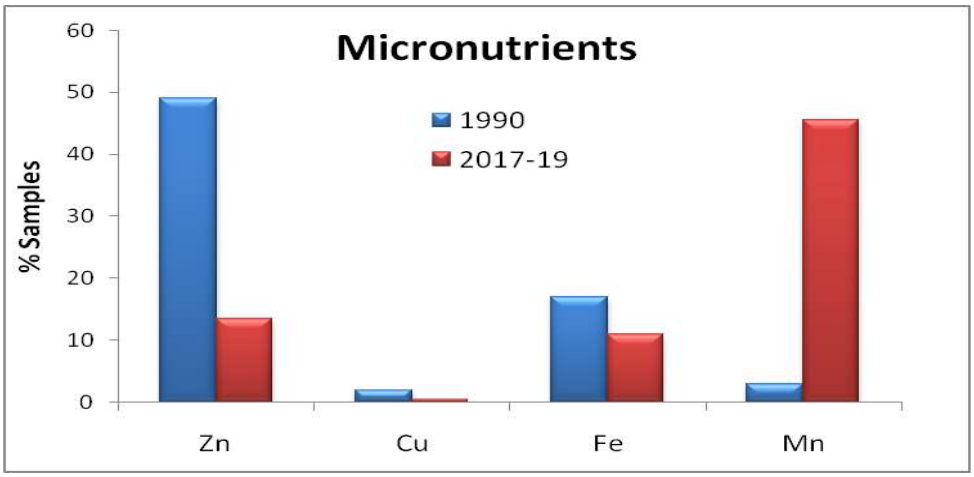


Salinity and/or Sodicity of Soils

- Salt-affected soils cover about 2.68% area of the total degraded land area in Punjab during 2015-16 mainly in South-west Punjab (Source: https://bhuvan-app1.nrsc.gov.in/thematic/thematic/index.php).
  - Among different categories of salt-affected soils, saline soils cover 85.7% area of the total area under salt-affected soils, sodic soils cover 0.5% area and saline-sodic soils cover 13.8 % area
  - The use of marginal quality groundwater for irrigation has further aggravated the problem of water logging and salinity in South-west Punjab.

[5]Nayyar V K, Takkar P N, Bansal R L, Singh S P , Kaur N P and Sadana US (1990). Micronutrients in soils and crops, Research Bulletin, Punjab Agricultural University, Ludhiana, p 148

Figure. 7. Variation in available Zn, Cu, Fe and Mn concentration in soils of Punjab during 1990 and 2017-19



- Residue burning of wheat and paddy residues is contributing to the loss of soil fertility. According to NPMCR (2014), it is reported that the burning of one tonne of straw accounts for the loss of the entire amount of organic carbon, 5.5 kg of N, 2.3 kg of P, 25 kg of K and 1.2 kg of sulphur. On average crop residue of different crops contain approximately 80% of N, 25% of P, 50% of sulphur (S) and 20% of K (Bhuvaneshwari et al., 2019[6]). If crop residues are retained on soil/mixed using various tillage operations, it can enrich the soil with C, N, P, K, S and micronutrients.
- Crop residue burning results in accelerated heat penetration into the soil, elevating the soil temperature to about 42°C (Jain et al., 2014[7]). Consequently, it leads to the loss of moisture and thermal instability, making it difficult for the succeeding crops to grow. It also kills soil microorganisms present at a depth of 2.5 cm, which are critical for soil fertility.

- ***Pesticide residues and soil health***
  - In Punjab, the use of pesticides was 9.2% of the total pesticides used in the country during 2018-19 and over 8% during 2019-20 (Directorate of Plant Protection, Ministry of Agriculture and Farmers Welfare, Govt. of India).

[6]Bhuvaneshwari S, Hettiarachchi H, Meegoda JN (2019). Crop residue burning in India: policy challenges and potential solutions. International journal of environmental research and public health 16 (5):832

[7]Jain N, Bhatia A, Pathak H (2014). Emission of air pollutants from crop residue burning in India. Aerosol and Air Quality Research 14 (1):422-430

- Pesticides typically are designed to adsorb to organic matter. High organic matter in soils results in a greater chance of pesticide retention in soil and remains available for its intended use. Lower soil organic matter leads to a higher risk of pesticide leaching into groundwater. As more water enters the soil profile through precipitation or irrigation, pesticides may become "desorbed" (when pesticides become soluble and detaches from soil organic matter).
- The commonly used herbicides disrupt the process of nutrient transformations in soils. Few examples are
  - Triclopyr inhibits soil bacteria that transform ammonia into nitrite.
  - Glyphosate reduces the activity and growth of free-living nitrogen-fixing bacteria in the soil.
  - 2,4-D inhibits the transformation of ammonia into nitrates by soil bacteria.

- ***Soil erosion***
  - The submontane zone (*Kandi area*) suffers from soil erosion (5.0% per cent area of the State) by water, mainly in the districts of SBS Nagar, Pathankot, Hoshiarpur, Rupnagar and SAS Nagar.
  - Average annual soil loss of >15 Mg/ha, with some areas having as high as 80 Mg/ha.
  - Off-site impacts of soil erosion by water lead to the siltation of water bodies.

Challenges

- Tackling the triple challenge
  - Feeding a growing population;
  - Providing a livelihood for farmers; and,
  - Protecting the environment (including conserving soil health) together.
- Resilience against local/national/global environmental and economic factors.

- Movement of nutrients and pesticide residues with runoff waters from the agricultural fields into the water bodies.
- Increasing weather resiliency of crops to reduce the crop input cost and its impact on soil health.

Short and Long-term Strategies: 2030 and 2047 Soils

- **Restoring carbon cycle**
    - *Recycling crop residues preferably through in-situ means of m*ulching and/or incorporation
        - Enhancing research efforts on crop residue management including enhanced decomposition through microbial means.
        - By 2030: Check burning (through in-situ disposal) by 100%
    - *Emphasis on reduced rate of GHG emissions*
        - Development of novel climate-smart and higher-efficiency fertilizers.
        - Precise application of fertilizers on
            - Soil test basis
            - Leaf colour chart and green seeker sensors, etc.
            - Intermittent irrigation practices in paddy
            - Integrated nutrient, pest and water management
- **Integrated nutrient and insect-pest management**
    - Farmer-friendly development and use of plant and animal residue-based composts and bio-fertilizers.
    - In-situ management of plant residues viz. mulching, incorporation.
    - Including leguminous crops in prevailing cropping systems.
    - Mechanical methods of insect-pest control.
    - Use of bio agents for pest control including friendly insects.

- Use of organic and green pesticides.
- Based on the above components, a timeline is being suggested to shift from chemical agriculture to integrated agriculture:-
  - By 2030, 20% of the total cropped area
  - By 2047, 70% of the total cropped area

- **Revisiting Soil Health Card Scheme**: The prevailing SHC scheme could not fulfil the objectives of improving soil health due to certain shortcomings. Soil health can be improved through:
  - Provision of integrated nutrient management concept in SHC
  - Including soil's physical and biological health
    - Present and potential scenario of sub-surface compaction
    - Susceptibility towards crusting
  - Provision of pesticide residues in soils
  - By 2047 all the farmers will be issued soil health card.
- **Soil erosion management**
  - Redrawing of watershed boundaries at the State level under changed landscape conditions and identification of micro-watersheds within watersheds for efficient soil and water conservation measures.
  - Higher emphasis on vegetative means for soil conservation strategies in catchment areas.
  - Re-forestation in the Shiwalik hills
    - By 2030, 100% of the total forest area (public or private sector) be planted with native and/or established vegetation in the form of trees, bushes and shrubs
  - Ensure no change of land use in *Kandi* area of the State

- **Digitization of soil resource**
    - Soil texture maps at 1:10,000 scale
    - Digitization of soil health cards
    - Overlaying of soil fertility, soil erosion, and soil salinity maps to develop a decision support system for better soil management strategies.
    - The digitization of soil resources be completed as per the following timeline:
        - By 2030, 50% of the total cropped area.
        - By 2040, 100% of the total cropped area.
- ***Research*** targeting nutrient and pesticide fate and resistance within soils

Current Status (Air)

- About three crore people in Punjab are breathing toxic air
    - RSPM (Respirable Suspended Particulate Matter) levels are above the maximum permissible limits in almost all the cities of Punjab.
    - Rising air pollution led to 41,090 deaths in Punjab in 2019.
- Air pollution quite variable over time and space
    - PM2.5 – 83-303 $\mu g/m^3$
    - AQI - 40-151
- Ludhiana is in the top 50 most polluted cities in the world
- Industrial gaseous effluents
    - 13,070 red category industries (coal/rice husk-based) in 2011-12.
    - Industrial combustion contributes 47% of PM10.0 emissions followed by brick and open agriculture burning.
- Vehicular air pollution
    - Lakhs of cars, trucks, buses and scooters (46 lakhs in 2008 to 67 lakhs in 2012 to one crore in 2019)
    - Ludhiana alone has 12 lakh vehicles

- Almost 56% of nitrogen oxide emissions are contributed by the transport sector apart from other GHGs
- Adds to the already increased air temperatures (Island effect)

- Agricultural air pollution
  - CO_2 and CH_4 emissions from fields
  - Nitrogen oxide gas emissions (fertilizer application)
  - Stubble burning – 16-20 million tonnes of crop residues
  - SMOG (Smoke + GHGs)

Challenges

- *Ever-increasing human population*: The increasing population is taking a toll on the environment, particularly the air.
- Virtually there is no forest land in Punjab.
- Burning of crop residue
- Prolonged flooding in rice fields
  - *Ever-increasing vehicular population*
  - *Domestic and industrial solid waste disposal* -Lack of awareness among the masses regarding the concept of 'reduce and reuse' and separate biodegradable waste from non-biodegradable one. Besides, Lack of awareness and will to systematic process for collection and scientific disposal of solid wastes at the local body level officials.

Short and Long-term Strategies : 2030 and 2047

- ***Re-visiting vehicular management :***

  Details regarding this are in chapter Sustainable Transport

- ***Planning for clean fuel*** (non-fossil based) use: Details in chapter on Affordable and Clean Energy

- ***Carbon sequestration and recycling***: Nature has provided us with a beautiful 'Carbon Cycle' through which the carbon dioxide is taken by the plants as an ingredient for photosynthesis and hence producing their biomass. These plants when die (depending on their life, be it annuals, biennials or perennials) become part of the soil and remain decomposing, thereby emitting carbon dioxide back into the atmosphere at a very slow rate. However, this cycle has been disturbed by anthropogenic activities, where humans apart from producing large amounts of greenhouse gases, also increase the rate of release of these gases more than those of the natural rates of emissions. For this purpose, the following points can be taken into consideration*:*
    - *Urban afforestation*: The so-called scrub forest should be converted into well-defined forests. The native species of trees and other vegetation need to be planted in a systematic way. Since there is no scope for expanding the forest area, there is a strong need to create minor forests in the villages.
        - By 2030: The whole of the area designated as forest land should be planted with native species of trees, along with some quick-growing trees which are adapted to such climatic conditions. All the national and State highways should have a line of trees on both sides as well as the area in between 2 opposite direction roads, wherever feasible. All the farmlands must have at least five trees per acre. In turn, the farmers should be credited on the basis of the amount of sequestered carbon.
        - By 2047: All the towns and cities should have at least 5-ha of dedicated forest area with recreational facilities so as to be a source of income for the local bodies.
    - *Incorporation of crop and animal residues into soils*
    - *Moving from Chemical to Integrated agriculture*
    - Reducing *methane and other GHG emissions*:
        - Intermittent irrigation in paddy fields is a way to reduce methane gas emissions.

- Cattle on carbohydrate-rich diets with high intake will produce less methane as a percentage of dietary gross energy.
- Grinding and pelleting of forages increases the passage rate and reduces methane emitted by the animals.

- *Scientific management of solid wastes*: There is a strong need to plan for solid waste management in urban and rural.
- *Urban greening*
- *Locality-specific greening modules to be developed by the local bodies*: The local bodies must plan for the greening of different localities in the cities and towns in consultation with specialists, architects and inhabitants.
- *Identification and/or development of quick-growing trees/bushes for plantation*: The quick-growing species of trees, bushes, shrubs, etc. be identified or developed by the forest scientists for those particular climatic conditions.
- *Easy and non-destructive method of plantation*: Also, the planners must take into account the ground situation and try to suggest easy and non-destructive methods of plantation, especially in households, which should be inhabitant-friendly.
- *Development of* site-*specific modules of plantation* with respect to
    - Size of house
    - Type of soil
    - Availability of space
- The timeline for urban greening should be as under
    - By 2030, 15% of the urban area to be revegetated
    - By 2040, 20% of the urban area to be revegetated
    - By 2047, 30% of the urban area to be revegetated

Mining of Sand, Gravel and Earth

The State government framed and approved the 'Mining of Sand and Gravel Policy 2021'. The policy does not mention the mechanism/process of mining sand and gravel. Though mining is important to maintain the carrying capacity of streams and rivers apart from letting these change their course, scientific site-specific modules be developed for the mining of sand and gravel in the seasonal streams, streams and rivers. The State government should come out with a mining policy keeping in view the following points:

- Sand mining in rivers, streams and seasonal streams is a must for maintaining their carrying capacity. However, the mining by private contractors must be done under the strict supervision of geologists or environmental specialists so as not to adversely impact the environment.
    - The rivers or streams or seasonal streams should not change their course and damage agricultural and domestic land.
    - The river/stream bed must be of the similar level after the mining has been done.
    - The mining should not be carried out in such a way so as to affect the hillsides and lead to mass erosion of hillsides, streams or river banks.
    - An upper limit of sand mining should be defined for each site separately by the specialists and should in no way it should exceed this limit.

Annexure

Table 1. Projected changes in temperature, precipitation and total runoff in Punjab
(With relation to baseline 1970-2000)

Region	Year	Temperature(°C)	Precipitation (%)	Total runoff (%)
North	2030	0.5	0	0
	2040	1.5	7.0	5.0
	2050	2.0	10.0	7.0
Central	2030	0.5	0	0
	2040	1.0	7.0	5.0
	2050	1.5	10.0	7.0
South	2030	0.5	0	-5.0
	2040	1.0	4.0	-2.0
	2050	1.5	5.0	0

Table 2: Impact of an increasing number of dry spells on groundwater decline in central Punjab

Year	Monsoon rain (mm)	Number of rainy days	Dry spells (Number/duration, days)	Additional water pumped out (BCM)	Fall in the water table (cm)
2009	832	24	4 (14, 13, 16, 19)	15.0	30.0
2010	650	36	1 (19)	5.25	10.0
2011	1157	33	1 (14)	3.50	7.00
2013	696	23	2 (11, 10)	8.75	17.5
2018	843	28	3 (10, 11, 13)	12.3	24.6
2019	844	28	5 (12, 18, 12, 12, 11)	15.0	30.0

Source: Dr PK Kingra, PAU

Table 3: Quantitative assessment of soil erosion by water in Punjab

Magnitude of soil loss (Mg ha^{-1})	Area (%)
<5	87.51
5–10	6.31
10–15	2.16
15–20	0.88
20–40	1.72
>40	1.42

Source: Pal et al., 2016[8]

[8]Pal, S., Sidhu, G. S., Tiwari, A. K., Sarkar, D. and Sharda, V.N. 2016. Soil erosion in Punjab. Current Science. 111: 1687-1693

VISION 2047 – RESOURCES

TARGETS, SHORT- AND LONG-TERM STRATEGIES

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
WATER				
Crop diversification	Rice area = 30.8 lakh ha (Paddy = 25.8 lakh ha + Basmati = 5 lakh ha) Wheat area = 35.1 lakh ha	Replace 35% area from paddy to block-specific alternate crops Replace 10% wheat area with mustard or block-specific niche crops	Replace 75% area from paddy to block-specific alternate crops Replace 20% area with mustard or block-specific niche crops	Three-pronged strategy for crop diversification at the micro-level (block/cluster of blocks) based on (i) water availability, (ii) niche crops and (iii) market infrastructure and intelligence
Water metering in agricultural sector	Not in practice	Installation of tube well water/electricity meters on all farms > 12 ha	Installation of tube well water/electricity meters on all farms	Will ensure judicious use of water and any saving in water from the prescribed could be credited to the farmers
Water metering in domestic sector	Not in practice	Installation of water meters in the houses with a plot area of 500 sq m (or above) by the local bodies including Nagar Panchayats and Gram Panchayat.	Installation of water meters in all the houses by the local bodies including Nagar Panchayats and Gram Panchayat.	Charging for water on per unit basis will inculcate a sense of water conservation as in the case of electricity
Water rationing in agricultural sector	Not in practice	400% of nominal rates for Farms >12 ha	200% of nominal rates for all farms up to 4 ha	The minimum prescribed quantum of irrigation water as per good practices recommended by PAU could be provided free or at nominal rates. Any quantity consumed above to be charged at higher rates
Water credits in agricultural sector	Not in practice	Farms >12 ha be credited @Rs 2/m^3 with a capping of Rs 3750/ha	Farms up to 4 ha be credited @Rs 2/m^3 with a capping of Rs 6250/ha	Water credits @Rs 2/m^3 be credited to farmers who save upon irrigation water over the minimum prescribed limit with differential capping
Micro-irrigation	1% area under micro-irrigation	20% area under micro-irrigation	50% area under micro-irrigation	Farmers opting for micro-irrigation be credited for the water so saved

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Revival of drains in rural area	Majority of drains are defunct (lack of data)	40% drains revival with gabions	100% drains revival with gabions	The drains need to be desilted and fixed with gabion-type of structures so as to ensure the natural recharge of excess runoff during the rainy season
Excess canal water -GW recharge	Most of the canal water recharge structures are defunct	40% of the total feasible length of canals be linked to recharge structures	100% of the total feasible length of canals be linked to recharge structures	Presently, 1.8 BCM of surface water goes out of State boundaries (could be actually higher). This water could be used for recharging groundwater. However, a committee of experts should suggest low-cost and low-maintenance structures.
Capping of agricultural land lease amount	No mechanism for capping land lease amount	The lease amount should be based on recommended input cost and 15-20% profit to the cultivating farmer	--	The input cost incurred should be estimated as per the recommendations of PAU. A profit of 15-20% should be estimated on the total input cost as above.
Water conservation by industry	PWRDA – in the process of issuing guidelines	Units extracting >1000 m^3/day should conserve/harvest rain/runoff water equivalent to 300% of the water being extracted Units extracting 100-1000 m^3/day should conserve/harvest rain/runoff water equivalent to 300% of the water being extracted Units extracting 10-100 m^3/day should conserve/harvest rain/runoff water equivalent to 300% of the water being extracted	--	This conservation of water scheme should be made mandatory by PWRDA

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Roof top rainwater harvesting	As per CGWA guidelines	All existing and new houses in rural and urban areas with a plot area of 500 sq meters or higher; all educational and official buildings (public or private sector); all housing societies including multistory buildings, etc.	All existing and new houses in rural and urban areas	This could be the flagship programme of the Smart City Project
Reuse of treated effluents	No data made available	Laying of 40% of the total underground pipeline based on potentially treated wastewater	Laying of 100% of the total underground pipeline based on potentially treated wastewater	The treated water from ETPs or CETPs be diverted for irrigation and/or non-drinking domestic purposes
Green belts	No exact information (mostly concretized)	4-m (or higher) wide green strip on all 4 sides of the industrial units (or an equivalent area) extracting groundwater >100 m^3/day 2-m wide grass strip on all 4 sides of the industrial unit (or an equivalent area) extracting groundwater 10-100 m^3/day 1-m wide grass strip on all 4 sides of the industrial unit (or an equivalent area) extracting groundwater <10 m^3/day	--	Green belts are an important groundwater recharge point Most of the units have concretized the area around the buildings/sheds
De-concretization of pavements	Not in practice despite of NGT orders	All pavements/strips in all major cities and towns should be laid with perforated tiles and/or green grass for 90% infiltration of rain/runoff water.	--	The pavements and metaled strips along the major and minor roads/streets in urban areas need to be revisited for improving the infiltration rate of water into the soil.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Sewage water treatment and reuse	Only 21% of treated (1827 MLD) sewage water is being re-used	50% of total sewage water generated to be treated as per the approved technology/ BIS standards along with the laying of a pipeline system for its distribution.	100% of total sewage water generated to be treated as per the approved technology/ BIS standards along with the laying of a pipeline system for its distribution	Total sewage water generated in the State is 2500 MLD
SOILS				
Integrated nutrient and pest management	No specific information is available	20% of the total cropped area under integrated agriculture	70% of the total cropped area under integrated agriculture	Use of plant and animal-based composts and biofertilizers along with chemical fertilizers will improve soil physical, chemical and biological health
Soil health cards	Prevailing scheme could not fulfil the objectives	Revised SHCs to be issued for all farmers having >12 ha of land	Revised SHCs to be issued for all the farmers	SHCs need to be updated with * provision of INM concept * provision of soil physical and biological health * provision of pesticide residues in soils * provision of locally available non-chemical sources of nutrition

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Soil erosion management	No specific information	100% of the total forest area (public or private sector) be planted with native and/or established vegetation in the form of trees, bushes and shrubs	--	Watersheds delineation including the minimum possible micro-watersheds
Digitization of soil resource	No specific information	50% of the total cropped area	--	Digitization of soil resources especially on 1:10,000 scale
AIR				
Afforestation in non-forest areas	No information	All the national and State highways should have a line of trees on both sides All farmlands must have at least 5 trees per acre.	Each village to have at least 2-ha of dedicated mini-forest All the towns and cities should have at least 5-ha of dedicated forest area with recreational facilities so as to be a source of income for the local bodies	These strategies should be part of Smart City Mission Urban afforestation is an important component of the strategy for managing air pollution levels in all cities.
Shift towards integrated agriculture	Almost nil	Reducing the use of chemical fertilizers by 20% and synthetic pesticides by 15%	Reducing the use of chemical fertilizers by 40% and synthetic pesticides by 40%	Integrated agriculture is the best bet to balance between chemical hazards and food security
Urban greening	Not in practice	At least 15% of the urban area to be under green cover	At least 30% of the urban area to be under green cover	

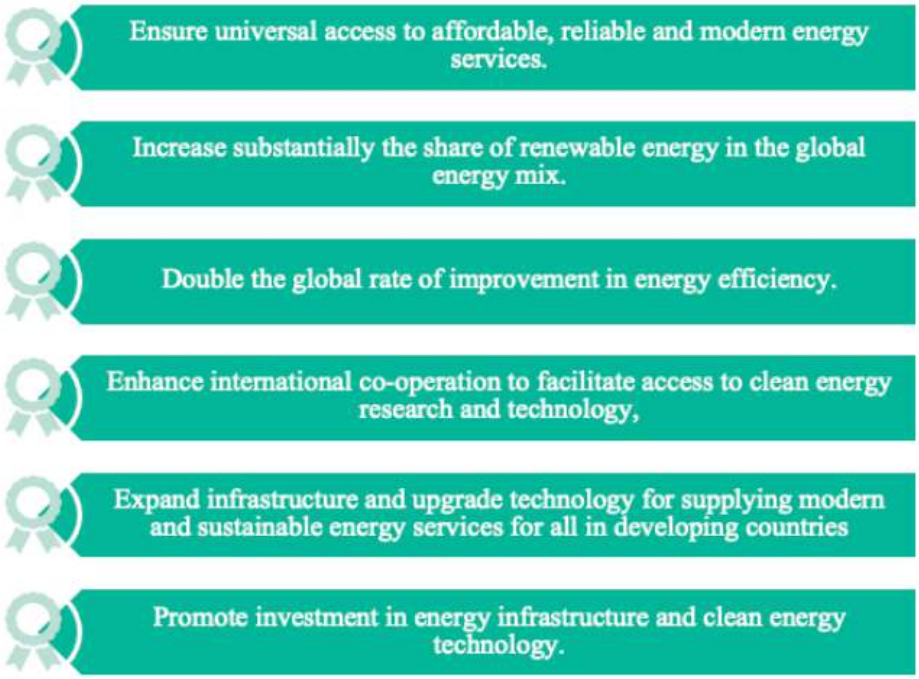
Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Online Continuous Emission Monitoring System (OCEMS)	Prevalent in Punjab, but few are offline	All industries	--	• Installation of online emission quality monitoring system in 17 categories of highly polluting industries and in Common Hazardous waste and Biomedical waste incinerators for measurement of the parameters, Particulate Matter, NH_3 (Ammonia), SO_2 (Sulphur Dioxide), NO_X (Oxides of Nitrogen) and other sector-specific parameters, • Installation of a surveillance system with industrial grade IP (Internet Protocol) cameras having PAN, Tilt, Zoom (PTZ) with leased line real-time connection for data streaming and transmission of the same in case of industries claiming Zero Liquid Discharge (ZLD); • Ensure regular maintenance and operation of the online system with tamper proof mechanism having facilities for online calibration.

II
AFFORDABLE AND CLEAN ENERGY

There is no development without fuelling the engine of growth. Energy is a critical resource, and people without sustainable access to energy are deprived of the opportunity to become part of national and global development. And yet, one billion people worldwide live without access to energy. The Secretary-General of the United Nations, Ban Ki-moon, has said, "Energy is the golden thread that connects economic growth, social equity, and environmental sustainability. With access to energy, people can study, go to university, get a job, start a business – and reach their full potential." Energy access, therefore, constitutes a core component of the sustainable development agenda. The production of useable energy can also be a source of climate change – accounting for around 60% of total global greenhouse gas emissions.

Many scholars believe that renewable energy has the potential to replace fossil fuels on a commercial basis due to its many desirable properties. Furthermore, large-scale commercial production of renewable energy would lead to a decline in carbon emissions, promote energy security among developing nations, diversify agriculture and reverse land degradation. Renewables currently constitute only 10 percent of the global energy needs. Recently, India achieved 5th global position in solar power deployment by surpassing Italy. Solar power capacity has increased by more than 11 times in the last five years, from 2.6 GW in March 2014 to 30 GW in July 2019. Today, India's solar tariff is very competitive and has achieved grid parity. Sustainable Development Goals (SDGs) also aim to correct this enormous imbalance by ensuring that everyone has access to affordable, reliable, and modern energy services by 2030. Targets for achieving SDG 7 are listed in figure 1.

Figure 1: Targets for achieving SDG 7



Current Status

- The total installed capacity of Punjab as of 30th Naovember 2022 is 14907 MW. The total contracted capacity as per Punjab SLDC web site of PSTCL along with total installed Renewable Energy Project in the state of Punjab as on 30.11.2022 is as under:-

Source	**DISCOM Cintracted Capacity**	**Total Installed Capacity**
Central Sector	4128 MW	4128 MW
BBMB Share	1133 MW	1133 MW
Renewable Energy Pvt Projects outside the state	1183 MW	1183 MW
Total	**6444 MW**	**6444 MW**
State Projects		
PSPCL owned Thermal	1760 MW	1760 MW
IPP Thermal	3920 MW	3920 MW
Hydel	1015 MW	1015 MW
Roof Top Solar	239 MW	239 MW
Renewable Energy	1212 MW	1529 MW
Total	**8146 MW**	**8463 MW**
Grand Total	**14590 MW**	**14907 MW**

- According to the PSPCL, the electricity generation in the State has increased by 20%; and,

- The State has reduced its transmission and distribution losses from 20.12% to 13.68% during 2010-2020.

National Level Status of Punjab (State Energy and Climate Index)

NITI Aayog has undertaken extensive research and, through a consultative process to construct a fair, transparent and progressive Index called the State Energy and Climate Index (SECI). First Index document was prepared and published in April 2022. States have been categorized into three groups: Frontrunner, Achievers and Aspirants. Punjab has been adjudged as the frontrunner and achieved a SECI Score of 48.6 after Gujrat and Kerala, among the category of larger States. Table 3 (Annexure).

For any economy, power is the lifeline as it is the crucial for almost all the sectors agriculture, industry, services etc. The priority in the energy sector of Punjab is mainly to maintain an uninterrupted power supply and to take care of the increasing power demand. Compared to other States, the power situation in Punjab has improved significantly, and the State has emerged as one of the most improved States as per the State Energy Efficiency Index 2020.

Vision 2047

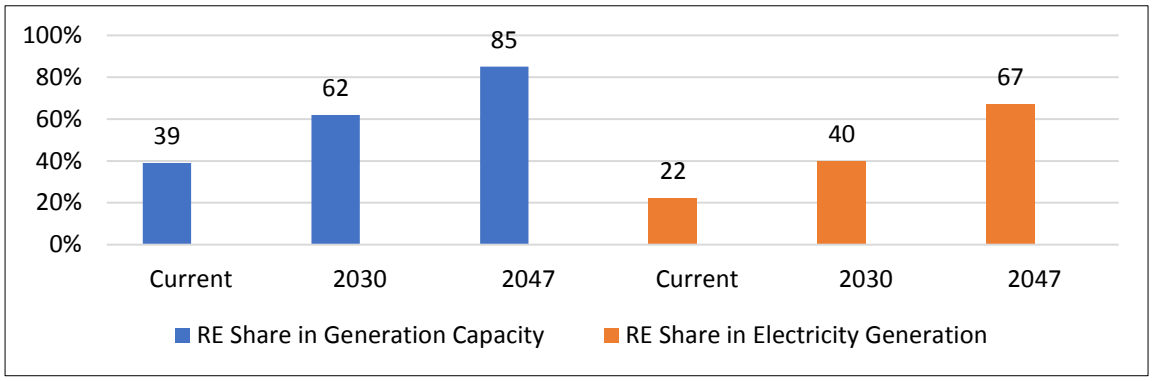
It is envisaged to achieve the following key goals in the power sector by 2047:

1. To achieve energy independence and energy security
2. To Enhance Decarbonization of the Energy Sector
3. Self-sufficiency in manufacturing of renewable energy technologies
4. To become the global hub for Green Hydrogen production and exports

India, in its Nationally Determined Contributions (NDCs), has committed that it will reduce the emission intensity of its GDP by 33% to 35% by 2030 from the 2005 level.

The national power sector overview/targets are given in Table 4 (Annexure) and the RE share in installed capacity and the percentage of electricity generation are shown in figure 2.

Figure 2: RE Share in installed Capacity and Electricity Generation (%)



Source: CEA Optimal Energy Mix Report (Jan. 2020), NITI Aayog – India Energy Outlook, 2021

Energy Forecasting

While energy forecasting, a study onload growth in the industry, agriculture, commercial, domestic and other categories of consumers has been carried out by taking baseline data of PSPCL and PEDA from the year 2014-15. Electrical power projections depend upon two factors, electrical energy requirement (MU) and peak demand (MW), for various categories of consumers.

Year-wise & Category-wise Electrical Energy Requirement Forecast upto the year 2047

Category-wise growth forecast has been calculated to bring out the annual peak demand (MW) and annual energy requirement (MU) by considering the T&D loss reduction fixed corresponding to that year, energy saving and demand side management. Year-wise total energy consumption by various categories of consumers is depicted in the Tables 5, 6 and 7 respectively in the Annexure.

Status Of Schemes Implemented Through PSPCL/PSTCL

1. **Deen Dayal Upadhay Gyan Jyoti Yojana (DDUGJY) (State) –** For this scheme, REC Ltd. vide letter dated 31.03.2016 had sanctioned Rs.250.73 Cr. for all the 20 no. districts (as per the census 2011) of the State under various components i.e. System Strengthening, Metering, SAGY & Feeder Separation. Closure proposals of all the 20 no. projects stand submitted to REC. Approval of closure proposals has already been received from REC.

2. **Deen Dayal Upadhay Gyan Jyoti Yojana (DDUGJY) (Kandi Area) Scheme-** GoI / MoP launched this scheme for electrification works in rural areas. Rs. 190.24 crore was

sanctioned for segregation of feeders/AP consumer metering in 5 no. districts of Kandi Area. Closure proposals of all the 05 no. projects stand submitted to REC Approval of closure proposals has already been received from REC.

3. **Integrated Power Development Scheme:-** Work orders for executing the IPDS Scheme on a full turnkey basis in 20 No. circles of Punjab State were issued to the turnkey contractors in Sept 2017. The work of all the 20 no. circles (102 no. towns) covered under the IPDS Scheme have been completed.

4. **Ujjwal DISCOM Assurance Yojana (UDAY):-** The UDAY scheme was launched on 15thNovember 2015, under the Government of India for operational and financial turnaround of the Power Distribution Companies (DISCOMs) owned by any State. This scheme was established to provide an affordable and accessible 24×7 supply of power to all.

   PSPCL, GOP and MOP entered into a tripartite agreement as per which 75% of the PSPCL's debt as on 30.09.2015 amounting to Rs.15,628.26 Crore is to be taken over by Govt. of Punjab. In compliance with the MOU, Non-SLR bonds amounting to Rs.15,628.26 Crore were issued by Govt. of Punjab and transferred this amount to PSPCL as a GOP loan upto FY 2019-20 and on 31.03.2020 converted this loan into equity.

5. **Revamped Distribution Sector Scheme (RDSS):-**GoI recently launched RDSS Scheme to improve operational efficiencies and financial sustainability of DISCOMs by providing result-linked financial assistance to strengthen supply infrastructure based on achieving basic minimum benchmarks and meeting pre-qualifying criteria like advance payment of subsidy & clearance of Govt. dues by State Govt. GoI's Revamped Distribution Sector Scheme (RDSS) 21. In this respect, PSPCL has submitted the Action Plan to GoI's Nodal Agency- PFC. The Project cost submitted to PFC is around Rs. 25237 Cr.

Renewable Energy

Punjab is an agriculture-rich State with limited availability of land for solar power projects. Even with zero potential in wind energy, Punjab has come up as the best-

performing State in renewable energy and energy efficiency. There is huge potential for the use of solar energy for power generation. Punjab has also developed large canal network with the potential for harnessing hydropower.

The Punjab Energy Development Agency is making continuous efforts to increase the share of Renewable Energy. Punjab has an overall renewable energy potential of 6.72 GW. Currently, Punjab has renewable energy installed capacity of 1780 MW as of 31.05.2022 (Ministry of New and Renewable Energy) constituting almost 13% of its total installed capacity. However, under the prerogative of sustainable development goals (SDGs) efforts are being made to increase the share of renewable energy to 30 percent of the total energy matrix by 2030 and 55% by year 2047.

New and Renewable Sources of Energy (NRSE)Thrust Areas

1. Small / Micro Hydel Projects: Punjab has a canal network which is being harnessed to generate electricity by installing small hydel units across these canals.
2. Co-generation: Co-generation power projects are being set up to use biomass for co-generation in sugar, paper, fertilizer, chemical, textile and other industries.
3. Power generation from Biomass / Agro residue and waste (cotton stalks, paddy husk, paddy straw etc.)
4. Production of Bio-CNG / Compressed Biogas from Agro Residue
5. Power Generation from Solar Energy: Solar power projects on the ground, rooftop, canal top etc.
6. Energy Conservation in all sectors of the economy. Implementation of PAT scheme in industries, ECBC in the building sector, LED street lighting and energy-efficient water pumping in the municipal sector.
7. Promotion and development of other renewable energy programmes like Biogas programme, Photovoltaic demonstration programme, Solar Thermal extension programme, Conversion of cities into 100% RE City, Electric Operated Vehicles, Production of Hydrogen from Agro-waste and sewage for transportation and Production of 2G Bio-ethanol from Agro-waste for transportation

8. Pradhan Mantri-Kisan Urja Suraksha Evam Utthan Mahaabhiyan (PM-KUSUM) scheme for implementation of solar pumping programme
9. Solar Steam cooking by increasing sustainability and clean fuel for group housing, hostels, jails, and community cooking.

Strategic Initiatives

1. To create conducive conditions for attracting private sector investment in NRSE projects along with broader participation by the public community/ civil society.
2. To provide decentralized Renewable Energy for agriculture, industry, commercial and household sector particularly in rural areas thereby improving the quality of power and reducing transmission & distribution losses.
3. To support specific NRSE projects and schemes for generating and conserving energy through energy efficiency.
4. To support research and development, demonstration and commercialization of new and emerging technologies in the renewable energy sector, such as fuel cells, hydrogen and chemical energy, alternate fuels for transportation etc.
5. To utilize surplus paddy straw which is nearly about 10 million tonnes produced annually and has the capacity to generate about 1200 MW power or 3000 tonnes CBG per day.
6. Compulsory mixing of at least 10% Biomass pallet manufacturing mainly of Rice Straw being generated within the state by IPP and PSPCL owned Thermal Plants and coal-based cogeneration plants operating within the state.
7. Generation of electricity by paper industry using industrial wastes (black liquor) produced in house.
8. Setting up of floating solar PV projects in the RSD reservoir, irrigation dams, sarovars of religious places etc.
9. Single window clearance of Renewable projects under PIB portal.
10. Setting up the Agri-PV projects where farmers can be benefitted of both cropping/agriculture yield and also solar power generation.

Implementation Strategies

1. The programmes relating to biogas, SPV demonstration programmes and other schemes related to the rural masses are promoted and implemented in line with the guidelines from the Ministry of New and Renewable Energy (MNRE), Government of India.
2. The programs of power projects like Small/ Mini Hydro, co-generation, Biomass/ Agro residue, power generation from waste, solar power, etc. are implemented through private and public participation on Built, Operate and Own Basis.
3. The programme of energy conservation is being implemented under the guidelines of the Bureau of Energy Efficiency (BEE) Ministry of Power, GOI, to implement the Energy Conservation Act, 2001, as framed by the Govt. of India and other related programmes to conserve energy in different sectors.

Major Challenges

- The peak demand of electricity has increased to 14,744 MW in the year 2021-22 which is going to double by year the 2030.
- The per capita consumption of electricity in the State has increased to 2,171 kWh in 2019-20.
- Power theft is one of the prominent issues in Punjab, which needs to be addressed especially the divisions that fall under the border belt.
- There is the need to find clean alternative. State utility PSPCL not signing PPA with biomass power project developers, at tariff notified by PSERC.
- Sole dependence on Hydel and Thermal Power.

PEDA is a State nodal agency for setting up following renewable energy projects/programmes to achieve the short-term target of 2030 and long-term target of 2047.

- **BIOMASS and Cogeneration Power Project/ Compressed BIOGAS Projects**:
  - State utility (PSPCL) is showing reluctance for signing of PPA in Biomass sector developers due to higher tariff rates. The development in the sector can only

take off if government provides Subsidies/Grants/Incentives to biomass developers or State DISCOM.

- Paddy Straw collection in a short period and huge space requirement for storage; Left out stubble due to combine harvesting is tedious to collect.
- Long-term storage of the bales leads to the degradation of BIOMASS and also loss in GCV.
- 100% take of Compressed Biogas.

- **Mini Hydel Projects**:
  - The left-out sites are either of a very low head or the duration of water supply in those sites is very less, therefore, these sites are not technically viable.
  - Non-availability of NOC of BBMB to harness 60-65 MW Hydro power from BML.
- Canal-top Solar Power Projects cost 30% more than ground-mounted; CFA is required from MNRE, GOI.
- Withdrawal of CFA by MNRE under waste-to-energy projects for CBG.
- Lack of disposal of Bio-fertilizer generated by large fertilizer companies.
- Withdrawal of subsidy for Solar Water Heating program.

Short-term Strategies: 2030

Priority should be the energy conservation and energy efficiency mission in all sectors of the economy for sizeable reduction in power demand.

- Need for judicious use of energy - by implementing energy conservation and energy efficiency to reduce demand through strict directives under the Energy Conservation Act 2001.
- Ensuring the use of energy-efficient and BEE Star labelled electrical appliances/equipment and strict compliance with the use of ECBC in the State.
- State utility would be given clear targets under the demand-side management programme.

- Ensuring time-bound effective implementation of Renewable Purchase Obligations.
- Building effective and strong coordination mechanisms among various stakeholder departments/organizations.
- Ensuring streamlining single-window clearance of power projects.
- 10% solarization of rural water pumping system as enough land is available on the water supply schemes.
- Encouraging solar and biomass power developers and ensuring the signing of PPA on the rates approved by the PSERC.
- Providing State and Central Financial Assistance for important renewable energy projects
- Promoting the use of solar cookers for domestic, community-level kitchens.
- Providing incentives to renewable energy and energy efficiency investors and consumers.
- Mass awareness programs for using renewable energy systems and adopting energy efficiency in the State.
- Huge demand for Solar Water Heating systems in households and institutions.
- Punjab State Electricity Regulatory Commission (PSERC) to allocate pre-fixed capacity for RE projects to be set up through competitive bidding, for which signing of PPA by DISCOM shall be mandatory.
- Determination of feeding tariff for sale of surplus power of cogeneration power plants using renewable fuels.
- Ministry of Power, Government of India should do away with the capping of a maximum 500 KWp capacity installation for Rooftop Solar Power Projects in industries. It should be only 70% of the sanctioned load.
- Utilization of the surplus paddy straw (about 10 million tons produced annually for about 1200 MW power generation or production of 3000-ton CBG per day). This will also improve the environment quality.

- The signing of 141MW IA/PPA under the Farmer Solar Power Scheme will bring an investment in the State, which will also generate employment for thousands of skilled/unskilled workers.

Long-term Strategies [2047]

Secondly, maximum power may be generated through renewable energy resources by clearing hurdles as challenges mentioned by the department of new and renewable energy. The share of renewable energy may be targeted to 55% of the total installed power capacity in the State envisions @2047.

- Transition to green hydrogen in the long run.
- High-temperature pyrolysis in the plasma environment will be the ultimate solution for municipal solid wastes.
- Developing Energy Service Companies for energy efficiency, renewable energy and other power projects on competitive bidding and arrangements repayment guarantee and a low-interest loan.
- Identification of unproductive land to promote solar and biomass parks through private developers.
- 50% solarization of rural water supply system as enough land is available on the water supply schemes.
- Promoting solar power generation capacity installation through net metering and rooftop solar system with suitable regulations.
- Providing decentralized Renewable Energy for agriculture, industry, commercial and household sector, particularly in rural areas, will improve the quality of power and reduce transmission and distribution losses.
- Developing and implementing new technology in energy efficiency, solar, biomass, micro wind turbine of low wind speed, efficient batteries and hydrogen power generation.
- Leveraging international cooperation in technology transfer for efficient power generation technology of higher efficiency.
- Developing local solar manufacturing through effective industrial policy.

- Developing and implementing power sector reforms in State utilities through demand-side management programs.
- 100% solarization of agriculture pumping system to get relief from free power.
- All the smart cities to be developed as 100 per cent RE Cities.
- The existing sites of power projects need to be reassessed, and potential can be harnessed. For instance, a potential of about 60-65 MW is available on Bhakra Main Link in the stretch passing through Punjab State. If BBMB grants NOC, PEDA can harness this potential.
- CBG: Punjab has abundant paddy straw from which CBG/Bio-CNG can be produced. For marketing such a huge quantity of CBG, GAIL should be directed to accept the whole amount of this CBG in its gas pipeline network. The present system of sale of CBG on the petrol pump of oil companies required heavy investment. This mechanism delays the offtake of CBG from the Developers/investors.
- Setting up of Rooftop SPV Power Plants/Ground Mounted Solar Power Plants are required to be facilitated by DISCOM.
- The Ministry of Petroleum and Natural Gas, GOI should invest in creating infrastructure for storing large quantities of Compressed Biogas (CBG) from Agro-Residue.
- Support Research and Development, Demonstration and Commercialization of New and Emerging Technologies in the Renewable energy sector, such as fuel cells, hydrogen and chemical energy, alternate fuels for transportation etc.

Table 1: Annual per capita sale of electricity in Punjab (KWH +KVAh)

Sectors / Year	2017-18	2018-19	2019-20	2020-21
Domestic	449	443	535	557
Commercial	128	130	175	142
Industrial	528	571	584	530
Public lighting	37	36	37	26
Agricultural	411	365	370	413
New Category	-	-	-	-
Total	1552	1544	1702	1669

Source: Statistical Abstract of Punjab 2021, Dept. of Planning, Govt. of Punjab (Info as of31st March 2021)

Table 2: Consumption of Petroleum Products in Punjab

Products / Year	2018-19 (M.ton.)	2019-20 (M.ton.)	2020-21 (M.ton.)
Petrol	879200	960243	888360
High-speed diesel	3216700	3213695	2741734
kerosene	2300	4481	1170
Light diesel oil	9400	9224	12255
LPG	856900	891337	917478
LPG connections	8307	8550	8851
Furnace Oil	213400	173894	148678

Source: Statistical Abstract of Punjab 2021, Dept. of Planning, Govt. of Punjab (Info as of 31st March 2021)

Table 3: SECI-Round 1 Scorecard of Larger States (partial)

Score and Ranking of Larger States								
Rank	**State**	**DISCOM's Performance**	**Access, affordability & reliability**	**Clean Energy Initiatives**	**Energy Efficiency**	**Env. Sustain-ability**	**New Initiatives**	**SECI Score**
1	Gujrat	72.7	52.4	39.2	40.1	35.1	5.5	50.1
2	Kerala	64.4	67.3	21.5	58	46.9	7.7	49.1
3	**Punjab**	**77.1**	**46.8**	**26.1**	**35.1**	**37**	**2.3**	**48.6**
4	Haryana	69.8	53.6	42.9	11.7	33.4	6.9	47.9
5	Uttarakhand	61.9	55.3	18.5	50.5	48.7	14.7	46.5
6	Maharashtra	57.7	51.2	34	75.7	36.2	10.4	46.0

Source: State Energy & Climate Index: Round – 1 Published By: NITI Aayog (April 2022)

Table 4: National Power Sector Overview / Targets

Power Generation	Current		Target for 2030		Target for 2047	
	Total	**RE**	**Total**	**RE**	**Total**	**RE**
Generation Capacity (GW)	393	151	817	506	1325	1125
Electricity Production (BU)	1372	297	2518	1012	4721	3153

Source: CEA Optimal Energy Mix Report (Jan. 2020), NITI Aayog – India Energy Outlook, 2021

Table 5: Year-wise energy consumption by different consumers

Consumers	2019-20	2020-21	2021-22	2022-23	2023-24	2029-30	2034-35	2039-40	2046-47
Domestic	13546	15324	16611	18421	20249	32644	44419	57351	80000
Commercial	3714	3283	3718	4281	4878	9720	14225	19266	28734
Public Lighting	140	210	212	228	240	301	339	375	430
Public Water Works	613	596	661	786	882	1304	1625	1932	2455
Irrigation	11468	13051	14129	16539	18471	27880	33436	37159	42765
LT Industries	3400	3312	3491	3786	4077	6090	8069	10401	14762
HT Industries	13395	12468	13457	14922	16331	26619	36342	47020	66718
Bulk Supply	881	990	1009	1077	1139	1573	1940	2347	3043
Total (Energy consumption)	47157	49234	53287	60040	66267	106129	140395	175851	238907
T & D Losses-MU	9288	8903	9403.588	10346.87	11147.72	16705.49	21630.39	26509	34912
T & D Losses- in%	16.45	15.31	15.00	14.70	14.40	13.60	13.35	13.10	12.75
Energy requirement in MU (UR)	56445	58137	62690.59	70386.87	77414.72	122834.5	162025.4	202360	273819
Annual Load Factor - % (UR)	47.36	50.53	48.59	48.79	48.99	51.39	55.89	60.89	67.89
Peak Load Demand in MW (UR)	13606	13148	14744	16495	18080	27537	33774	37937.27	46041.13

Source: PSPCL & PSTCL.

Table 6: Sector-wise installed capacity in MW in Punjab

	2019-20	2020-21	2021-22	2022-23	2023-24	2029-30	2034-35	2039-40	2046-47
Thermal	8214	8214	7174	7174	7174	7174	7174	7174	7174
Hydro	3371	3371	3371	3451	3483	3933	3933	3933	3933
Bio-mass + biogas+ waste	253	253	157	210	210	210	210	210	210
Mini Hydel	54	54	54	60	60	60	60	60	60
Solar	1039	1114	1161	1191	2491	3721	3871	3901	3901
Baggasse & Co-gen	171	128	128	137	137	137	137	137	137
Wind	350	350	350	700	800	800	800	800	800
Nuclear	197	197	197	197	197	197	197	197	197
Total	13649	13681	12592	13120	14552	16232	16382	16412	16412

Source: PSPCL & PSTCL.

Note:

- T&D losses figures are trued up figures up to FY 2019-20. Accordingly, for working out the energy requirement, it has been assumed that for subsequent years, there will be a decrease of, 0.3% during FY 2023-24 to 2025-26 and 0.05% per year from FY 2026-27 to FY 2035-36.
- Category-wise consumer's growth rate is taken as per under:-

Table 7: Category-wise consumer growth rate

S. No.	Category	Period		Growth Rates (CAGR) in %
1	Domestic (No. of Consumers)	2017-18 to 2020-21	**Actual**	2.95
		2021-22 to 2022-23	**Projected**	2.75
		2023-24 to 2030-31		2.50
		2031-32 to 2035-36		2.00
2	Commercial (Connected Load)	2017-18 to 2020-21	**Actual**	3.79
		2021-22 to 2022-23	**Projected**	2.75
		2023-24 to 2030-31		2.50
		2031-32 to 2035-36		2.00
3	Public lighting (Connected Load)	2017-18 to 2020-21	**Actual**	0.49
		2021-22 to 2022-23	**Projected**	2.50
		2023-24 to 2030-31		2.00
		2031-32 to 2035-36		1.75

Table 8: Renewable Energy Achievements and Targets (cumulative) upto March, 2047 in the State of Punjab

Project / Program	Achievements			Targets						Remarks
	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25 to 2029-30	FY 2030-31 to 2034-35	FY 2035-36 to 2039-40	FY 2041-42 to 2046-47	
Solar Power Projects (MW)										
a) Ground Mounted	815	815	815	815	815	1315	1915	2415	3115	Subject to signing of PPA by PSPCL
b) Farmer Solar Power Scheme -2015 (MW)	141	141	141	341	541	1741	2741	3741	4800	-
c) Rooftop	23.3	29	43.6	43.6	43.6	73.6	108.6	148.6	155	
d) Canal Top	20	20	20	20	20	20	20	20	20	*
Off Grid Solar Rooftop Power Plants (MW)	--	--	1.0	1.0	3.0	13.0	23.0	33.0	42	-
PM Kusum Scheme										
Comp-A (MW)	--	--	--	200	400	1600	2600	3600	5000	-
Comp-B (No.s)	2000	8000	14000	24000	34000	94000	119000	144000	174000	-
Comp-C (No.s)	--	--	--	50000	100000	400000	6,50000	900000	1200000	-
Biomass Power c) Bio-refinery										
a) IPP (MW)	97.5	97.5	97.5	107	107	107	107	107	1232	**
b) Co-gen (MW)	462.07	462.07	462.07	462.07	462.07	462.07	462.07	462.07	462.07	
National Biogas Program (Nos.)	2112	4949	4949	4949	4949	4949	4949	4949	4949	
Mini Hydel Projects (MW)	167.8	169.55	172.10	172.10	175.35	175.35	175.35	175.35	240	***
Energy Efficiency / Conservation (Avoided) in MW	125	150	175	200	225	375	500	550	600	
Total			1752			5509			15,066	

*Canal top solar projects cost 30 per cent more than ground mounted. MNRE discontinued 30 % CFA. If revived, it can harness the potential of 2000 MW.

** PEDA is planning to setup an 1125 MW Hybrid Power Project with a capacity of (1000 MW Solar + 125 MW Biomass Power Project) subject to the signing of a Power Purchase Agreement with PSPCL.

*** The left-out sites are either of the very low head or water availability duration is very less, therefore these sites are not technically viable. A potential of about 60-65 MW is available on Bhakra Main Line in the stretch passing through Punjab State. lf NOC is granted by BBMB, MBL being an inter-State canal, PEDA can harness this potential.

Source: PEDA

AFFORDABLE AND CLEAN ENERGY
TARGETS, SHORT- AND LONG-TERM STRATEGIES

Indicator	Current Status/Baseline	Target(s) (2030)	Target(s) (2047)	Strategies
Reduction in T & D Losses in (%)	15	13.60	12.75	Increasing power factor towards unity, decreasing losses by correcting transformer capacity, cable losses and reducing theft.
Avoiding capacity addition by energy efficiency/energy conservation (MW)	175	375	600	Implementation of Perform, Achieve & Trade Scheme, Energy Conservation Building Code, Energy Efficient LED Lighting, Energy audit of Industry and Buildings etc.
Increase in Renewable Energy Generation (%)	14	30	55	Installation of Solar power plants, Biomass Power plants, Bio-CNG plants, Mini-Hydel power stations etc.
Solarization of rural water supply systems / Scheme (%)	-	10%	50%	Policy intervention to use available land at rural water supply schemes for installation of a solar power plant to run pump motors. Reducing electricity burden on State utility.
Solarization of Agriculture Pumping System (%)	0.5	30	100	Implementation of PM KUSUM Scheme with central, State and beneficiary funding for solarization of Agriculture pump-sets, to reduce power subsidy burden and decrease power demand.
Development of 100 % RE cities in the Smart Cities Programme	-	2	5	Policy intervention to reduce the power load of cities by implementing rooftop solar, net-metering solar and solar street lighting etc.
Scheme-wise Renewable Energy Generation				
Ground Mounted Solar Power Plants (MW)	815	1315	3115	Solar Power Projects in Govt./Pvt. Sector subjected to PPA signed by State utility
Farmer Solar Power Scheme (MW)	141	1741	4800	Implementation of Farmer Solar Power Scheme – 2015
Rooftop Solar Plants (MW)	43.6	73.6	155	Promoting rooftop solar power in institutions and houses
Canal Top Solar Power Plants (MW)	20	20	2000	2000 MW can be increased subjected to reviving of 30% CFA from MNRE, GOI
Off-Grid Solar Rooftop plant (MW)	1	13	42	Promoting off-grid solar rooftop in industry and institutions
Biomass Power Plant (IPP) in MW	97.5	107	1232	1125 MW Hybrid Power Projects subject to the signing of PPA by State utility
Mini-Hydel Power Plants (MW)	172.10	175.35	240	Installation of the plant on left-out sites and 60 MW on BML subject to NOC from BBMB
PM KUSUM Scheme; Comp-A (MW)	-	1600	5000	Solarization of Agriculture Pumps through Solar Power Plants

III
CLIMATE ACTION & NATURAL RESOURCE CONSERVATION

- One-third of all carbon emissions come from burning coal, making it the single largest contributor to climate change worldwide (State of India's Environment, 2022).
- Annual CO2 emissions have reached 36.7 billion tons, more than double of what was emitted in 1972.
- **India** is the 5th most vulnerable to climate change globally. In 2018, India lost nearly 37 billion dollars due to climate change (almost twice what it lost between 1998-2017).
- NITI Aayog (2018) estimates that more than 600 million Indians will face 'acute water shortages' in the coming years. MIT estimated that flash flooding would significantly increase in 78 of India's 89 urban areas if global temperature rise to 2° Celsius above preindustrial levels.

Since climate change and its effects have no geographical boundaries, the climate action scenario of Punjab has to be located in global and national context. The IPCC (Intergovernmental Panel on Climate Change) Working Group I Sixth Assessment report shows that emissions of greenhouse gases from human activities are responsible for approximately 1.1°C of warming since 1850-1900 and finds that averaged over the next 20 years, global temperature is expected to reach or exceed 1.5°C of warming. World Health Organisation (WHO) predicts that an additional 250,000 climate-related deaths will occur globally, per year, between 2030 and 2050 given the current trajectory from malnutrition, malaria, diarrhoea and heat stress. The Stockholm conference in 1972 started a global debate on the environment, and since then, the world has seen a 38-fold increase in environmental laws. However, the condition of the planet continues to worsen. As per the IPCC 2021 report, the world will face unavoidable multiple climate hazards over the next two decades with global warming of 1.5°C. Even temporarily exceeding this warming level will result in additional severe impacts, some of which will be irreversible.

Floods compromise hygiene and access to water and sanitation facilities and services, leading to diseases such as cholera, to which children are particularly susceptible and vulnerable. Droughts led to crop failures and rising food prices, which for the poor mean food insecurity and nutritional deprivations that can have lifelong impacts. Twenty-one of the world's 30

most polluted cities are in India (IQ Air Report, 2020), and a Lancet study from 2018 estimates that air pollution in India killed 1.24 million people in 2017 (12.5 per cent of total deaths).

- India recycled 12% and burnt 20% of the 3.5 million tons of plastic waste it generated in 2019-20. There is no information on the remaining 68% of plastic waste, which most likely ends up in dumpsites and landfills.
- By the middle of the century, around 35 million people in India could face annual coastal flooding, with 40-50 million people at risk by the end of the century if emissions are high.
- In 2022, India recorded its hottest March. This triggered an early onslaught of heatwaves. The country reported 280 heatwave days between March 11 and May 18, the highest in the past 12 years.

Climate change presents two challenges that shall be addressed simultaneously. The first is to stabilize the climate. Secondly, to slow the rate of warming to reduce the risk of climate extremes. This dual approach that tackles emissions of CO2 in the longer term and non-CO2 super pollutants in the near term is necessary to limit and reduce the impacts of climate change (Gabrielle Dreyfus et al, 2022). Cutting short-lived super climate pollutants, including black carbon, methane, tropospheric ozone, and hydrofluorocarbons can avoid four times more warming by 2050 than CO2 cuts alone. Such strategy should be adopted in Punjab to effectively reduce the impacts of climate change on Punjab and build a climate-resilient economy through an integrated multi-sectoral and multi-governance approach. Such an approach will ensure long-term food security, agricultural yields and income security for the marginalized.

GENERAL EMISSIONS OVERVIEW					
Common Pollutants	**CO2**	**Methane CH4**	**Black Carbon**	**Ozone (O3)**	**Hydrofluorocarbons (HFC)**
Human Activities	Almost all human activities emit CO2	Agriculture Waste, Fossil Fuel Burning, Dairy Production	Agriculture Household Energy Transport Industries Waste	No direct activities release O3 but Sunlight in combination with CO2, CO, VOC's, N oxides causes O3 emissions	HVAC Systems Residential, commercial, Industrial Foam Agents Transport Air Conditioning
Life in Atmosphere	Doesn't Destruct	12 Years	2 Weeks	Few Weeks	15 Years
Warming Potential	1	86 times CO2 in the 20-year period	460-1500 times CO2	Variable	3790 times CO2 in 20 years
Overall Impacts on Punjab	Annual yield losses Warming climate Health Diseases And many more	Annual yield losses of wheat, rice, soy, maize Warming climate Health Diseases	Modifying Rain Patterns Blocks sunlight entering Earth Increasing Temperatures	Toxicity to Flora & Fauna Yield Losses Major cause of deaths	Can accelerate warming by 0.1'C Thousands of times more potent than CO2

Current Status: Climate Change Scenario in Punjab

The State is already facing various consequences of climate change, causing distress to all developmental and socio-economic sectors. Out of the 33 identified types of hazards by the High-Powered Committee (HPC) on Disaster Management of the Government of India, Punjab is vulnerable to 21 kinds of hazards. These include climatic-induced hazards such as floods, hailstorms, heat & cold waves, drought, thunder, lightning, etc. Detrimental challenges of these hazards may directly or indirectly affect agricultural yield, water yield, net primary productivity of the forest, energy security etc.

Industrial towns have high pollution potential. Cities like Amritsar, Batala, Gobindgarh Mandi, Jalandhar, Khanna, Ludhiana, Nangal and Phagwara have already been earmarked by the board as the most polluted areas in the State. The sectors that contribute maximum emissions at the global, national, state or even at the individual level are Agriculture, forest and other land use (AFOLU), transportation, energy, building sector, Industrial process & product use (IPPU) and waste generation.

BOX-3 Extreme Climate Change Impacts

- 41090 deaths (18.8% of the total fatalities) in Punjab attributed to Air Pollution in 2019 (State of India' Environment, 2021).
- Snowfalls in Pathankot district during Jan 06-07, 2011
- 400 mm rainfall in 24 hours at Ludhiana city on Aug 12, 2011
- Extreme low temperature of -0.4°Cat Bathinda district on Feb 09, 2012
- Prolonged winters (cold wave spell) in year 2012 compared with the past
- Ludhiana district witnessed monthly average of maximum temperature in December 2019, lowest in last 22 years
- In 2019, district Ludhiana received above normal rainfall 1156 mm against normal of 760 mm
- Higher number of frost days witnessed during the year 2018-19 compared with the previous years (Envistats, 2022. Ministry of Statistics and Programme Implementation).

<table>
<tr><td colspan="2">2030 Goals: Concrete goals with a definite timeline, expenditure and measuring metrics. Progress shall be reviewed annually with Status reports generated by the concerned departments.</td><td>2047 Vision: This is the long-term strategy or path the State wants to follow, complementing the Global & National climate change vision. The point of this is to ensure a path towards a sustainable future helping the next generation of decision-makers to move towards a carbon-free world by prioritizing clean air, clean water and unadulterated food for the masses.</td></tr>
<tr><td colspan="3">PRIORITY ACTIONS TAKEN BY PUNJAB GOVERNMENT TO COMBAT CLIMATE CHANGE</td></tr>
<tr><td colspan="2">ENERGY SECTOR PRIORITIES

1. Addressing climate change through the development of solar and other clean energy technologies to power a clean and sustainable future
2. Increase coverage of solar lighting in urban and rural areas
3. Linking renewable energy to rural development by providing affordable and clean energy to the rural population</td><td>BUILT ENVIRONMENT &INDUSTRIAL PROCESS AND PRODUCT USE PRIORITIES

1. Strengthen the livelihood generation
2. Promoting affordable housing in rural areas
3. Enhance the drainage capacity of existing stormwater drainage systems in towns to address the issue of excessive runoff
4. Developing Mechanism for climate-sensitive disease tagging
5. Abate continued water pollution of underground and surface water sources which is likely to increase due to a spurt in industries and population
6. Inventorization of Industrial Pollutants</td></tr>
<tr><td>SUSTAINABLE TRANSPORTATION SECTOR PRIORITIES

1. Efficient waste management systems with proper segregation and scientific disposal
2. Promotion of Non-emitting vehicles
3. EV adoption policy & Old vehicles phase-out policy
4. Upgrading the current public transport system
5. Achieving Pollution & Stress-free commute</td><td>WASTE MANAGEMENT SECTOR PRIORITIES

1. Bioremediation of landfill site for legacy waste management and setting up of sanitary
2. landfills for inert waste
3. Upscaling Existing Waste Management Infrastructure to meet future demands</td><td>AGRICULTURE FOREST AND OTHER LAND USE SECTOR PRIORITIES

1. Optimum use of water resources and promoting high-density aquaculture system
2. Promote crop diversification including enhancing areas under horticulture and fishery
3. Manage livestock health in the emerging pest and disease scenario
4. Climate resilient shed
5. Smart and resource-efficient dairy farming
6. Manage Floods in a future erratic and excess extreme rainfall scenario
7. Undertake a focused approach to augment groundwater especially in problematic areas</td></tr>
</table>

THE GUIDING PRINCIPLES				
Vulnerability Assessment		**Data Driven**		**Circular Economy**
Vulnerability is defined as a function of its 'sensitivity' i.e., susceptibility to harm from a first-order impact of a hazard or stressor and its lack of 'adaptive capacity' to overcome or cope with such situations. Risk composition consists of two dimensions (i.e., risk-causing factors and risk-bearing bodies) and three aspects (i.e., probability, vulnerability, and exposure as shown in the figure above. In climate change risk research, risk-causing factors, which include the natural climate and anthropogenic climate change, determine the probability of risk occurrence and are presented as sudden onset events and slow onset events. Exposure and vulnerability are two attributes of risk-bearing bodies; the former refers to the number of risk-bearing bodies that may experience adverse effects, and the latter refers to the tendency or trend of adverse effects, which is often characterized by sensitivity and propensity		Climate data are essential inputs for government officials responsible for the management of public finances, assets, such as electricity grids, government buildings and roads, and services such as emergency response and assistance.		A circular economy is a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, narrowing energy and material loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing and recycling.
Public Awareness and Market Perception	**Equality and Justice**	**Financial Feasibility and Economic Viability**	**Education and Skill Development**	**Technology Integration**
The increasing frequency of extreme weather events across the globe, the intensifying international debates about the political urgency to mitigate climate change, as well as the respective more action-demanding social movements, have caused a significant increase in climate change awareness among the population.	Climate justice means, countries that have become wealthy through unrestricted carbon emissions have the greater responsibility to not only stop warming the planet but also to help other countries adapt to climate change and develop economically with non-polluting technologies. Also, marginalized groups and those unable to overcome the effects of climate change shall be given support by the affluent population of the country.	The financial system could help achieve global climate targets by aligning investments to sustainability. However, investors are largely exposed to carbon-intensive assets that could become stranded, thus delaying the low-carbon transition and bringing new sources of risk for financial stability, i.e., climate-related financial risks.	Education and Skill development helps people understand and address the impacts of the climate crisis, empowering them with the knowledge, skills, values and attitudes needed to act as agents of change and be eligible for 'GREEN JOBS'. Ex. Strengthening Knowledge Networks in the domain of Environment & Climate Change to address research issues, and promote technology development for enhancing State's resilience; Capacity building of Govt. functionaries for effective implementation of State initiatives; Specialized certificate training for dairy farmers/youth entrepreneurs for sustained milk productivity in climate change scenarios and minimizing methane emissions from dairy.	Climate technologies aim to better our ability to mitigate and adapt to the effects of climate change. Although implementing clean technology would require additional investment, it would ultimately lower operating costs. The journey for any single technology from early-stage R&D and proof-of-concept to early deployment and commercial competitiveness depends on a complex system of support models and stakeholders.

I. Energy Sector Emission Management

Energy sources are one of the largest contributors to a State's Green House Gas (GHG) emissions. This sector also includes fugitive emissions, particularly during the extraction, transformation, and transportation of primary fossil fuels.

1. Global Perspective

As per British Petroleum (BP) 2019, Statistical review of the world energy report, fossil fuels have mainly satisfied the world's rapid growth in energy demand over the past four decades. Oil, coal, natural gas, hydroelectric, nuclear energy, and renewables accounted for 33.6%, 27.2%, 23.9%, 6.8%, 4.4% and 4% of the world's primary energy consumption in 2018, respectively.

2. National Scenario

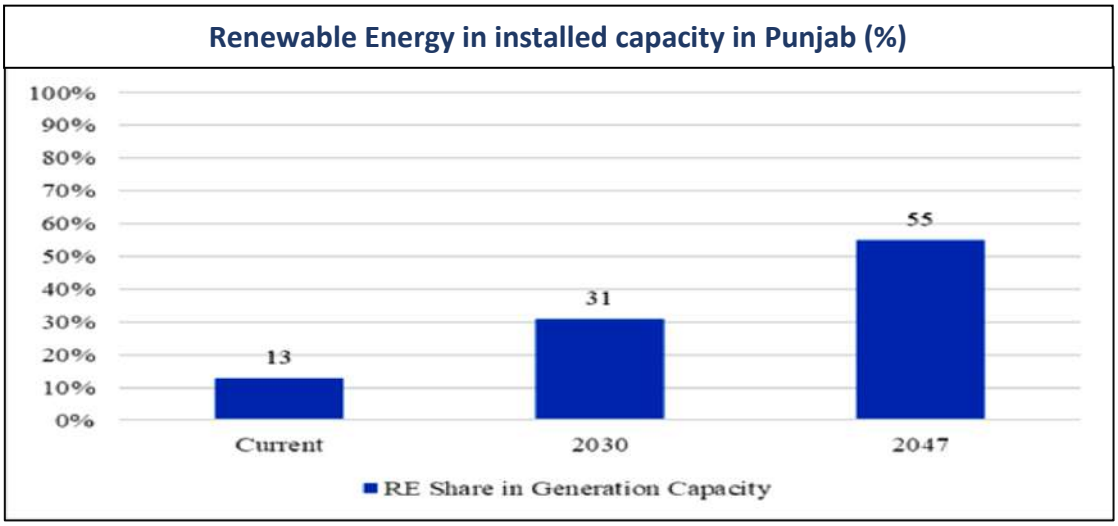
India is the third-largest global emitter of CO2, despite low per capita CO2 emissions. The carbon intensity of its power sector, particularly, is well above the global average. Additionally, particulate matter emissions are a major factor in air pollution. In 2019, there were well over one million premature deaths related to ambient snd household air pollution.

Current Status

Punjab is energy surplus for 8.5 months of the year and shortfall is for 3.5 months during the paddy period where shortfall is due to excessive demand of paddy crop (PEDA). The State has shown a remarkable performance in providing affordable and clean energy to its population. In the SDG index 2020-21, Punjab has obtained 1st rank in terms of progress under SDG 11 (Sustainable Cities and Communities) and SDG 7 (Affordable and Clean Energy). It is worth mentioning that the State has established itself as an Achiever with a score of 100 in SDG 7. Access to modern and affordable energy services is fundamental in driving economic growth and powering human development. The State is in an energy surplus with 3.83% of the total installed capacity of India. The State's available capacity in 2020 was estimated to be 14205.42 MW. Electricity in the State is generated and distributed by the State-owned Punjab State Power Corporation Limited (PSPCL) and transmitted by Punjab State Transmission Corporation Limited (PSTCL).

The government has already notified Net Metering Policy and to date, Solar Rooftop Power domestic, institutional, government, commercial and industrial sectors. The graph below shows the percentage of installed Renewable Energy in the State.

Plants with a cumulative capacity of 74.1 MW have been installed in different sectors i.e.,



Understanding Punjab's GHG Emissions for Energy Sector

1. Emissions due to Fuel Combustion in Buildings
    a. Domestic
    b. Commercial
    c. Industrial
    d. Mixed-use Buildings
    e. Agriculture, Forestry and Food industry

Table-1 Annual Per-Capita Sale of Electricity in Punjab (KWh+KVaH)

Sectors / Year	2017-18	2018-19	2019-20	2020-21	2021-2022
Domestic	449	443	535	557	523
Commercial	128	130	175	142	174
Industrial	528	571	584	530	625
Public lighting	37	36	37	26	26
Agricultural	411	365	370	413	397
Total	1552	1544	1702	1669	1743

Source: Statistical Abstract of Punjab 2021, Dept. of Planning, Govt. of Punjab (Info as on 31st March 2021)

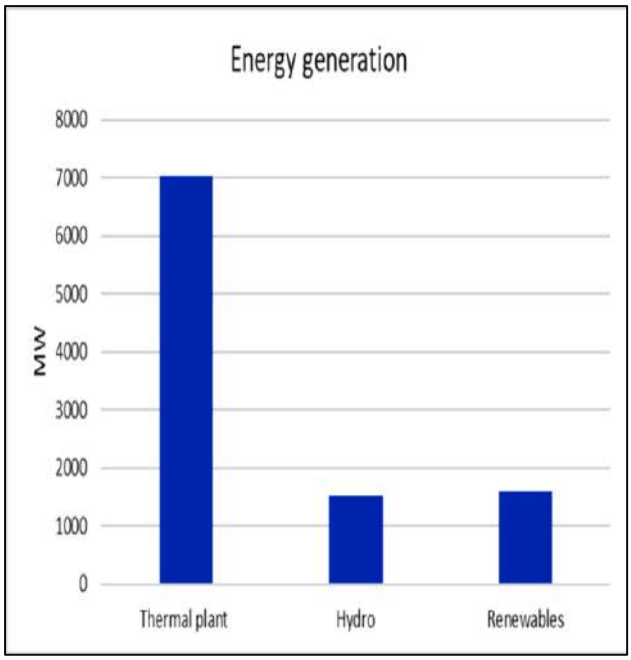
2. Energy Production Emissions
    a. Primary Fuel Production (e.g., coal mining, oil, and gas extraction)
    b. Fuel Processing and Conversion (e.g., crude oil to petroleum products)
    c. Energy production supplied to the grid
        i. Cogen
        ii. Waste-to-Energy
3. Emissions from Manufacturing & Construction Industries
4. Other Emissions
    a. Fugitive Emissions
    b. Transmission & Distribution Losses

Source: Global Protocol for Community-Scale Greenhouse Gas Inventories, Version 1.1

Action Plan and Policy Measures

There is a need to develop and adopt solar and other clean energy technologies to power an unpolluted and sustainable future. The State has set high targets to develop renewable energy generation and has launched a draft renewable energy policy to streamline its collective efforts towards renewable energy (RE). With these planned efforts, the RE share for the State is expected to rise. The State has a cumulative grid-connected renewable energy-based power generation of 580.95MW supplying power to the State grid. Data for the current status of energy generation in the State is shown in the graph above.

Figure 2. Energy Generation



01. Reduce Energy Consumption

- Ozone-depleting substances
- Eco-friendly Refrigerants
- Energy-efficient lighting fixtures
- 4/5-star-rated electric appliances
- Managing transmission and distribution losses
- Commissioning plan for Buildings, Equipment & Systems

02. Monitoring, Metering & Data Analytics

- Energy Management Systems (EMS)
- Data gathering useful for effective energy management
- Mandatory energy metering for all industries, commercial, and governmental buildings

03. Shift towards Renewable Energy

- This inevitable shift from coal/thermal power to renewable energy is a commitment to the State of Punjab.

Types of Renewable Energy in Punjab

- Solar Energy: Continuously increasing capacity till our mission of Coal Zero.
- Bio-gas: Through a combination of new technology and foreign support, ensuring
    - Reusable Water
    - Energy from Bio-gas
    - Treatment of Sludge and Creation of Nutrient rich Manure for farmers
- Hydropower (mini & large) Plant Development & Improvement Project
- To invest & explore Green Hydrogen

04. Goals and measures

- Increase the share of Renewable Energy in the total energy mix
- Cost reductions through R&D, demand-side financing mechanisms, and fiscal instruments
- Improvements in energy efficiency in buildings, solid waste management and shift to public transport
- Enhance ecosystem services, including carbon sinks, understanding of challenges of and response to climate change
- Initiatives to be introduced in the areas of efficient and cleaner technologies, promoting renewable energy generation, reducing emissions from the transport sector, afforestation and greening activities and standardizing knowledge management systems for adaptation and mitigation.

Energy Management Measuring Progress

Indicator	Installed Capacity (MW)	2030 Goals (Mw)	2047 Vision

Solar Power Projects ground Mounted	815.5	1251	• Developing Solar parks
			• Increasing the capacity of solar energy generation
			• Increase the number of rooftop solar installed
			  • Rural
			  • Urban

Rooftop solar	60.5	295	
Solar Net-metering	244.41	95	
Canal top Solar	20	20	
Co-generation	462.07	53	• Focusing on smaller Cogen plants
Mini-Hydro	172.10	11	• Revisiting the Existing infrastructure Building potential mini projects
Waste to Energy	1.5	1.5	• Mandatory source waste-to-energy plants to be installed
Biomass Power	97.5	660	• Biogas energy projects in rural areas for both waste management and energy production

Table-3

Indicator and Current Status	2030 Goals	2047 Vision	India's Target
Enhancing the private sector involvement in the renewable energy sector. **Current status of Energy generation (2020-2021)** Thermal - 7025 MW Hydro - 1531 MW Renewable -1605MW	• **Reduce coal consumption by 25%** (1756.25 MW) • Increase share of **Renewable Energy** by 21% • Increasing Yield of Hydropower structures (mini) • **Waste-to-Energy** • Investment in new technology such as **Thermo-Hydrolysis Plants** • Biogas energy projects in rural areas • Increasing the number of solar pumps installed for irrigation • PPP option provided to the private sector	• Coal Zero Mission to be achieved • Shift the Entire Energy Grid to Renewable and Non-emitting sources of Energy • Become Energy Surplus State with renewable energy as a major contributor not thermal power plants. • Become a Net-Zero Energy State to contribute to India's 2070 Vision	• One-third of all carbon emissions come from burning coal, making it the single largest contributor to climate change in the world. • 50% of Energy Requirement met by RE • Non-Fossil Energy Capacity to reach 500 GW by 2030.
Professional Skill Development	• Identification of Specific Courses • Identification of Teaching Institutes • Budget allocation for meeting future workforce development demand	• Green Jobs with a sufficient workforce • Compulsory education on Climate Change Science	• MNRE - 300 Crores allocated for Skill dev.in Renewable Energy • MNRE - 200 Crores for R&D
Promote energy efficiency in residential, commercial &institutional buildings	• Electrifying Punjab with LED lights • Energy Audits to be made mandatory	• Focus on non-emitting sources of energy • Mandatory & Automated Energy audits through IoT	• One-third of all carbon emissions come from burning coal, making it the single largest

Table-3			
Indicator and Current Status	**2030 Goals**	**2047 Vision**	**India's Target**
such as hotels, malls, and govt. buildings **91976 Solar Street Lighting Systems installed in 4077 villages**	• Only Energy Efficient Appliances with circular economy to be sold and used • Solar lights to be installed in rural areas • Research &Development of Energy efficient technologies • Mandatory Energy Efficient ratings for all residential, commercial and institutional buildings	enabled platforms &metering • Solar or LED or new efficient Lights installed in rural &urban areas • All new buildings to be built energy efficient • All existing buildings to be retrofitted with energy efficient systems	contributor to climate change in the world. • 50% of Energy Requirement met by RE • Non-Fossil Energy Capacity to reach 500 GW by 2030.
Reducing Energy Consumption Transmission &Distribution Losses from 2010-2020were (**20.12% - 13.65%)**	• Down to less than **12.1%** Losses • Promote Energy Efficient Fixtures and ban higher-emitting ones • Only 4*-5* Energy Star Rated products allowed • Passive and architectural methods to save electricity	• Down to less than **7.1%** Losses • Only lower-emitting products are available • Product lifecycle to have Net-Zero Emissions • Only 4*-5*Energy Star Rated products allowed • Energy Saving Techniques to be part of the National Building Codes	• Non-Fossil Energy Capacity to reach 500 GW by 2030. • Net-zero by 2070

Energy Monitoring& Metering	• 10 major cities to be monitored throughout the energy supply	• All businesses/Govt. Offices to have Internal & External metering
		• Metering to be done across the State
		• Real-Time Data to be displayed online with action areas identified
			• Government Orgs/ Portals to submit this data-
			  • MNRE
			  • Pollution Control Boards
			  • Niti Aayog
			  • MOEFCC

II. Waste Management

"One Man's Trash Is Another Man's Treasure"

Municipal Solid Waste (MSW)[1] contains

a) organic waste (food scraps, yard leaves, grass, brush, wood, process residues paper, etc.),

b) paper waste (paper scraps, cardboard, newspapers, magazines, bags, boxes, wrapping paper, telephone books, shredded paper, paper beverage cups, etc.) Paper is organic, but unless it is contaminated by food residue, the paper is not classified as organic;

c) plastic waste (PW) (bottles, packaging, containers, bags, lids and cups);

d) glass waste (bottles, broken glassware, light bulbs, coloured glass, etc.);

e) metal waste (cans, foil, tins, non-hazardous aerosol cans, railings, bicycles, etc.) and

f) other waste (textiles, leather, rubber, multi-laminates, e-waste, appliances, ash, other inert materials, etc.).

MSW can additionally be categorized into the following streams as

a) recyclables (paper, glass, plastic, metals, etc.);

b) compostable organic matter (food waste, fruit and vegetable waste, etc.);

c) toxic substances (paints, pesticides, medicines, used batteries, etc.) and

d) hazardous solid waste (blood-stained cotton, disposable syringes, sanitary napkins, etc.)

It has been analysed that the quantity of waste generation positively correlates with the nation's economic growth, population explosion, urbanization and industrialization.[2] These practices create serious health, safety, and environmental consequences.

The accumulation of mismanaged waste is a growing global concern. Managing waste is essential for building sustainable and liveable cities, but it remains challenging for many developing countries and cities. Effective waste management is expensive, often comprising

[1]Gupta, N., Yadav, K.K. and Kumar, V. (2015), "A review on current status of municipal solid waste management in India"
[2]UN-Habitat and UNESCAP 2015

20%–50% of municipal budgets, and operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported.

Understanding Punjab's GHG Emissions through Waste

Disposing of and treating the waste (solid and liquid waste) leads to carbon dioxide (CO2), Methane (CH4), and Nitrous Oxide (N20) emissions. The activities involving managing the waste that produces these emissions are:

1. **Disposal of Solid Waste in Landfills** (both legal and illegal dumping)

   Solid waste may be disposed of at managed sites such as sanitary landfill and managed dumps, and at unmanaged disposal sites such as open dumps, including above-ground piles, holes in the ground, and dumping into a natural feature - as ravines. Cities need to first calculate emissions from managed disposal sites and separately calculate and document emissions from unmanaged disposal sites.

2. **Converting Waste into Energy** through incineration

3. **Treatment of Solid Waste** through aerobic or anaerobic decomposition.

4. **Wastewater Treatment Facilities and Discharge**

   Municipal wastewater can be treated aerobically or anaerobically. When wastewater is treated anaerobically, methane (CH4) is produced. Both treatments also generate nitrous oxide (N2O) through the nitrification and denitrification of sewage nitrogen. N2O and CH4 are potent GHGs.

5. **Burning of Solid Waste**

   Incineration is a controlled, industrial process, often with energy recovery, where inputs and emissions can be measured, and data is mostly available. By contrast, open burning is an uncontrolled, often illicit process with different emissions and can typically only be estimated based on collection rates. Non-CO2 emissions, such as CH4 and N2O, depend more on technology and conditions during the incineration process.

Source: Global Protocol for Community-Scale Greenhouse Gas Inventories, Version 1.1

Current Status

The Department of Local Government oversees the waste management activities in the State. Punjab generates 4,300 tonnes per day (TPD) of municipal solid waste. Punjab is successfully implementing the low-cost decentralized approach for scientific and sustainable solid waste management in Urban Areas to ensure compliance with the Solid Waste Management Rules, 2016 and Punjab State Solid Waste Management Policy. The State has prepared and notified the Model Solid Waste Management, Cleanliness & Sanitation Byelaws. The ULBs have started low-cost composting through micro compost units and material recovery facilities for dry waste management. Punjab Model Municipal Solid Waste Management Plan, 2014 aims at managing Municipal Solid Waste of all Urban Local Bodies of Punjab (India) in Public Private Partnership (PPP) mode for a concession period of 25 years. Under this Punjab Model Municipal Solid Waste Management Plan, 2014, a State Level Municipal Solid Waste Master Plan has been prepared. Punjab has been divided into eight Municipal Solid Waste Clusters:

i) Jalandhar Cluster,

ii) Ludhiana Cluster,

iii) Bathinda Cluster,

iv) Ferozepur Cluster,

v) Patiala Cluster,

vi) Amritsar Cluster,

vii) Pathankot Cluster and

viii) GMADA Cluster

All municipal corporations have started using waste segregation techniques and have achieved 100% door-to-door waste collection. Further, a ban on single use plastic (SUP) items has been imposed, and enforcement monitoring is done. Moreover, the government has also focused on the following initiatives for the effective implementation of SWM Rules, 2016:

- Engagement of 115 community facilitators and 400 motivators at the ULB level to assist sanitation-related work.

- Encouraging the adoption of low-cost techniques to manage municipal solid waste in ULBs.
- Special drives and campaigns involving education & religious institutions and line departments. All 166 ULBs of Punjab have achieved certified Open Defecation Free status. Further, Punjab has been adjudged as the best state in sanitation in the country, with 08 ULBs and 2 Cantonment Boards awarded on various parameters.
- 100 % collection & treatment of Bio-Medical waste through common bio-medical waste treatment facilities set up in the state.
- Online tracking of bio-medical waste for effective monitoring.

The State is actively working on reducing GHG emissions at landfills by recycling and composting waste. These towns require a total of 242 Sewage treatment plants (STPs) with an overall capacity of 2200 MLD. State has worked on the following projects;

- 7729 compost pits constructed;
- 259 Material Recover Facility built;
- 249 Bulk waste generators compliance;
- 1825 on site composting of horticulture waste in parks/green belts/institutions;
- 861 elimination of garbage vulnerable points;
- 94 remediation of legacy waste;
- 15 sanitary landfill facilities for inert waste;
- 88 construction & demolition waste managing facility;
- Built two (1.5 MW) waste to energy plants in Bhatinda and Amritsar; and 124 STPs are in operation.

Source: Draft SAPCC 2.0 Punjab, GoP.

Source: Draft SAPCC 2.0 Punjab, Government of Punjab,

ACTION PLAN AND POLICY MEASURES

1. Efficient Waste Management

Waste Management is the biggest challenge in this sector. We do have the technology & expertise to overcome the challenge but fail in implementing, enforcing and logistical systems.

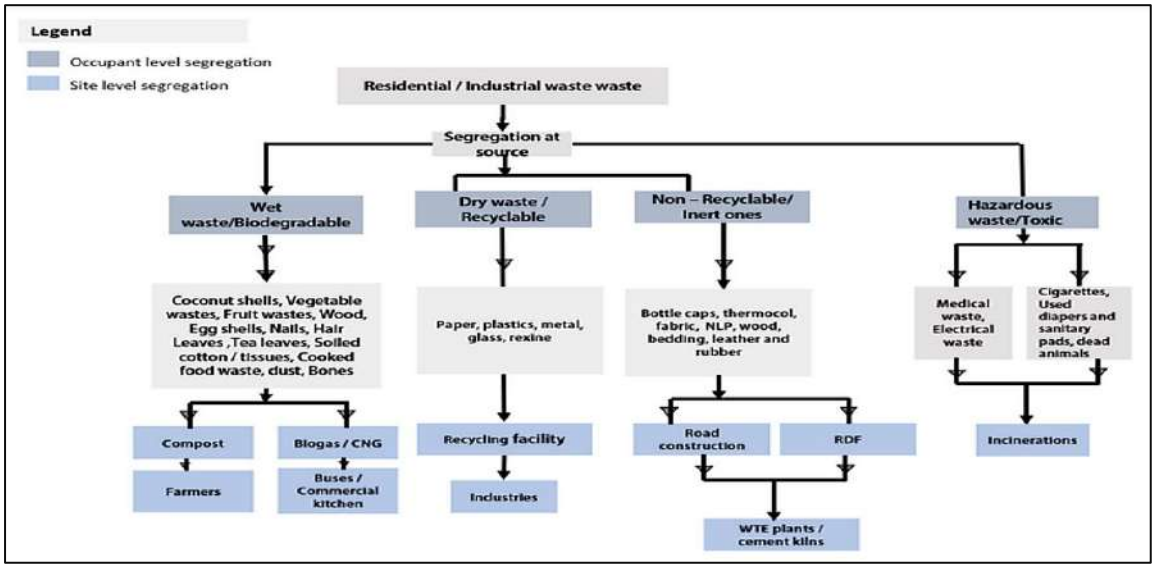


Figure 3 Efficient Waste Management Overview

2. Waste Segregation

- Decentralized Segregation - At Source Segregation
- Centralized Segregation - At MRF (Material Recycling Facility)
- Recognized/Registered Ragpickers
- Extended Producer Responsibility (EPR) enforcement
- Identifying legal and illegal dumping areas

3. Upscaling of Liquid and Solid Waste Treatment and its Compliance

The overall goal of waste management is to reduce its ill effects on human health & environment for a sustainable future and superior quality of life. The action points under the strategy would be:

- Installation of STPs with effective sludge management
- 100% door-to-door collection
- segregation of waste at source

- Construction of compost pits and MRFs
- Maximize recovery out of recyclable / non-recyclable fractions of waste
- Elimination of Garbage points from vulnerable sites
- Compliance by Bulk Waste Generators
- Treatment & management of legacy waste
- Harnessing energy from waste
- Promoting industries in compliance with pollution standards

Source: Draft SAPCC 2.0 Punjab

4. **Bioremediation of landfill sites for legacy management and setting up of sanitary landfills for inert waste**

Unscientifically constructed landfills create irreversible damage to the environment. They generate leachates, emit greenhouse gases, pollute groundwater, etc. There is a need to reclaim the prevailing dumpsites for optimal use of land and recycling of untapped resources. Thus, this strategy is focused on legacy waste management and the development of sanitary landfills in a scientific manner.

5. **Scientific Disposal of Waste**

- Qualification of categories and sub-categories of waste
- Investment in new technologies like Pyrolysis and thermal hydrolysis for better sludge management
- Combination of EPR implementation, Waste Management Technology, Research and enforcement required

Types of waste categories being managed;

- Municipal Solid Waste
- Sewage Waste
- Plastic Waste
- E-Waste
- Bio-Medical Waste

- Re-investigation and re-purposing of ineffective STP's, MRF's and transport infrastructure

Solid Waste Management (SWM) Policies

- State Action Plan for Clean Air and Waste Management

  - Clean Air, Road Safety & Waste Management Sub-Missions under Mission Tandarust Punjab.
  - Solid Waste Management Rules, 2016
- Punjab State Solid Waste Management Policy, 2018
- Punjab Solid Waste Management and Cleanliness & Sanitation Byelaws 2020
- Standard Operating Procedure (SOP) for solid waste management 2021
- Guidelines/SOP for Domestic hazardous waste management and sanitary waste management, 2020
- Swachh Bharat mission- Urban guidelines

- Under Swachh Bharat Mission (SBM), the State has adopted a decentralized approach to Solid Waste Management in-line with SWM Rules & Punjab SWM Policy. At present, 4100 MT of urban solid waste is generated per day, out of which more than 90% of the waste is collected and 50% of the collected waste is being managed through composting & recycling of non-biodegradable waste.
- Dairy waste curbs direct GHG emissions as well as tap the energy to generate electricity for sustainable operations of cattle sheds at farmer households, dairy farms, 'gaushalas'. This strategy focuses to generate energy from livestock manure by promoting biogas plants and the generation of electricity.

Source: Department of Housing and Urban Development, Government of Punjab, India

Waste Management Measuring Progress

Table 4

Indicator and Current Status	2030 Goals	2047 Vision	2030 India's Target
Swachh Bharat Mission Urban(SBM-U) of wards with 10% door-to-door collection 99.52%	99.8 %	100%	100%
SBM-U: Individual household toilets constructed against target (%) 102	105	110	100
SBM-U: Municipal solid waste (MSW) processed to total MSW generated (%) 76.02%	88 %	100 %	100%
SBM-U: Wards with 100%source segregation (%) 93.40%	100%	100%	100%
Installed sewage treatment capacity to sewage generated (%) 88.79%	100%	100%	100%
Hazardous waste generated per 1,000 population (tonnes/ annum) 4.11	3.00	2.00	4.04
Hazardous waste recycled/utilized to Waste generated 18.02	21.01	40	21.01
Plastic waste generated per 1,000 population(tonnes/annum) 4.02	1.27	0.9	1.27
Percentage waste generated used for energy	To be calculated and results should be presented in State's annual waste management reports		
Percentage of waste used for other purposes (roads, products,etc)			

III. Built Environment& Industrial Process And Product Use (IPPU)

Buildings are responsible for 40% of emissions in the world. Eco-friendly construction materials and strategies that involve clean energy and low emissions need to be promoted. India is witnessing rapid urbanization. While cities are engines of growth, they also contribute to more than 70% of India's greenhouse gas (GHG) emissions.

Understanding Emissions from Industrial Process and Product Use (IPPU)

GHG emissions are produced by a wide variety of industrial activities. The main emission sources are releases from industrial processes that chemically or physically transform materials. During these processes, many different GHGs, including CO2, CH4, N2O, HFCs and PFCs, can be emitted.

GHG emissions from industrial processes

• Production and use of mineral products

1. Cement Industry – CO2 Emissions
2. Lime Industry – CO2 Emissions
3. Glass Production – CO2 Emissions

• Production and use of chemicals

Table 5

Emission Sources	Ammonia Production	Nitric Acid Production	Adipic Acid Production	Carbide Production	Titanium Dioxide	Soda Ash Production	Hydrogen Production
GHG Emissions	CO2	N2O	N2O	CO2 & CH4	CO2	CO2	CO2

• Production of metals

Table 6

Emission Sources	Metallurgical Coke	Iron & Steel	Aluminium Production	Magnesium Production	Lead Production	Zinc Production	Rare Earth Production
GHG Emissions	CO2 & CH4	CO2& CH4	CO2	CO2, HFC, PFCs & SF6	CO2	CO2	CO2

GHG emissions from Product use

• Lubricants and paraffin waxes used in non-energy products

Table 7

Type of fuels Used	Non-Energy Uses	Gases
Lubricants	Used in Transport Industry	CO2
Paraffin Waxes	Candles, corrugated boxes, paper coating, board sizing, adhesives, food production, packaging	
Bitumen; road oil and other petroleum diluents	Used in asphalt production for road paving	VOCs, CO
White spirit, kerosene, some aromatics	As solvent, e.g., for surface coating (paint), dry cleaning	

• FC gases used in electronics production

Table 8	
Emission Sources	**GHG Emissions**
Etching and CVD cleaning for semiconductors, liquid crystal displays and photovoltaic	HFCs PFCs SF6 NF3
Heat transfer Fluids	

Current and expected application areas of HFCs and PFCs include:

- Refrigeration and air conditioning
- Fire suppression and explosion protection
- Aerosols
- Solvent cleaning
- Waterproof films for electronic circuits
- Foam blowing

• Fluorinated gases used as substitutes for Ozone depleting substances

Table 9	
Emission Sources	**GHG Emissions**
Substitutes for ozone-depleting Substances	HFCs PFCs
Heat transfer Fluids	

Source: Global Protocol for Community-Scale Greenhouse Gas Inventories, Version 1.1

Current Status

Punjab is considered more urbanized than many parts of India. The state has witnessed rapid urbanization and is regarded as the 5th most urbanized state in India, next to Tamil Nadu, Maharashtra, Gujarat, and Karnataka. The three major cities of the state namely Ludhiana, Amritsar and Jalandhar have been identified to be developed as Smart Cities by ensuring adequate water supply & sanitation, assured electricity, effective solid waste management, efficient urban mobility & public transport, affordable housing etc.

IPPU Current Status

- The share of the manufacturing sector in the state income of Punjab was 14.4 per cent in 2021-22.
- The State's industrial structure is dominated by small-scale units constituting 99.83 per cent of the total industrial units in 2019-20.

- In the case of investment and production, large and medium-scale industries are the major contributors.
- Large and medium-scale units employ capital-intensive technology and have high labour productivity.

Challenges

For more information please refer to Section II – Commerce and Industry of this document.

Action Plan and Policy Measures

1. **Enhancing Quality of Life by Creating Sustainable Ecosystems**
   - Synergy between the human-built environment & natural ecosystems
   - Developing sustainable street lighting systems in rural areas
   - Development of Green Community Space
   - Rejuvenation/Rehabilitation of village ponds
   - Natural Resource Conservation around the built environment
   - Strengthening rural infrastructure
   - Addressing Water Issues and improving drainage systems
2. **Priority Action Undertaken by Punjab Government for Communities**
   - Undertake nature resource conservation measures
   - Strengthen the livelihood generation
   - Promoting affordable housing in rural areas
   - Bioremediation of landfill site for legacy waste management and setting up of sanitary landfills for inert waste
   - Enhance the drainage capacity of existing storm water drainage systems in towns to address the issue of excessive run off
3. **Required Action for IPPU**
   - Establishing common effluent treatment plants.
   - Incentivizing renewable energy sources, including rooftop solar plants for industry.
   - Capital Subsidy for Research and Development/Product Development Centres.
   - State-of-art infrastructure in industrial areas.
   - Incentivizing the upgradation of technology in the existing industry.
   -

Built Environment & Industrial Process and Product Use Measuring Progress

Table 10			
Indicator and Current Status	**2030 Goals**	**2047 Vision**	**Strategies**
Voluntary Green Building Certifications **Development of green community space**	• Making Green Building Certifications mandatory for all new buildings • Retrofits to be done by certified green products • An online list of certified products will be published by the State • All public, religious, educational, industrial buildings to attain a minimum green rating as per available standards	• All buildings to be green buildings • Pathway towards Net-Zero carbon buildings • Development of sustainable habitats with synergy between human built environment and the natural environment	• Making Green building features part of National Building Codes (NBC). • Promoting Circular Economy with construction material
ENVIRONMENTAL-FRIENDLY INDUSTRY			**For promoting environmental sustainability, white, green and orange industries need to be incentivized.** **Incentivizing renewable energy sources including rooftop solar plants for industry.**
INDUSTRY KNOWLEDGE CORRIDORS			Digital Technology and knowledge-based industry are jointly developed by industry and educational institutions. Keeping in view the location of universities and research institutions, five knowledge-industry corridors/parks and start-up hubs are recommended. These include: i. Chandigarh-Mohali-Patiala Corridor; ii. Chandigarh-Mohali-Ludhiana Corridor; iii. Chandigarh-Mohali-Ropar Hoshiarpur Corridor; iv. Ludhiana-Jalandhar-Kapurthala-Amritsar Corridor; and v. Sangrur-Bhatinda-Faridkot Corridor. Setting up Incubation Centres in universities and research institutes
UPGRADATION OF TECHNOLOGY OF THE EXISTING INDUSTRIAL UNITS			Adoption of technology upgradation and modernization schemes for MSMEs such as Credit Linked Capital Subsidy Scheme (CLCSS), Technology and Quality Upgradation Scheme (TEQUP), Lean Manufacturing, Quality Management Standards and Quality Technology Tools (QMS & QTT) and Zero Defect and Zero Effect (ZED).
DEVELOPING AN INTEGRATED MODEL OF INDUSTRIALIZATION	Small and large-scale units are working in isolation		For rapid and sustained industrialization integrated model of industrialization is recommended. In this model, big industries act as parent/anchoring industries and medium and small-scale industries as ancillaries.

For more information on IPPU please refer to Section II – Commerce and Industry of this document

IV. Sustainable Transportation

In a State, transport systems are designed to carry goods and living beings from one place to another. Since most of our modes of transport are fuelled by petroleum or its products, they emit loads of carbon emissions. Combustion in vehicles and indirect usage of grid electricity both contribute to GHG emissions.

Sustainable transportation refers to low- and zero-emission, energy-efficient, affordable modes of transport, including electric and alternative-fuel vehicles, and domestic fuels. However, a change in the existing system is required by switching to an electric vehicle that offers a low-carbon alternative compared to gasoline-powered cars. Optimal driving techniques and maximizing the usage of public transportation can help in cutting down emissions and costs.

The State and its cities are facing the growing problems of severe congestion as a result of need is felt to move towards more sustainable patterns of transportation in both passenger and freight transport for better liveability.

India's commitment by 2030, is to substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution contamination. This policy shall lead to the adoption of EVs that help reduce vehicular emissions which lead to pollution and contamination of the environment.

Current Status

In Punjab, where road transport forms the backbone of the transport system, the transport policy shall aim to arrest the rising motorization trends in the State, especially the rapidly increasing shares of personal modes and declining shares of sustainable modes like public and non-motorized transport.

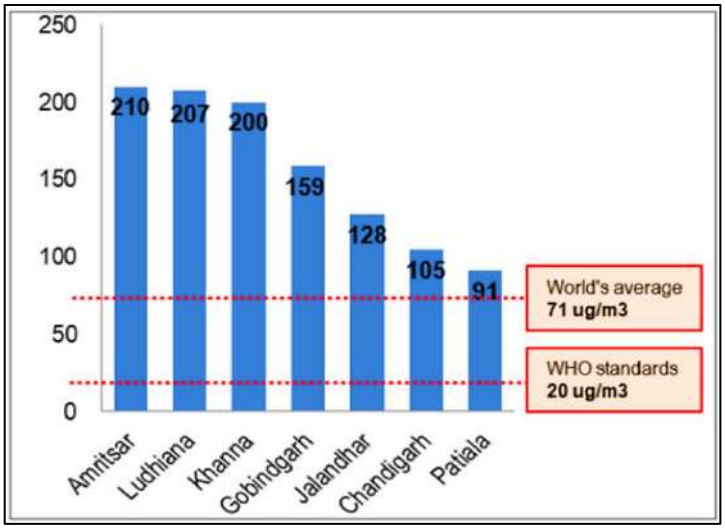


Figure 4 shows PM 10 and PM 2.5 concentrations (annual mean values in ug/m3) in the main cities in Punjab (2012).

Punjab is considered one of the most developed States in the country. Punjab is well placed as an Auto & Auto Ancillary manufacturing destination with leading players already present in the State, access to large consumer markets and State-of-the-art infrastructure. The State has 12.21 million registered vehicles which are 4.3% of the total registered vehicles of the country. The Government of Punjab recognizes the need for cleaner mobility considering vehicular emissions in major cities- Ludhiana, Jalandhar, Patiala, Amritsar and Bhatinda. The State has come up with a draft Electric Vehicle Policy in 2019.

Action Plan and Policy Measures

There is a need to upgrade and strengthen the existing road network hence achieving importance in the State for continued economic growth. To do so the State government shall prioritise removing road capacity bottlenecks.

- Develop a roadmap to promote the use of clean fuels in the State
- Develop Air Quality Improvement Plans for the most polluted cities
- Organize Vehicle scrapping programme
- Introduce Green tax for old, poorly maintained vehicles
- Create no emission zones or pedestrianized zones as per the air quality plans.

- **EV Adoption Policy**
  - Public Transport based on either EV or Hydrogen technology
  - EV Vehicle adoption, subsidies, tax exemptions, policy, free-toll pass for non-emitting vehicles
  - Charging Facilities to be installed for making adoption of EV's easier
  - Connecting Major cities & Highways with EV Infrastructure
  - Service centres for the repair & maintenance of these vehicles
  - Compulsory for all paid parking areas to facilitate parking and charging stations for EV vehicles
  - One Mandatory charging station at all petrol pumps

- **Promotion of other non-emitting modes of transportation**
  - De-incentivizing other emitting vehicles by the carbon tax
  - Every litre of petrol purchased shall have some percentage of tax deducted to go to an Environmental Fund used for activities benefitting the environment
  - Promotion of Hydrogen or other types of renewable-energy modes of transport
  - Punjab Energy Development Agency (PEDA) will be facilitating hydrogen fuel cell technology and solar/biomass based hydrogen generation facilities when the technology is commercially viable

- **Work on achieving a Comfortable, Stress-Free & Pollution-Free Road Travel Experience**

  Reduce congestion, improve operational efficiency, and reduce noise and air pollution by introducing these measures
  - An intelligent traffic management system has been installed at 25 locations, and after analysing the results, more systems are planned for many other locations
  - Dynamic traffic light and communication system to be developed and tested for State-wide implementation
  - Connecting all major Punjab cities by Installation of Charging Stations for E-Vehicles to reduce air pollution and create a noise-free environment
  - Ban on diesel-operated three-wheelers in Jalandhar, Ludhiana and Amritsar imposed
  - Regular checking for overloading/polluting vehicles and challans are being issued.
  - Policy for phasing out old transport vehicles is under consideration.
  - Mass media campaigns for road safety on social media have taken up
  - Introduce car-free zones and car-free days
  - Raise awareness about better driving practices and maintenance of vehicles to enhance fuel efficiency
  - Declare markets and heritage areas as no fossil fuel-driven vehicle zones

- **Improvement in Public Transportation System**
  - Reduce emissions from the public transport sector by adopting efficient fuel-based vehicles (CNG, Hybrid, etc.) and non-emitting vehicles (EVs, Hydrogen based, etc.)

- 4/6 lane State Highways for ease of commuting
- Reduce emissions from diesel-operated heavy-duty trucks
- Use bus simulator and infrastructure to raise awareness of better driving and maintenance of buses
- Enhance fuel efficiency in bus transport and reduce GHGs emissions
- Phasing out old public transport (buses, trucks, cars, autos)
- Promote utilization of battery-operated/SPV/alternate fuel-operated small bus services to travel small distances
- Develop a fast-moving freight corridor between the industrial towns of Punjab to the Other States
- Heavy vehicle driving training centres set up for raising awareness on driving and maintenance of vehicles.

- **Rail and Air Travel**

The State of Punjab is spread over an area of about 50,362 square kilometres, which is 1.53 % of the total geographical area of India. Punjab is wholly dependent on roads and railways for transportation. The rail track used for public transport is the route track, which is 2,265 route kilometres in the State, accounting for nearly 3.3 percent of the total railway network in India.

The technological advancement for railways in terms of the public transport system could be faster. The fast-speed rails and electrification of rail routes are yet to be done in parts of the State. Route enhancement and better route planning of trains on existing routes still need to be put in place. Less reliability, safety and lack of hygiene are the other factors pushing users to go for other modes of transport.

Punjab has two international Airports and four domestic airports. However, there is a need to facilitate, enhance and emphasise the optimum utilization of aviation infrastructure in the State to establish an eco-friendly infrastructural development leading to the overall growth of the State. Aviation industries like MROs and the latest training techniques like flight stimulators are installed in the State to enrich Punjab's air infrastructure. Additionally, convert the existing and new airports into Greenfield airports for eco-friendly infrastructural development.

Sustainable Transportation Measuring Progress

Table 12			
Indicator and Current Status	**2030 Goals**	**2047 Vision**	**India's Target**

EV adoption & building EV infrastructure	• EV vehicle purchases to be incentivized
	• Tax & subsidy benefits for all new EV buyers
	• Charging Facilities to be established
	  - Inter-city
	  - Intra-City
	• Mandatory charging stations in paid parking and public buildings
		• 60% of all fleet shall be run on non-emitting fuels
		• Charging infrastructure is available throughout the State.
		• EV charging sub-stations developed
			India is a member of the Electric Vehicles Initiative (EVI), a multi-governmental Policy forum dedicated to accelerating the deployment of EVs. The EV@30 campaign, launched in 2017, sets a collective aspirational goal for all EVI members to have EVs contribute to 30% of all vehicle sales by 2030.

Other Eco-friendly modes of Transportation	• Low-carbon transportation initiatives
	• Investment & Research in other alternate fuels such as
	  • Hydrogen
	  • Water
	  • Solar
	  • Other technology
		• Policies and a clear strategy to be developed for vehicles with alternate and greener fuels like
		  • Hydrogen
		  • Water
		  • Solar
		  • Other technology
		• Research &development of a sustainable supply chain to manufacture these vehicles
			It is estimated that the success of FAME II(Faster Adoption and Manufacture of Hybrid and Electric Vehicles) coupled with other policy initiatives including State policies would result in EV sales penetration of 30% of private cars, 70% of commercial cars, 40% of buses and 80% of 2Ws and 3Ws can be achieved by 2030

Work on Achieving Sustainable/Stress-Free travel Experience **Develop a Smart urban mobility** • **356 public awareness campaigns** • **Traffic management systems have been installed at 25 locations**	• Smart Parking Spaces established • periodic public awareness campaigns to be organized for control of vehicular emissions • Efficient traffic management systems to be installed in all major cities & State governed road networks • Introduction of car-free days in certain locations and certain holidays	• Intelligent traffic management systems developed to be the norm throughout the State • Periodic public awareness campaigns to be organized for control of vehicular emissions • Clear penalties for those who fail to phase out old vehicles • Halt in production/manufacturing of emitting vehicles	Government of India Automotive Mission Plan2026 estimates to generate 65 million new jobs in the automotive industry. Within the plan, electric mobility mission is expected to generate 10million jobs by 2030. The plan involves creating as killed workforce with electric vehicle expertise in areas such as design and testing, battery manufacturing and management, sales, services and infrastructure.

Table 12			
Indicator and Current Status	**2030 Goals**	**2047 Vision**	**India's Target**
	• Declaring heritage sites and public areas as non-polluting areas • Phasing out fossil fuel-based vehicle policy to be introduced		
Improvement in Public Transportation	• 271 remote sensor-based PUC systems have been linked with VAHAN/SAARTHI • Phasing out of Euro-3/ Euro-4 compliant buses and introduction of 842 no. Euro-6 compliant buses. • 4/6 lane State Highways for ease of commute	• Reduce emissions from diesel-operated heavy-duty trucks • Phasing out old public transport vehicles and replacing them with efficient and non-emitting vehicles • Develop a fast-moving freight corridor between the industrial towns of Punjab to the Other States	Keeping in view the climate change commitments made by the Government of India during the COP21 Summit held in Paris to reduce emission intensity by 33- 35% by 2030 from 2005 levels it is pertinent to introduce alternative means in the transport sector which can be coupled with India's rapid economic growth, rising urbanization, travel demand and country's energy security
Reducing Aviation and Railway related emissions **Current Status** **2 International Airport and 4 Domestic Airports**	Work towards ensuring railways and aviation infrastructure is environmentally friendly and sustainable Developing carbon credit and offsetting strategies to reach net-zero emissions Proper Inventorization of emissions from both railways and air travel.	Researching and investing in renewable and non-emitting fuels for aeroplanes and trains	• Develop efficient air traffic management and air navigation system • Deploy advanced technologies for the optimal growth of the sector. • Electrification of old railway routes and extension of existing railway routes towards remote /regional areas of Punjab. • Identification of new railway routes for better inter and intra-State connectivity and uplifting the potential emerging commercial trade routes.

V. Agriculture, Forest And Other Land Use (AFOLU)

The Agriculture, Forestry and Other Land Use (AFOLU) sectors produce GHG emissions and removals through a variety of pathways, including land-use changes that alter the composition of vegetation and soil, management of forests and other lands, methane produced in the digestive processes of livestock and nutrient management for agricultural purposes.[3]

> *A sustainable agriculture is one which depletes neither the people nor the land.* - Wendell Berry

The changing climate is adversely affecting the productivity of crops. An increase in temperature can reduce crop duration; affect the chilling requirement of horticulture crops such as pear and stone fruits; enhance evapotranspiration rate; alter photosynthate partitioning between source and sink; affect the survival and distribution of existing pest and pathogen populations and the emergence of new insect pests and pathogens; hasten nutrient mineralization in soils and decrease fertilizer use efficiency. Thus, it is important to draw our focus on the development of adaptation technologies to mitigate the adverse effects of climate change on crop production.

Understanding Emissions from AFOLU Sector

Table 13

Emission Sources	Enteric Emissions	Manure Management	Biomass Burning	Harvested Wood Products	Soil Management	Rice Cultivation	Fertilizer Use
GHG Emissions	CH4	N2O & CH4	CH4, N2O & CO2	CO2 & CH4	N2O & CO2	CH4	CO2

Source: Global Protocol for Community-Scale Greenhouse Gas Inventories, Version 1.1

Large emissions from the AFOLU sector can be divided into three categories:

1. Livestock Management
    a. Enteric Emissions

        The amount of Methane (CH4) emitted by enteric fermentation is driven primarily by the number of animals, digestive system, type, and amount of feed consumed. Cattle (dairy and other); Buffalo; Sheep; Goats; Camels; Horses; Mules and Asses; Deer; Swine; Poultry; and Others are all included in calculating CH4 emissions.

    b. Manure Management

[3]Global Protocol for Community-Scale Greenhouse Gas Inventories, Version 1.1

Manure management takes place during the storage and treatment of manure before it is applied to land or otherwise used for feed, fuel, or construction purposes.CH4 is produced by the decomposition of manure under anaerobic conditions, during storage and treatment.

2. Usage of Land for Agriculture, Forestry, Grassland, Wetlands and other land covered with rock or bare soil.
3. Other Non-CO2 Emission Sources
   a. Biomass Burning

      Biomass burning refers to burning living or dead vegetation including grassland, forest, agricultural waste, and biomass burning for fuel. Biomass material, when burned, releases varieties of gases such as CO, CO2, CH4, volatile and semi-volatile organic compounds, aldehyde, organic acid and inorganic elements and particulate matter (PM).[4]

   b. Liming

      Liming reduces soil acidity and improves plant growth in managed systems, particularly agricultural lands and managed forests. Adding carbonates to soils in the form of lime (e.g., calcic limestone (CaCO3), or dolomite(CaMg(CO3)2) leads to CO2 emissions as the carbonate limes dissolve and release bicarbonate (2HCO3-), which evolves into CO2 and water (H2O).

   c. Urea Application

      Using urea (CO (NH2)2) as fertilizer leads to emissions of CO2 that were fixed during the industrial production process. Urea, in the presence of water and urease enzymes, is converted into ammonium (NH4+), hydroxyl ion (OH), and bicarbonate (HCO3–). The bicarbonate then evolves into CO2 and water.

   d. Management of Soil

      Agricultural emissions of N2O result directly from the soils to which N is added/released and indirectly through the volatilization, biomass burning, leaching and runoff of N from managed soils. N2O emissions also take place through

[4] *Ishwar C. Yadav, Ningombam L. Devi, in Encyclopedia of Environmental Health (Second Edition), 2019*

volatilization of Nas NH3 and oxides of N (NOx), and leaching and runoff from agricultural N additions to managed lands.

e. Rice Cultivation

Anaerobic decomposition of organic material in flooded rice fields produces methane (CH4), which escapes to the atmosphere primarily by transport through rice plants. The amount of CH4 emitted is a function of the number and duration of the crop grown, water regimes before and during the cultivation period, and organic and inorganic soil amendments.

f. Harvested Wood Products

Harvested wood products (HWP) include all wood material that leaves harvest sites and constitutes a carbon reservoir (the time carbon held in products will vary depending on the product and its uses).

Current Status

Agriculture and allied sectors are the backbones of the rural economy of Punjab. The State continues to be a major food producer ensuring self-sufficiency in food grain production for the past several decades. The Impact of climate change can be severe as predicted below:

- 1°C rise in the minimum temperature in the rice-growing period will decrease the rice yield by 1.2%, and 1°C rise in the maximum temperature in the wheat-growing period would reduce the yield by 1.08%
- Lowering of the rice yield by 8.10% by 2080 and wheat by 6.51%
- It is expected that reduction in rainfall amount will lower the rice yield by 8.10% and wheat by 6.51% by 2080
- The contributing factors of this high vulnerability are identified as high net sown area with low proportion of net irrigated area, low milk production and food grains yield
- Climate change induced extreme weather events that can decrease in milk production, reproductive efficiency and can impact animal health
- The growth of nursery plants and the flowering pattern of subtropical fruits will be severely affected due to rise in temperature

The State plays a key role in ensuring food security and self-sufficiency in food grains to the nation. Punjab is among the top States in the country to implement the National Food Security Act of 2013, and the National Food Security Mission (NFSM). Smart Ration Card and One Nation One Ration Card schemes are being implemented for priority households & migrants, respectively. The State is implementing schemes/ projects for efficient use of irrigation water, on-farm management of water resources besides rainwater harvesting and enhancing productivity.

The Government of Punjab is also implementing "Towards Climate Resilient Livestock Production System in Punjab" project in Ludhiana, Bhatinda and Tarn Taran districts of the State, funded under the National Adaptation Fund for Climate Change.

Punjab, as a large State gives shelter to 2.8 crore people and has vast resources as well. Multifold measures and initiatives are in place to help its population adapt to climate change. Under AMRUT Mission, Detailed Project Reports for INR 23790 million have been approved by Govt. of Punjab and works worth INR 5320 million have been awarded for building a sustainable infrastructure focusing on climate change adaptation. Under Mahatma Gandhi Employment Guarantee Act (MGNREGA), Punjab has about 3.24 million registered workers, of which 1.48 million are women, and 1.76 million are men. Between FY 2014-15 to FY 2020-21 the government spent a total of INR 40,754 million on various work undertaken under MGNREGA and generated a total of 134.49 million man-days per project.

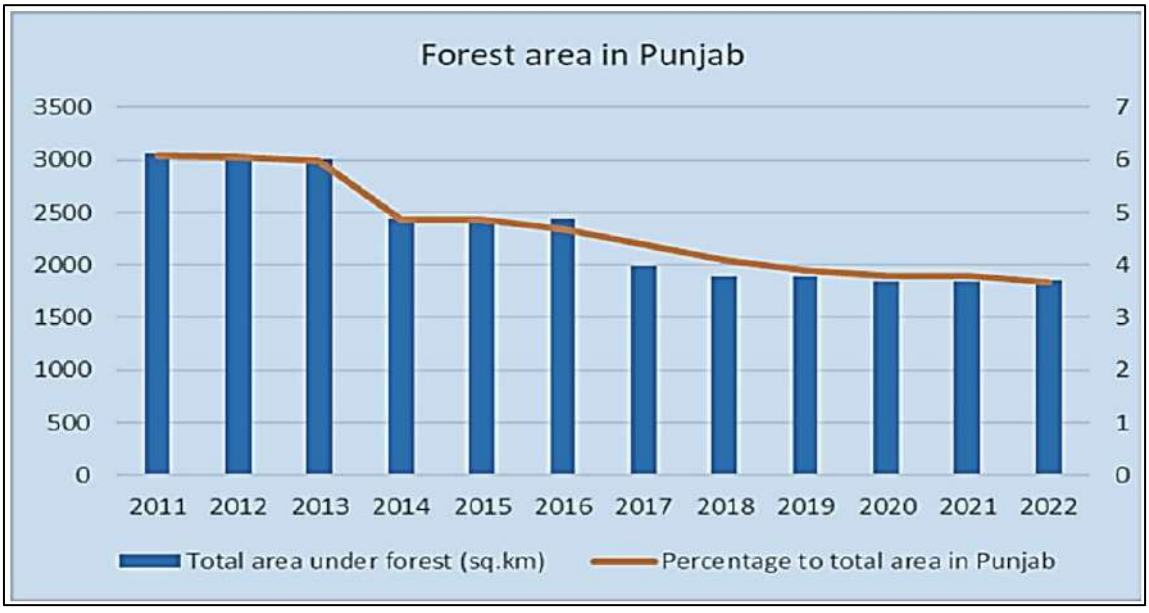
Being an agricultural State, nearly 82% of the land is diverted for agricultural activities. Due to limited land availability, forest cover improvements are one of the key challenges. The State is thus working on its target by planting more trees outside the earmarked forest area. The State has also undertaken a Smart Village Campaign for sustainable management of villages and to improve the quality of rural life through the management of streets and drains, community centre, cremation ground, etc. A total of 18906 works in phase 1 of SVC have been executed at a total cost of 835 Crores. Further, 58991 works are under implementation in phase 2 of the scheme. This includes the installation of 915 solar lights, out of which, 597 have been completed. The State has been able to achieve 100% connectivity to rural habitations under Pradhan Mantri Gram Sadak Yojana to ensure access to financial and other essential services.

Action Plan and Policy Measures

Key Initiatives

- Optimum use of water resources and promoting high-density aquaculture system
- Promotion of crop diversification including enhancing the area under horticulture and fishery
- Promotion of integrated nutrient management in soils and reducing the use of pesticides, fertilizers and promoting organic farming
- Efficient utilization of livestock manure for energy
- Research for developing suitable crop cultivation, short duration and climate resilient varieties of crops, vegetables and fruits
- Proper management of agricultural crop residue
- Development and management of climate-resilient shed
- Manage livestock health in the emerging pests and disease scenario
- Promote shrimp culture and other suitable species in saline and water-logged area to generate livelihood opportunity
- Smart and resource-efficient dairy farming
- Research for enhancing the resilience of the livestock sector

Figure 5.



Forest Cover, Biodiversity & Land Degradation

The forest cover in Punjab is continuously declining despite the 2030 goal of increasing the forest cover. To meet or even get close to this target, extensive efforts need to be made for the intensification of forests and managing land degradation. The government of Punjab in collaboration with the government of India have taken the following initiatives, Green India Mission, Bamboo Mission, Halting Bio-diversity Loss, and Sustainable Management of Forests.

- Improving the stocking of existing forests and bringing them from the degraded (canopy density<0.4) category to medium dense forest (0.4 to 0.7) category by carrying out plantations.
- Afforestation in public areas, industrial sites, settlement areas, along the rivers, roadside plantations, and shelterbelt plantation
- Increasing tree cover outside forest areas by promoting agro-forestry and household forestry in the State.
- Conservation and Protection of Biodiversity in the State
- Forest Fire Management
- Strengthening capacities and extension services of the forest department for sustainable management of forests
- Facilitation of better market opportunities for major and minor forest produce
- Ecosystem improvement and habitat protection for wildlife and dependent biodiversity Conservation

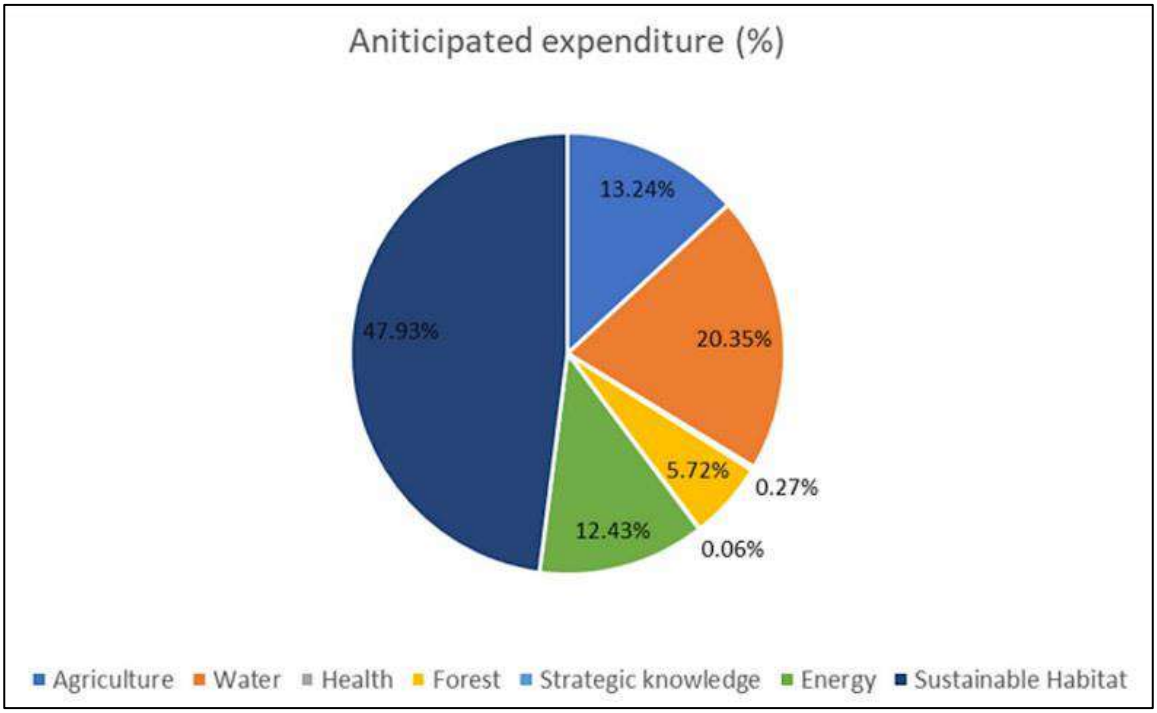
National Mission on sustainable habitat

- The State has made the following progress under the four components of the Pradhan Mantri Awas Yojana-Urban Scheme covering the urban areas of Punjab
- In-situ-slum-rehabilitation: 100% survey has been completed and proposals to develop three slums at Lalru, Mohali and Patiala, are underway
- Affordable Housing

Project: Affordable houses for 394 EWS in Ludhiana and 176 EWS in Patiala are under implementation.

- Credit Linked Subsidy Scheme: 2,083 loans in 2017-18 and 7,437 loans in 2018-19 were sanctioned for the purchase or construction of a new house
- Beneficiary Led Construction: 25,697 building plans were approved, and INR 370 million were disbursed to the beneficiary

Figure 6



Source: Draft SAPCC 2.0, Punjab

Food and Agriculture Measuring Progress

Table 14

Indicator	Short Term Strategy	Long Term Strategy	Strategies
Inventorization of AFOLU emissions	Identification of the scope of emissions Inventorization of major pollutants (CO2, CH4, O3, black carbon, HFCS, VOCs, PMs)	Real-time data access through smart metering for pollutants Publicly Data Available	• Formation of State Climate change Pollutant Database • Mandatory reporting of pollutants by all districts, cities, industries, commercial, and religious entities. • Fines to be levied for not or falsely reporting the emissions • Smart metering systems to be installed throughout the State for Real-time data

Table 14			
Indicator	**Short Term Strategy**	**Long Term Strategy**	**Strategies**
Dairy Emissions The number of milch animals in the State in 2019-20 **was 28.56 lakh.** **59 percent are buffaloes**, **37 percent cross breed cows**, **4 percent desi cows**	Change of Milch animals from buffaloes to cross-breed cows as more yield and fewer emissions Alternative milk (soy/almond/etc.) options are to be explored and promoted to reduce the CH4 and CO2 emissions. Calculation of Milch animals as well as related emissions		• Animals and their replacement with higher yield Milch Animals; • Progressive replacement of buffaloes and Desi Cows by Cross-breed cows; • Progressive improvement in the quality of buffaloes, cross-breed cows and desi cows; • Regular monitoring of the health of Milch animals by veterinary experts. This service will be provided free to all farmers; • Development of the animal feed industry and complete regulation of quality and environmental sustenance of animal feed; • Green Fodder availability
Forest Cover 3.67% **Tree Cover 3.16%** Required forest area 20% to maintain ecological balance as per national Forest Policy, 1988.	10%	The increase in forest area can only be achieved when we meet our agricultural needs using less land and can use the rest of the land to practice agro-forestry	Increase by 0.5% from 2017-2021 By 2030, 45 to 64% of forest likely to become climate hotspots
Intensification of Forests	Bamboo Mission - Plantation on 900ha Management of 22,000 ha forest area	• Bamboo Mission - Plantation on 1000ha • Management of 30000 ha forest area	Proposed to spend Rs. 4,050 lakhs from 2017 to 2029-30 under this scheme.
Area covered under afforestation schemes (%) 0.14	2.5%	Hard to have a number here but the schemes depend on State & national initiatives	Area covered under afforestation schemes (%) 2.74 by 2030
Increase in area of desertification (%) 55.35 **Degraded land over the total land area (%) 3.15** **117200 ha degraded Land**	• 5200 ha plantation on degraded area • 247 self-help groups to be constituted • Treatment of 76 sub-watershed in the Shivalik tract	Vision to decrease degraded land and desertification through human intervention Close to 0% (vision to have as less as possible)	Degraded land over the total land area (%)5.46
Green India Mission Plantation has not been done and is the forest area on the decline?	• management of forest fires, • maintenance of fire lines, • purchase of firefighting equipment, • demarcation of forest boundaries, • improving communication through wireless equipment • and creation of awareness among the local masses	• management of forest fires, • maintenance of fire lines, • purchase of firefighting equipment, • demarcation of forest boundaries, • improving communication through wireless equipment • and creation of awareness among the local masses	Green India Mission 21,001 lakh budget allocated for 18994 ha Plantation

Table 14			
Indicator	**Short Term Strategy**	**Long Term Strategy**	**Strategies**
State Forest Development Agency (SFDA)	1400 ha land to be used for plantation	3000 ha land to be used for plantation	It is proposed to spend Rs. 3,400 lakhs from 2017 to 2029-30 by doing plantation over an area of 1400 ha under this scheme
Punjab Forestry Watershed Development Project	10,0000 ha land to be used for plantation	20,0000 ha land to be used for plantation	It is proposed to spend Rs. 23,200 lakhs from 2017 to 2029-30 by doing plantation over an area of 14,000 ha under this scheme.
Biodiversity & Natural Conservation Project	10,0000 ha land to be used for plantation	20,0000 ha land to be used for plantation	It is proposed to spend Rs. 2,31,453 lakhs from 2019 to 2027-28 by doing plantation over an area of 48800 ha under this scheme.

For more information, please refer to Tables 10 & 11, Section III Chapter 5, Agriculture and Rural Development of this document.

To conclude, Punjab is working on a new Comprehensive Climate Action Plan Punjab (SAPCC 2.O) as

- Yearly Reviews of SAPCC 2.0 & Progress Report Submission with required updating of SAPCC
- 3-5 Year Remake of SAPCC due to changing environment and technology
- Effectiveness to be ensured by accountability and strict enforcement

In context of the Emission Reduction, to combat climate change Punjab will be addressing its high-emission Sectors

- Energy Sector
- Transportation
- Built Environment
- Industrial Process & Product Use
- Agriculture, Forestry and Other Land Use (AFOLU)
- Waste Management

CLIMATE ACTION: VISION 2047

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
Energy Sector: **Emission management**	Enhancing the private sector involvement in the renewable energy sector Current status of Energy generation (2020-2021) Thermal - 7025 MW Hydro - 1531 MW Renewable -1605 MW	Reduce coal consumption by 25% (1756.25 MW) Increase the share of Renewable Energy by 21% Increasing Yield of Hydropower structures (mini) Promote Waste-to-Energy Investment in new technology such as Thermal-Hydrolysis Plants Biogas energy projects in rural areas Increasing the number of solar pumps installed for irrigation PPP option provided to the private sector	Coal '0' Mission to be achieved Shift the Entire Energy Grid to Renewable and Non-emitting sources of Energy Become an Energy Surplus State with renewable energy as a major contributor. Become a Net-Zero Energy State to contribute to India's 2070 Vision	• Increase the share of solar energy in the total energy mix • Enhance energy efficiency through market-based certification mechanisms, cost reductions through R&D, demand-side financing mechanisms, and fiscal instruments • Improvements in energy efficiency in buildings, solid waste management and shift to public transport • Enhance ecosystem services including carbon sinks • Enhance the understanding of challenges and response to climate change • Initiatives to be introduced in the areas of efficient and cleaner technologies, • promoting renewable energy generation, reducing emissions from the transport sector, • Afforestation and greening activities and standardizing knowledge management system for adaptation and mitigation • Electrifying Punjab with LED lights • Energy Audits to be made mandatory • Only Energy Efficient Appliances with circular economy to be sold and used • Solar lights to be installed in rural areas • Research & Development of Energy
	Promote energy efficiency in residential, commercial and institutional buildings such as hotels, malls, and government buildings 91,976 Solar Street Lighting Systems installed in 4,077		Focus on non-emitting sources of energy Mandatory & Automated Energy audits through IoT-enabled platforms & metering Solar or LED or new-efficient lights installed in	

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
	villages		rural & urban areas All new buildings to be built energy efficient All existing buildings to be retrofitted with energy-efficient systems	efficient technologies ● Mandatory Energy Efficient ratings for all residential, commercial and institutional buildings ● Promote Energy Efficient Fixtures and ban higher emitting ones ● Passive and architectural methods to save electricity ● Allowing only 4*-5* Energy Star Rated products allowed ● Developing Solar parks ● Increasing the capacity of solar energy generation ● Increase the number of rooftop solar installed • Rural • Urban ● Focusing on smaller Cogen plants ● Revisiting the Existing infrastructure Building potential mini projects ● Mandatory source waste-to energy plants to be installed ● Biogas energy projects in rural areas for both waste management and energy production
	Reducing Energy Consumption Transmission & Distribution Losses from 2010-2020 were (20.12% - 13.65%)	Down to less than 12.1% Losses Promote energy efficiency fixtures and ban higher emitting ones	Down to less than 7.1% Losses Product lifecycle to have Net-Zero Emissions Only 4*-5* Energy Star Rated products allowed Energy Saving Techniques to be part of the National Building Codes Ban higher emitting products	
	Solar Power Projects ground mounted – 815.5MW	1251 MW		
	Rooftop solar - 60.5MW	295 MW		
	Solar net metering- 244.41 MW	95 MW		
	Canal Top Solar 20MW	20 MW		
	Co-generation – 462.07 MW	490 MW		
	Mini Hydro – 172.10 MW	178.8 MW		
	Waste to Energy - 1.5 MW	3 MW		
	Biomass Power - 97.5 MW	660 MW		

Indicator	Current Status	Target/s 2030	Target/s 2047	Strategies
Waste management	Swachh Bharat Mission Urban (SBM-U) of wards with 10% door-to-door collection 99.52%	99.8%	100%	● Installation of STPs ● 100% door-to-door collection ● Segregation of waste at the source ● Construction of compost pits and MRFs ● Maximize recovery out of recyclable / non-recyclable fractions of waste ● Elimination of Garbage points from vulnerable sites ● Compliance by Bulk Waste Generators ● Treatment & management of legacy waste ● Harnessing energy from waste ● Promoting industries in compliance with pollution standards ● Efficient waste management to be introduced via introducing technology and expertise ● Efficient waste segregation via the introduction and strict adherence to the following norms: 1. Decentralized Segregation - At Source Segregation 2. Centralized Segregation - At MRF (Material Recycling Facility) 3. Recognized/Registered Ragpickers 4. Extended Producer Responsibility (EPR) enforcement Scientific disposal of Waste for the following waste ● Municipal Solid Waste ● Sewage Waste
	SBM-U: Individual household toilets constructed against target (%) 102	105	110	
	SBM-U: Municipal solid waste (MSW) processed to total MSW generated (%)76.02%	88%	100%	
	SBM-U: Wards with 100% source segregation (%)93.40%	100%	100%	
	Installed sewage treatment capacity to sewage generated (%) 88.79%	100%	100%	
	Hazardous waste generated per 1,000 population (tonnes/ annum) 4.11	3	2	

Indicator	Current Status	Target/s 2030	Target/s 2047	Strategies
	Hazardous waste recycled/utilized to Waste generated 18.02	21.01	40	• Plastic Waste • E-Waste • Bio-Medical Waste • Bioremediation of landfill sites for legacy management and setting up of sanitary landfills for inert waste • Upscaling of Liquid and Solid Waste Treatment and its compliance • Developing sustainable street lighting systems in rural areas • Effective implementation of existing policies and schemes
	Plastic waste generated per 1,000 population (tonnes/annum) 4.02	1.27	0.9	
	Percentage waste generated used for energy	**To be calculated and results should be presented in State's annual waste management reports. Idea is to promote 100% resource recovery and repurpose it.**		
	Percentage of waste used for other purposes (roads, products,etc)			
Agriculture, Forest and Other Land Use (AFOLU)	Forest Cover 3.67% Tree Cover 3.16%	10%	The increase in forest area can only be achieved when we meet our agricultural needs using less land and can use the rest of the land to practice agro-forestry	• Promoting Soil Conservation Practices • Management & Conservation of Ponds • Undertake natural resource conservation measures in/around habitations • Strengthen the livelihood generation through Mahatma Gandhi National Rural Employment Generation Act (MGNREGA) • Promoting affordable housing in rural areas • Strengthening sanitation facilities in rural schools and creating herbal/kitchen gardens for promoting a healthier lifestyle • Develop a Smart urban mobility
	Intensification of Forests	Bamboo Mission - Plantation on 900ha Management of 22000 ha forest area	Bamboo Mission - Plantation on 1000ha Management of 30000 ha forest area	
	Area covered under afforestation schemes (%) 0.14	2.5%	Hard to have a number here but the schemes depend on State & national initiatives	

Indicator	Current Status	Target/s 2030	Target/s 2047	Strategies
	Increase in area of desertification (%) 55.35 Degraded land over the total land area (%) 3.15, 117200 ha degraded Land	5200 ha plantation on degraded area Treatment of 76 sub-watershed in the Shivalik tract	Vision to decrease degraded land and desertification by human intervention Close to 0% (vision to have as less as possible) 247 self-help groups to be constituted	• Bioremediation of landfill site for legacy management and setting up of sanitary landfills for inert waste • Enhance the drainage capacity of existing stormwater drainage systems in towns to address the issue of excessive runoff • Development of Green Buildings official spaces/institutions
	State Forest Development Agency (SFDA)	1400 ha land to be used for plantation	3000 ha land to be used for plantation	
	Punjab Forestry Watershed Development Project	10,0000 ha land to be used for plantation	20,0000 ha land to be used for plantation	
	Biodiversity & Natural Conservation Project	10,0000 ha land to be used for plantation	20,0000 ha land to be used for plantation	
Sustainable Transportation	271 remote sensor-based PUC system linked with Improvement in Public Transportation VAHAN/SAARTHI	• Phasing out of Euro- 3/ Euro-4 compliant buses and introduction of 842 no. Euro-6 compliant buses. • 4/6 lane State Highways for ease of commute	• Reduce emissions from diesel-operated heavy-duty trucks • Phasing out old public transport vehicles and replacing them with efficient and non-emitting vehicles Develop a fast-moving freight corridor between the industrial towns of Punjab to the Other States	• Public Transport based on either EV or Hydrogen technology • EV Vehicle adoption, subsidies, tax exemptions, policy, free-toll pass for non-emitting vehicles • Charging Facilities to be installed for making the adoption of EVs easier • Connecting Major cities & Highways with EV Infrastructure
	Other Eco-friendly modes of Transportation		Policies and a clear strategy to be developed for vehicles with alternate and greener fuels like- • Hydrogen	• De-incentivizing other emitting vehicles by the carbon tax • Every litre of petrol purchased shall have some percentage of tax deducted to go to an Environmental Fund used for activities benefitting the

Indicator	Current Status	Target/s 2030	Target/s 2047	Strategies
			• Water • Solar • Other technology Research & development of a sustainable supply chain to manufacture these vehicles	environment
	EV adoption & building EV infrastructure		60% of all fleet shall be run on non-emitting fuels Charging infrastructure is available throughout the State. EV charging substations developed	• Mass media campaigns for road safety on social media to be taken up • Introduce car-free zones and car-free days • Raise awareness about better driving practices and maintenance of vehicles to enhance fuel efficiency • Declare markets and heritage areas as no fossil fuel-driven vehicle zones

Indicator	Current Status	Target/s 2030	Target/s 2047	Strategies
BUILT ENVIRONMENT & INDUSTRIAL PROCESS AND PRODUCT USE (IPPU)	Voluntary Green Building Certifications Development of green community space	• Making Green Building Certifications mandatory for all new buildings • Retrofits to be done by certified green products • An online list of certified products will be published by the State • All public, religious, educational, and industrial buildings to attain a minimum green rating as per available standards	• All buildings to be green buildings • A pathway towards Net-Zero carbon buildings • Development of sustainable habitats with synergy between human-built environment and the natural environment	• Making Green building features part of National Building Codes (NBC). • Promoting Circular Economy with construction material
	ENVIRONMENTAL-FRIENDLY INDUSTRY			For promoting environmental sustainability, white, green and orange industries need to be incentivized. Incentivizing renewable energy sources including rooftop solar plants for industry.

Indicator	Current Status	Target/s 2030	Target/s 2047	Strategies
	INDUSTRY KNOWLEDGE CORRIDORS			Digital Technology and knowledge-based industry are jointly developed by industry and educational institutions. Keeping in view the location of universities and research institutions, five knowledge-industry corridors/parks and start-up hubs are recommended. These include: • Chandigarh-Mohali-Patiala Corridor; • Chandigarh-Mohali-Ludhiana Corridor; • Chandigarh-Mohali-Ropar Hoshiarpur Corridor; • Ludhiana-Jalandhar-Kapurthala-Amritsar Corridor; and • Sangrur-Bhatinda-Faridkot Corridor. Setting up Incubation Centres in universities and research institutes
	UPGRADATION OF TECHNOLOGY OF THE EXISTING INDUSTRIAL UNITS			Adoption of technology upgradation and modernization schemes for MSMEs such as Credit Linked Capital Subsidy Scheme (CLCSS), Technology and Quality Upgradation Scheme (TEQUP), Lean Manufacturing, Quality Management Standards and Quality Technology Tools (QMS & QTT) and Zero Defect and Zero Effect (ZED).
	DEVELOPING AN INTEGRATED MODEL OF INDUSTRIALIZATION	Small and large-scale units are working in isolation		For rapid and sustained industrialization integrated model of industrialization is recommended.

SECTION VIII

TECHNOLOGY

I. Technological Advancements

TECHNOLOGICAL ADVANCEMENTS

To stay relevant and to lead requires a massive change in our thought process as an individual, profit/non-profit institution, government, social or any political organization. The nature and delivery of work from top to bottom is changing dramatically. New businesses are emerging, challenging the existing ones and yet creating new unimaginable business opportunities.

Advanced technologies such as artificial intelligence, robotics, data analytics, cloud computing, and newer technical know-how on internet are creating huge impact on the world. In one of the research papers by WEF, it says that digitization will add more value to our Society.

Current Status

Technology transformation is now a part of every existing industry. India is pacing and coping with the speed of innovation in the present world. Highly ambitious big Technological companies and equally pacing corporations in the fields of manufacturing to services will have a sweeping impact on our society and economies. The governments which will equip themselves with a vision to harness such changes and transformation, and use these changes to leverage the same for societal services to improve the lives of their citizens will be rewarded by their fellow countrymen/citizen.

To be successful and lead in the new world, the State requires strategic relationships with industry and visionary planners to achieve their objectives for nation's development with citizen engagement and participation. While health, education, food, citizen infrastructure, and law and order will continue to dominate in the mindset of the governments, they will also have to focus on employment generation through new evolved policies, an interdisciplinary cross-sector approach that brings emerging industries leading to innovative outcomes.

To achieve the full advantage of bringing in technologies to play, Punjab requires to create its automation road map and put in place enabling policies and start the journey with priority areas immediately. It takes decades to be able to reach at a mature stage

where all kinds of technologies are being used. Adoption of technologies can lead to significant growth in economies, as per a research paper by McKinsey global institute *'A future that works; Automation, employment, and productivity 2017."*

Challenges

- **The age-old system of Commerce**: The existing logistic zones were developed on the basis of age-old technology and available information but by giving/adopting the advancements in the technological field, the rules of commerce have changed, and to keep up with them, it is necessary to upgrade the existing system of operational logistic zones.
- **Blurring boundaries between Urban Cities, Towns and Villages**: The dividing lines of urban cities, towns and villages are blurring/fading as cities and towns expand. The increasing population, along with the process of sub urbanization of rural areas, will increase the demand for a quality lifestyle.
- **Upgrading Agriculture**: The methods used to increase productivity in agriculture, like the irrational use of chemical inputs and the unnecessary exploitation of groundwater resources, has pushed agriculture into peril. Therefore, it is the need of the hour to adopt scientific methods in farming like precision agriculture.
- **Burdened Healthcare Institutions**: The existing healthcare institutions are burdened with a high rate of patients but health care institutions aren't at the stage for upgradation beyond providing basic healthcare services. The culture of regular health check-ups and precautionary measures are limited to some urban sections only, and lack of organ or disease-specific healthcare institutions is another major issue in the State.
- **A Pool of Cheap Labour**: Rather than becoming a pool of cheap labour for MNCs or a market of consumers, it is necessary to take some initiative with reference to innovation and creating our own products. We need to keep in mind that India leap frogged into the telecommunication/mobile space, and it may well happen in robotics. Punjab has to be prepared to take this opportunity and lead in areas best suited to meet this challenge. Attracting Robotics manufacturing to the State will be a good strategy.

- **Cyber Security**: The increased digitization and high reliance on technology-equipped services also require a digital security to avoid cyber crime on public databases etc.
- **Education and Skilling**: Quality education and skill is another important field that Punjab needs to pay attention to as the world has adopted the culture of digitized education.
- **Climate Change**: In Punjab, where agriculture is the major source of livelihood it is necessary to bring the climate change action policy equipped with effective and latest technological resorts.
- **Unemployment**: The increasing unemployment rate among youths in Punjab is another factor that government should take into consideration and find alternative employment in a rapidly changing global society. Government can also bring the field of gaming, media, entertainment and animation into educational and vocational courses to generate new employment opportunities in the State.
- **Public Transport System**: The State transport system is not bereft of leakage, corruption, and traffic mismanagement, and it also lacks safety measures. On the other hand, the inefficient public transport has further increased the private vehicular traffic, lack of parking spaces etc. It is the need of the hour that government shall formulate an effective transport policy to improve the public transport system and reduce private vehicle-induced traffic.
- **Reduce, Re-new, and Re-use**: This new area is a circular economy that the World Bank is pleased to support. It is all about eliminating waste and deploying re-use, refurbishments, recycling with the least impact on the environment etc. These initiatives require an incentive to attract investments. It improves employment opportunities in the area of repairs, re-manufacturing and recycling and supports through big way in the informal sector too.

Short-term Targets: 2030

- **e-Commerce:** The State can begin by strengthening DigiLocker for instant transfer of digitally self-attested/self-certified documents, using authorization; Interoperability

of DigiLocker for instant transfer of documents; and Approvals/NoC/Certificates from concerned departments may automatically be available in DigiLockers.

- **Smarter Cities:** Punjab shall work on short-term targets like *waste management, public transport, traffic (saving lives and fuel), parking (ease of living and happier citizens), disaster management and other environmental problems.* If States can achieve these goals, the cities and towns can become engines for economic growth and a hub of innovative practices at use.
- **Healthcare:** The central government is already working towards each citizen's database confidentially being available to any hospital that has subscribed to the database. This will empower the citizens to get their treatment done anywhere, and in case of emergency, if the data is available to a hospital, and the citizens would not required to carry all the reports or other documents over the years.
- **Robotics:** As robotics are moving faster than imagined, the usage of this may vary to the level of technology developed and the availability of talent in a country. Africa as a continent is already hosting events and running competitions, e.g., USD 10 Robotic Challenges. We, as a nation need to be prepared to take this opportunity and lead in areas best suited for us. Punjab should introduce this field by 2030 as an important sector of the economy through incentives and subsidies and a curriculum.
- **Life Sciences:** Adopting the latest technologies by encouraging investments and even subsidizing such work and making treatment affordable will create social welfare. The State of Punjab shall adopt and introduce such advancements in medical research into the mainstream curriculum.
- **Usage of Blockchain:** A distributed ledger technology by the governments, where records can be stored to avoid frauds. Examples of blockchain can be board results, issuance of online report cards and certificates, digital convocation by State universities, records of birth and death etc., all of which go on to improve ease of living.
- **Cyber Security:** As the reliance on digital-based platforms is going to multiply in future, the State should install a secure wall to avoid these cyber-attacks and citizens being robbed by these hackers.

- **Education and Skilling**: In the Future of Jobs Report 2020, it is estimated that by 2025 alone, 85 million jobs may be displaced because of technology, while 97 million new roles will emerge. The Government shall accelerate education and skilling reforms to make a real impact, or else there will be a perplexity at their end. Online distance learning, continuous assessments and outcomes-based education skills are best supported by technology adoption. There is also a need to Modernize and Convert Libraries to E-Libraries and ensure the Provision of E-books and Journals to Students and the Digitization of relevant materials. Increasing the use of Information Technology in the classroom for knowledge dissemination, such as e-content, Personalized Adaptive Learning for both teachers and students, will further ensure quality education.

  A recent study (2021) by Alpha Beta strategy and economics advisory organization indicates an estimated 174 million workforce need reskilling in digital skills in 12 countries in the next couple of years alone. The State of Punjab has a great opportunity to introduce the latest skill training working with industries through its Higher Educational institutions.

- **Climate Change:** The State of Punjab should reform their policies regarding Climate and implement effective strategies to reduce carbon emissions. This requires leveraging big data to get insights and take appropriate actions.

- **3D Printing,** also called additive manufacturing, can be more cost-effective than subtractive manufacturing techniques, as, in the latter, a final design is cut from a larger block of material. The State could do well to encourage the growth of this kind of manufacturing. Industries that use these manufacturing are aerospace, automobile, rail, robotics, defense and medical, to name some. 3D printing creates less material wastage, and it also saves on tooling costs and provides an advanced time-to-market.

- **Gaming, Media, Entertainment and Animation**: As we mentioned before, the government shall introduce new fields to generate employment, such as gaming, media, entertainment, and animation. The world has already seen how OTT platforms are increasing their presence. Opening the ways for such sectors will not

only provide opportunities, but the institutionalization of such courses into educational and vocational courses as short-term goals will help to set up new industries in the near future.

- **Travel and Tourism:** Punjab has a rich history; the government can, through policy and regulation, support sharing economy, which is based on platform-based technologies, with certain guard rails, thereby helping citizens unlock their fixed assets. The need for large hotels can easily be replaced/ complemented with Air B&B kind of solutions.
- **Broadband Penetration**: World Economic Forum (WEF) white paper on Unlocking Digital Value to Society: a new framework to growth shares through a case study that expanding access to broadband leveraging alternative technologies can be a great contributor to creating thousands of jobs. This requires incentivizing these vendors. This also has huge implications for driving education equity, quality, and accessibility.
- **Connected Smart Travels:** A very approachable target by any government. Imagine a smart bus card which can be taken by a traveller and can be used to travel on any government transport. It would facilitate ease of travelling and reduction of leakages, leading to lower costs and profitable transport systems. Government should take the initiative to form and implement such strategies as short-term goals in order to establish a smart travel network.

  There is a requirement to creatively develop and implement road safety strategies like Video Vehicle Detection Systems (VVDS) using PTZ cameras and AI. Other systems like Dynamic Traffic light Sequencing, Emergency Vehicle Notification Systems and Cooperative Intersection Collision Avoidance Systems (CICAS) need to be implemented on a priority basis.

  Placement of automated driving tracks to reduce the error in issuing a license to untrained and non-eligible drivers while reducing waiting time for applicants seeking permanent driving licenses has to be initiated. There is a need to implement Artificial intelligence and a sensor-based robust accident management system. Using the ITS interface, all the emergency spots within the district will be connected with a

common server room which would share all the required details with the vehicle involved in the accident, reporting mechanism, ambulances and hospitals.

Long-term Targets: 2047

- **In the context of e-Commerce,** as far as the 2047 vision is considered, small or large zones of this kind in State, depending on land availability, will give a big flip to the Business and support customers. Regulations and Policies around making available such land pockets at strategic places will be required to be formulated by the government.

  Indian Industry requires Industry 4.0 with regard to automation and data-driven changes in manufacturing technologies and processes. This would help in building smart factories with predictive maintenance, three-dimensional printing and smart sensors in production processes and software to monitor, control and assess workers. This requires forging and strengthening partnerships and international collaboration to facilitate economic diversification and technology dissemination and adoption by manufacturing firms in developing countries.

- **Smarter Cities:** By 2050, as per estimates given by the UN, 70% of the population will be living in cities. Making Smarter Urban and Rural infrastructure is a very pressing, urgent need that needs to accelerate on priority. Making cities smarter means that in the first phase, "Large and small Companies have been developing technologies -including sensors, software and data analytics to make cities more environmentally sustainable, livable and functional"[1].

  The smart city approach leads to smart grids and smart energy and water management, which is a big need for States like Punjab. On top of everything else, it improves reliability and reduces costs to benefit society.

  In order to contribute to the process of combating drastic climate change, *carbon-neutral villages* may be envisaged in our State, aiming at addressing this global challenge.

[1]An extract from the book "Building the Future" by Amy C Edmondson, Harvard Business School

- **Healthcare:** Governments' hospitals can, by leveraging AI determine prescriptions much more accurately, trends in diseases and possible actions leading to substantial improvement in community health. AI gives doctors much more intelligent support than what exists today.
- **Robotics:** has already made a big entry into healthcare, be it surgery, radiology etc. Automobile/ logistics companies around the world are putting robotics to big use. Waste management, sewerage cleaning etc., are works that can be best left to robotics. Attracting Robotics manufacturing to the State early may be a good strategy. Ellec Ross, in his boo*k "The industries of Future",* which is a well-researched book, say*s" that the current moment in the field of Robotics is very much like where the world stood with the internet 20 years ago."* The use of robots does require upfront Capex cost; however, it leads to drastically reduced operations costs. As manufacturing builds up, such Capex costs will reduce.
- **Life Science**: Genome mapping/sequencing is a very critical piece of Life sciences, and the cost of genome mapping has constantly been coming down. Cancer cure through life sciences intervention is gathering momentum too. Treatment of neurological and mental illness, Parkinson's disease, is also being addressed by leveraging genomics. The State of Punjab needs to adopt such a curriculum in medical and research institutions by the year 2030. There are already many startups in this area, and government could do well to attract them to set up a base in the State.
- **Cyber security**: Wars between governments/ nations and crony capitalization can happen through cyber-attacks, often called "weaponizing of code". A cyber-attack to bring down citizen services or delete old records or steal data or impact payments/ treasury records or attack smart grids has to be prevented.
- **Education and Skilling:** Virtual labs and virtual internship growth have to be unabated to execute on the same alignment with the industry on emerging skills, and apprenticeships and internships need more policy and regulatory support. Inequality will have to be addressed by making available broadband penetration and the availability of devices to the economically poor.

The State of Punjab has a great opportunity to introduce the latest skill training working with industries through its Higher Educational institutes. As the AWS Global Digital Skill index in India alone, 52% of employers have Stated that they need to retrain their existing Headcount. When it comes down to cloud skills, it is anticipated that it will be the 5th most in-demand skill by 2025. Similarly, in Cyber Security, only 15% of workers have been trained or are under training compared to the demand.

- **Climate Change:** In order to contribute to the process of combating drastic climate change, carbon-neutral villages may be envisaged in our State, aiming at addressing this global challenge.

  Given the changing nature of climate (rain pattern), it is a need of the hour to analyze and optimize the existing cross-drainage systems or re-construct them based on the latest analytical models and updated data available.

- **3D printing:** 3D manufacturing can have a democratizing effect on manufacturing, and its reach into various industries is growing. Analysts predict there will be a great deal of growth, and the market will be worth 32.78 billion USD by 2023. Another report talks of it growing to USD 47.5 Billion by 2028, at a CAGR of 19.6% during the forecast period 2021-2028: Greyviews.20-Apr-2022

- **Preparing for Usage-based insurance:** The big bottleneck is that if a particular component is required to become a part of the automobile, this is being pushed back, as consumers nowadays are not ready to take on further higher costs, and Manufacturers do not want to bear the costs. While this is a central subject, States can play an active role in society by demanding and influencing the centre to adopt these technologies.

- **Connected Smart Travels:** An established smart travel network equipped with easy access to ease of travel can further slowly bring private transport into synchronization with policy and regulatory changes, which leads to Private-public partnership as a long-term goal. Inc.com, a globally popular internet Publication talking about Autonomous vehicles (or AVs), States that it will likely be the single greatest opportunity for the creation of value and wealth during the 21st Century. A study done for Intel by Strategy Analytics predicted a $7 trillion industry by 2050,

making it one of, if not *the* single largest global industry. The article talks about facts that while the automobile is an industry, vehicle manufacturing is large enough to represent the equivalent of the world's sixth-largest economy, employing over 50 million people and producing nearly 100 million vehicles each year. Yet, there is simply no way that it can support a global population reaching 10 billion people with the same sort of vehicle infrastructure we have today. AVs will get to become main stream, and governments shall start planning and moving in that direction. Public transportation is in for a big revolution.

Use of Varying Road speed limits based upon road congestion, use of micro or nano satellite for live satellite and position data to implement data-driven enforcement & traffic management in real-time. Further placement of electric vehicles charging stations throughout the State. There is a need to upgrade the existing road infrastructure as per the requirement of self-driving vehicles. To drive safely and appropriately, autonomous vehicles need to be able to perceive their environment reliably within smart infrastructures. Placement of sensors like Lidar, Camera and Radar sensors all linked with robust network working without any latency.

- **Biotechnology provides** fast emerging business. It is not new but has huge potential, and in India, it is growing fast. Next What Business consultancy research indicates that India has just 2% of the global market share even when there are an estimated 800 companies. Areas like Biodiesel, Biofertilizers, Bio pesticides, and hybrid seeds, all such industries, can be a big focus for the State government. Healthcare is also a big area where Biopharma has a big role to play.
- **Machine learning, Artificial technologies, cloud computing and Visualization technologies can help Focus on the circular economy:** Leveraging Data analytics, machine learning, cloud and visualization technologies from geospatial data available with the central government, the State can effectively strengthen parks, water bodies, decide on where construction of buildings to be allowed or not, and decide on the judicious use of the public land. It will help the government to economically use its resources.

- Urban land, which is so valuable, can be put to effective use. Meaningful dashboards can be used for governance.
- Cloud platform technologies can bring communities, local governments, and the private sector together to support local challenges.
- Artificial technologies can be used to convert textual data locally collected into meaningful insights.
- Issues like dumping sites and illegal mining can be tackled through these technologies.
- Plastic waste management can be tackled by a consortium of private-sector organizations coming to invest in improving data collection across the plastic value chain and finally leading to advanced recycling.

Start from eliminating waste to the construction of markets for hard-to-recycle materials to biodegradable alternatives or bio based plastics, renewable feedstock etc., all supported by advanced detection technologies, one of them being AI-enabled object recognition. The areas of coverage in the circular economy are at multiple levels, covering textiles, battery supply chains, e-waste, food systems, the construction industry etc.

TECHNOLOGICAL ADVANCEMENTS: VISION 2047

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
E-COMMERCE	The logistics zones in the State are not up to date in the context of the available data, information, and advanced technological tools	Upgrade and Establish an operationalized e-commerce system by the year 2030	Achieving Industry 4.0 with regard to automation and data-driven changes in manufacturing technologies and processes	• Strengthening DigiLocker for instant transfer of digitally self-attested/self-certified documents, using authorization; Interoperability of DigiLocker for instant transfer of documents; and Approvals/NoC/Certificates from concerned departments may automatically be available in DigiLockers • Forging and strengthening partnerships and international collaboration to facilitate economic diversification and technology dissemination and adoption by manufacturing firms in developing countries.
SMARTER CITIES	By 2050, as per estimates given by the UN, 70% of the population will be living in cities. The dividing lines of urban cities, towns and villages are blurring as cities and towns expand. Making Smarter Urban and Rural infrastructure is a very pressing, urgent need that needs to accelerate on priority.	Waste management, Efficient public transport, traffic, and parking management	Disaster management and Environmental problems	• Making cities smarter means that in the first phase, Punjab needs to take care of issues such as waste management, public transport, traffic, parking), disaster management or other environmental problems etc. • Companies large and small have been developing technologies -including sensors, software and data analytics to make cities more environmentally sustainable and functional. • In order to contribute to the process of combating drastic climate change, carbon-neutral villages may be envisaged in our State, aiming at addressing this global challenge

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
PRECISION AGRICULTURE	At present, the State suffer from existing agrarian distress, and the cropping pattern needs to be changed while prioritizing low water-requiring crops. Deploying an AI-based precision agriculture system backed by the State-level digital platform for judicious input use and natural resource sustainability is the need of the hour.	To digitize agricultural operations like sowing, irrigation, fertilizers application and other important operations to save precious inputs, water, and electricity and facilitate time management for farmers	Adopting Climate-smart Agriculture	• Enabling & popularizing the Transfer of technology regarding the development of new innovative techniques in agriculture at each State level; the use of GIS, satellite imagery, drone technology, artificial intelligence, and data sharing • Developing smartphone-based irrigation, nutrient management, pest management and marketing applications. • Developing or adopting technologies for plant-based meat, milk and egg substitutes; Mainstreaming New Biotechnologies like genome editing, marker-assisted selection (MAS), speed breeding.
HEALTHCARE	The central government is already working towards each citizen's database confidentially being available to any hospital that has subscribed to the database. The data is available to a hospital, and the citizens are not required to carry out all the reports over the years.	Building citizen's health database.	Adopting Artificial Intelligence (AI) in Healthcare	Once the database is built, AI can be employed as AI is capable of reducing dependence on experts/specialized doctors in small towns and villages, and based on central diagnostic assessments, medication and next steps in treatment can be subscribed once all mapping of patient reports, as required, are input to AI-supported machines supporting a doctor.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
ROBOTICS	Robotics has already made a big entry into healthcare, be it surgery, radiology etc. Automobile/ logistics companies around the world are putting robotics to big use. Waste management, sewerage cleaning etc., are works that can be best left to robotics. But, at the current stage, the State has not invested much in the field of Robotics.	Introducing the field of Robotics in the State by 2030 as an important sector of the economy through incentives and subsidies and a curriculum.	Established and well-operationalized Robotics manufacturing Units in the State	• Attracting Robotics manufacturing to the State early may be a good strategy. • Drone manufacturing is another attractive area to step into for manufacturing at the State level • The use of robots does require upfront Capex cost; however, it leads to drastically reduced operations costs. As manufacturing builds up, such Capex costs will reduce
LIFE SCIENCE	Healthcare is one of the primary responsibilities of the State, and the State of Punjab has already initiated the advancement of the Health Care system, but there is a need to upgrade its scale at a larger level.	Adaptation and introduction of Advanced Life Science in medical research and bringing the same into the mainstream curriculum by the year 2030.	Advancing in the field of Genome mapping/sequencing	• Attracting and Setting up the Genome industries in the State • At the governance level, investing and supporting this industry and attracting talent from across the globe

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
CYBER SECURITY AND USAGE OF LOCKCHAIN	Cyber Security is going to be a key play for governments to guard their data. State governments shall ensure the safety of public data from any kind of security breach.	Set up and install a secure wall to avoid cyber-attacks and citizens being robbed by hackers	Setting up the Usage of Blockchain and a complete shift to a Cloud database	• Usage of Blockchain, also called distributed ledger technology by the governments, where records can be stored and transparently take away any possible fraud. • Wars between governments/ nations and corny businessmen can happen through cyber-attacks, often called "weaponizing of code". It will do good for governments to go on the cloud where cyber security becomes a shared responsibility with the cloud providers.
EDUCATION AND SKILLING	Future of Jobs Report 2020 States that by 2025 alone, 85 million jobs may be displaced because of technology, while 97 million new roles will emerge. The State of Punjab has a great opportunity to introduce the latest skill training working with industries through its Higher Educational institutes.	Upgradation of existing educational institutions by accelerating education and skilling reforms; Promoting Online Distance learning; Modernize libraries to e-libraries; Increasing the use of smart classrooms	Establishing new State-of-art institutions and facilities aimed at creating regional balance with a focus on the marginalized population of the country.	• Prioritizing the use of technology to deliver world-class content to all the stakeholders • Virtual labs and virtual internship growth have to be unabated to execute on the same alignment with the industry on emerging skills, and apprenticeships and internships need more policy and regulatory support • Addressing social Inequality, like having access • Introducing the latest skill training working with industries through its Higher Educational institutes
CLIMATE CHANGE	Climate change needs to be taken as a threat in the present and not a thing to worry about in future. At the State level, carbon emission needs to be brought down to a minimum level.	Reform and Formulate effective climate policies to be implemented in the State in accordance with the global and national climate policies	• Building Smart Cities and Carbon-Neutral Villages • Analyze and optimize the existing cross-drainage systems or re-construct them based on the latest analytical models and updated data available	Along with the implementation and reformulation of the climate policies of the State, it is necessary to Develop appropriate technology solutions and industries of the future to tackle issues like crop residue burning, carbon emission and drastic climate change.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
3D PRINTING	At present, the State has no such technique being used as of now, but the State could do well to encourage the growth of this kind of manufacturing as 3D printing creates less material wastage, and it also saves on tooling costs and provides an advanced time-to-market.	Introducing the field of 3D Printing in the State by 2030 as an important sector of the economy through incentives and subsidies and a curriculum.	To establish well-operationalized 3D Printing manufacturing Units in the State	Introducing the field of 3D Printing in important industries such as aerospace, automobile, rail, robotics, defence and medical, where it can create lightweight yet complex parts, offering weight saving which further leads to fuel-saving and environmental and ecological impact.
GAMING, MEDIA, ENTERTAINMENT AND ANIMATION	The world has already seen how the OTT platforms are increasing their presence, and opening the ways for such sectors will not only provide opportunities to set up new industries in the State. The governments shall utilize the potential of these industries as an alternative for employment generation for youth and a new economic sector for the State economy.	Introducing the field of Gaming, Media, Entertainment and Animation in the State by 2030 as an important sector of the economy through incentives and subsidies and a curriculum.	Setting up Gaming, Media, Entertainment and Animation industries in the State	Introducing and setting up Gaming, Media, Entertainment and Animation industries in order to generate employment through incentivization to attract global-level industries to the State
TRAVEL AND TOURISM	Punjab has a rich history; the government can, through policy and regulation, support sharing economy.	Upgrading Travel and Tourism in the State	-	• Platform-based technologies, with certain guard rails, will help citizens unlock their fixed assets • The need for large hotels can easily be replaced/ complemented with Air B&B kind of solutions

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
BROADBAND PENETRATION	WEF's white paper on Unlocking Digital Value to Society: a new framework to growth shares a case study that expanding access to broadband leveraging alternative technologies can be a great contributor to creating thousands of jobs.	Equipping the State with broadband leveraging alternative technologies	-	It requires huge support to provide incentives for these vendors. This industry has huge potential for job creation and implications for driving education equity, quality, and accessibility.
CONNECTED SMART TRAVELS	There is no such initiative in practice to provide ease of living to citizens in the context of travel. Government shall take the initiative to form and implement such strategies as short-term goals in order to establish a smart travel network. An established smart travel network equipped with easy access to ease of travel can further slowly bring private transport into synchronization with policy and regulatory changes, which leads to Private-public partnership as a long-term goal.	Setting up and Installing Smart Travel Network in the State by upgrading the existing road infrastructure as per the requirement of self-driving vehicles	Equipping the Smart Travel Network with the use of micro or nano satellite for live satellite	• To creatively develop and implement road safety strategies like Video Vehicle Detection Systems (VVDS) using PTZ cameras and AI, Dynamic Traffic light Sequencing, Emergency Vehicle Notification Systems, and Cooperative Intersection Collision Avoidance Systems (CICAS) need to be implemented on a priority basis. • Placement of automated driving tracks to reduce the error in issuing a license to untrained and non-eligible drivers • Placement of sensors like Lidar, Camera and Radar sensors all linked with robust network working without any latency • Using the ITS interface, all the emergency spots within the district will be connected with a common server room which shares all the required details with the vehicle involved in the accident, reporting mechanism, ambulances and hospitals.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
ADVANCEMENT IN THE BIOTECHNOLOGICAL FIELD	Biotechnological advancement can be a boon to industries like healthcare (biopharma), Biodiesel, Bio fertilizers, Bio pesticides, hybrid seeds etc. The industry is fast growing, and State shall utilize it.	Introducing the field of Biotechnology in the State by 2030 as an important sector of the economy through incentives, subsidies, and a curriculum.	Setting up Biotechnology industries in the State	Introducing and setting up Biotechnology industries in order to generate employment through incentivization to attract global-level industries to the State
MACHINE LEARNING, ARTIFICIAL TECHNOLOGIES, CLOUD COMPUTING AND VISUALIZATION TECHNOLOGIES CAN HELP FOCUS ON THE CIRCULAR ECONOMY	The State has environmental initiatives in practice managing and reducing waste and deploying Re-use, Refurbishments, and Re-cycling, but the upgradation and equipping of the same will enhance its efficiency.	Equipping and Installing the existing framework of repairs, re-manufacturing and recycling with emerging technologies	A complete shift to Machine learning, Artificial Technologies, Cloud Computing and Visualization technologies in regard to the areas of repairs, re-manufacturing and recycling	• It requires providing an incentive to attract investments • Leveraging Data analytics, machine learning cloud and visualization technologies from geospatial data available with the central government • Urban land, which is so valuable, can be put to effective use. • Cloud platform technologies can bring communities, local governments, and the private sector together to support local challenges. • Artificial technologies can be used to convert textual data locally collected into meaningful insights. Issues like dumping sites and illegal mining can be tackled through these technologies. • Plastic waste management can be tackled by a consortium of private-sector organizations coming to invest in improving data collection across the plastic value chain and finally leading to advanced recycling.

SECTION IX

GOVERNANCE

I. Governance

II-a. Safety and Security

II-b. Intelligent Traffic Management System

I
GOVERNANCE

India is among one of the fastest growing economies in the world. This exponential growth is driven by different yet inter-related sectors. To sustain the projected growth rates, the role of governance becomes paramount. The primary purpose of governance is the welfare of the citizens. While one aspect of governance relates to safeguarding the legal rights of all citizens, an equally important aspect is concerned with ensuring equitable access to public services in a time-bound manner on "anytime anywhere basis". Also, the governance system aims to address concerns of all citizens irrespective of their class, ethnicity, or religion.

Institutionalizing citizen-centric rights-based governance advances inclusive, secure and peaceful societies essential for sustainable development. In post-colonial societies the rules of state-citizen engagement need to be redrawn to make the system capable for justice and effective delivery of rights and accordingly mechanisms, processes and procedures have to be reframed and streamlined.

Governance cannot merely be ensured by making the service delivery institutions available for the people but also by providing their acceptance and efficacy in the society and ease of application, thus, ensuring simplification of procedures, time-bound service delivery with necessary technology up-gradation. Although the ultimate goal is to make the services available on digital platforms like websites and mobile applications, the need for physical front-end delivery centres cannot be ruled out completely due to factors like lack of internet penetration, digital literacy, data digitization and backend computerization of departmental workflow.

Under the governance sector, Punjab envisions to achieve the highest levels of e-governance and its transformation towards digital governance, at the same time empower governance to reach to the lowest levels. Punjab Governance aims at:

a) Improving citizens' day-to-day dealing and experience and interaction with the government with citizen-centric design of digital government;

b) Create a knowledge repository/ data economy by listing the existing projects and best-practices which can be further expanded in scope and scale; and,

c) Meeting the challenges of the state in its effort to achieve e-governance and also transformation towards digital governance at the same time to develop transformative strategies that are incremental and does not require massive human/financial resource restructuring.

Current Status

Punjab, to much extent has been successful in achieving desired goals related to e-governance by using information and communication technologies (ICTs) like the internet and mobile computing, wide area networks etc. at various levels of government and the public sector and beyond for the purpose of enhancing governance. However, much more still needs to be done to achieve digital governance. Digital governance is a framework for establishing accountability, roles, decision-making etc. digitally. Having a well-designed digital governance framework minimizes the cost and effort and at the same time brings the processes involved in governance to maturity.

Current Status

- **Types of Services:** Need-based Demand Driven Services; Need-based Supply Driven Services; Regulatory Services.
- **Process and Procedural Simplification and Transparent Citizen Interface:** Weeding out layers in Decision Making and Disposal; Procedural Simplification.
- **Instruments for Rights-Based Governance:** Right to Service Act (for an accountable and time bound services); Institutionalized Unified Civic Service Delivery System.
- **Convergence of Governance:** Making systems more accountable in terms of costs, conduct and performance, more accessible through availability of equal services to the people in equal needs (supply side) by enhancing its efficiency.
- **Institutional Building:** Institutionalized Police-Community Engaged Governance; Single Window Digital Platform; Establishing Citizenry Database and Institutionalization of Single Citizen ID.

Status of Services Delivered

Punjab enacted the **Punjab Right to Service Act in 2011** and **Punjab Transparency and Accountability in Delivery of Public Services Act in 2018**, a drive towards digitization of government services. The Act comprises of features such as: *providing statutory backing to ensure delivery of services within stipulated time limits; with sufficient scope to*

include new services, amend time schedule and adopt new technology innovations without long administrative procedures; inclusion of twenty police services.

Challenges

Despite being instrumental in setting-up the model physical and virtual infrastructure, the governance system is still not fully equipped to be responsive through the available institutional and digital platforms.

- There are challenges to implement any new IT system in the government due to restrictive adoption by most of the officers at field level;
- Low digital competence of the staff ;
- The IT staff is already over-burdened and has limited bandwidth to introduce to innovative IT interventions to digitize their existing processes and to GPRs; and,
- The IT era has been at its peak however the state has to put efforts in timely implementation of various digital transformations in order to streamline and minimize the multiple approval processes having physical involvement.

Governance Reforms: Instrument for Right-Based Governance & Institution Building

i. **Punjab Transparency and Accountability in Delivery of Services Act 2018:** The Act has provided statutory backing for ensuring delivery of services within stipulated time limits. It is a Dynamic Act. It has sufficient scope to include new services, amend time schedules and adopt new technology innovations without long administrative procedures. Main thrust is to provide services first and then start proceedings against erring officials. Easy complaint mechanism for grievance redressal without much time and material costs. The Government has empowered the citizens to claim services as a 'right' which in turn has reposed trust in citizens through procedural changes and technology.

ii. **Institutionalized Unified Civic Service Delivery System**: Under the aegis of project SAANJH, Community Policing Resource Centres (CPRCs) have been set up at the District, Sub-Division and Police Station level, to act as nodal points for relief and support (legal, medical and psychological) to the victims of crime. 'SAANJH Kendras'

also provide all non-crime related police services to the citizens in a friendly and dignified manner. Similarly, to provide dignified and easy access to civic services, front-end institutional forums - 'Sewa Kendras' - have been built. Primary aim to build these centres is to move from rural-urban dichotomy to rural-urban continuum, provide equitable access to services irrespective of the volumes, from multiple oversights to single oversight for delivery of services, and one rural centre for 8,000 to 10,000 population.

iii. **Convergence of Governance**: The main thrust of convergence of governance is to make systems more accountable in terms of costs, conduct and performance, more accessible through availability of equal services to the people in equal needs (supply side) by enhancing its efficiency. And also, to ensure quality and reduce transaction costs through checking perverse incentives, non-statutory and discretionary powers, amending inappropriate rules leading to inefficiency and corruption. Convergence of governance makes interaction between the citizens and the government more participatory leading to transparency.

The digitization of governance by employing means of information technology to such citizen-centric governance model through information and technology, online single window delivery of various services, web/app-based delivery of various services etc. will help to achieve digital transformation in governance.

iv. **Anytime Anywhere Access to Services:** Department of Governance Reforms (DoGR) is making efforts to take service accessibility to next level by bringing it to the door step. It has also started to provide Mobile Governance thereby providing anytime anywhere access to various services & schemes; and, auto eligibility or auto enrolment of a citizen for a service once fulfills the eligibility criteria.

v. **Institutionalizing Single Window Digital Platform:** Institutionalization, Upgradation and assigning power to Single Window Digital Platform to reduce the repetitious and delayed process and procedures in delivering a service. For example, Single Digitized Office; Single Common Online Application Form (CAF); Single Time Document Submission (online and offline); and, Single communication channel. It will also

reduce huge transaction costs including corruption linked to inspections/ maintenance of registers which have no nexus with objectives.

vi. **Establishing Citizenry Database and Institutionalization of Single Citizen ID:** It is the need of the hour to complete a digitization of legacy records and data cataloguing under the State Data Policy. The same can be used to deliver services with the institutionalization of Single Citizen ID accepted nationwide on any digital platform to access any service.

vii. **Grievance Redressal**: General complaints shall be registered with acknowledgement and get disposed of by relevant authority in a time bound manner.

Short-term Targets: 2030

- **Creating Digital Environment:** Digitally educate/literate and equip citizens.
- **Restructuring and Reforming Administrative Departments:** Engaged Governance through Institutional service delivery system to be upgraded for integrative and service delivery convergence and reforms in services - procedures, rules and Acts (Amendments); Restructuring of Departments - mergers; vertical restructuring; and, sectoral reforms.
- **Open Data:** Making government datasets available to citizens. By encouraging use, reuse and free distribution of datasets to make public institutions more transparent and accountable.
- **Digital, Accountable and Transparent Governance:** Encouraging digital interface; creation of an informed citizenry; empowering and equipping employees with digital identity.
- **Bringing Citizens and Government Closer:** Creating Digital Infrastructure; System Upgradation; and Process (equipping front-line workers with advanced and latest technological tools).
- **Bringing Digital Transformation:** Implementation of enterprise architecture, creation of single citizen ID to avail services across platforms/departments, ensuring

DBT an all social sector schemes, single sign-on for government officials, and, adoption of UPI in government departments.

- **Creating Centre of Excellence (CoE) for Emerging Technologies:** Establishment of CoE with participation of Academia, Government and Industry (AGI). Identification of Emerging Tech Preparedness, Creation of District level Emerging Technology Sandboxes, and, facilitating adoption of Emerging Tech in Government at the last-mile.
- **Fostering R&D and Process of Re-engineering in ongoing Government Services:** Transformation of existing government services through an end-to-end automation service process. Investment in R&D sector to be accelerated and fostered through initiatives.

Long-term Targets: 2047

Social well-being is broadly understood as the ability of the citizens to meet their necessities and have access to opportunities for their advancement. Thus, it included aspects like increased access to education and health care, increased access to public transport facilities and safety and security. The need is not e-governance, but engaged governance.

The state is progressing towards the Digital Transformation. However, few areas need attention. This is to be done by computerization; digitization of records; digitization of silo applications; ensuring informative and interactive websites of all the departments for delivery of services and grievance redressal; and availability of Citizen Charter indicating checklist, guidelines, standards of services and grievance redressal.

The Digital Transformative Governance aims at provision of maximum services at the single window system i.e. Sewa Kendras followed by identification of the services that can be delivered on the spot/same day, characterized with provision of doorstep or online delivery of services. These milestones will be strategically intervened through access to ease of living; ease of justice and convergence of governance.

- **Building Data Economy:** Creation of a Single Citizen ID based on the short-term strategies of computerization, digitization of records, and use of silo applications (digitized services) based single database.
- **Punjab as a National Hub State for Emerging Technology:** Creation of a pool of skills and resources considering futuristic technologies through a strategic intervention.
- **Open and Inclusive Government:** Enhanced transparency and promote an environment that is less conducive to corrupt activity and empowering citizens to demand better services from the government.
- **PUNJAB-3 (P-3: Precaution, Preparation, and Prevention):** Ensuring Resilient Government Infrastructure with Robust Technological Solutions to withstand Pandemic-Like Disruptions.
- **Digitally Transformative Governance:** Bringing an era of digitally transformed Punjab by making governance in Punjab completely digital and transformative.
- **Ease of Justice:** Adoption of One Stop Digital Justice Platform. This platform will enable all its users to perform end-to-end front office functions, processes and activities relating to adjudication, regulatory management, alternate dispute redressal (ADR) mechanism including grievance redressal and back office administrative functions, all on a single platform with zero paper, zero footfalls and zero contact.

GOVERNANCE: VISION 2047

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
CREATING DIGITAL ENVIRONMENT	Punjab, to some extent has been successful in achieving desired goals related to e-governance by using information and communication technologies (ICTs) but a large section of people still remain Digitally illiterate. Government employees are also not digitally well-trained.	• Transforming literate society to digitally empowered society. • Bringing citizens and government closer through digital platforms. • Creating Digital Environment to Digitally Educate/literate and Equip citizens.	Ensure continuity of the programmes/ action plan for Creating Digital Environment to Digitally Educate/literate and Equip citizens - as per requirement.	• Devise Action Plan to create digital environment for transforming literate society to digitally empowered society; • Digitally educate/literate and equip citizens; • Digitally educate/literate by introducing ICT curriculum as mandatory course in schools; • Advance level courses to enhance the capacity building of faculty; • Developing and promoting online and distance learning by setting up virtual labs; • Developing framework for academic-government-industry (AGI) alignments for curriculum development and skilling based on the surveys conducted across districts; and, • Equipping Punjab through wireless-connection with the provision of cost-effective internet-based devices, especially to the weaker sections.
RESTRUCTURING AND REFORMING ADMINISTRATIVE DEPARTMENTS	A digitally educated and equipped public will be needing a restructured and reformed administrative service mechanism as the departments lack digitally equipped infrastructure, system, and process; incomplete digitization of legacy records and incomplete data cataloguing under the State Data Policy.	• Engaged Governance through institutional service delivery system to be upgraded for integrative and service delivery convergence and reforms in services - Amendments in Procedures, Rules, and Acts; • Restructuring of Departments - mergers, vertical restructuring; and, • Sectoral reforms.	• Time to time upgradation of the institutional service delivery systems; • Amendments in Procedures, rules, and Acts; and, • Restructuring of Departments - as per requirement.	• Necessary upgradation and reforms of institutional service delivery systems for integrative and service delivery convergence; • Simplifying the procedures, process and rules; • Time to time amendments in procedures, rules, and Acts; • Restructuring of Departments (mergers, horizontal and vertical, sectoral); • Digitizing the government legacy records; • Introduction of a single-file system; and, • Revisit transfer policies, employee-government interaction, employee litigation, and single-page application proformas for all departments/services etc.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
DIGITAL, ACCOUNTABLE AND TRANSPARENT GOVERNANCE	Efforts are being made to minimize the interface of the citizen with the public service provider and encourage digital interface.	• Digitization of the government legacy records; • Making the government data open for citizens; • Making the public bodies produce and commission huge quantities of data and information available to the citizens; • Encouraging digital interface; Creation of an Informed Citizenry; • Empowering and equipping employees with digital identity; and, • Delivery of all public services through online mode.	Ensure time to time updating and continuity of the programmes/action plan for encouraging digital interface among the masses.	• Minimizing the interface of the citizen with the public service provider by encouraging digital interface; • Encouraging the use, reuse, and free distribution of datasets; and, • Empowering and equipping employees with digital identity.
BRINGING CITIZEN'S AND GOVERNMENT CLOSER	The system procedures widen the mistrust between citizens and the government. Such deficit still prevails during the citizens' interaction with the state. It is due to lack of citizens' participation in government processes - leading to less transparency and productivity. These deficits cannot be achieved without making the system accountable, transparent, and efficient.	• Creating digital infrastructure; • Preparing service catalogue; • Upgradation of departmental websites and availability of services through mobile based applications; • Equipping front-line workers, concerning all departments, with advanced and latest technological tools and infrastructure; and, • Reducing the burden of returned applications by continuous assessment.	Time to time upgradation of digital infrastructure, service catalogue, systems and processes - as per requirement.	• Bringing Citizens and Government Closer through Digital Platform by Creating Digital Infrastructure; • Transform citizen services through use of technology by leveraging the artifacts of India Stack that include Aadhaar, UPI, DigiLocker, UMANG, e Sign and consent framework; • Use technology for propagating end to end service delivery without human interference to the citizen at the grass root level; • Fast track the implementation of the national level public digital platforms in key social sectors viz. Health, Education, Agriculture, etc by adopting open interoperable architecture for joined up connected services; • Integration of all State/District portals with CPGRAMS for seamless Redressal of Public Grievances;

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
				• Upgrading all departmental websites and availability of services through mobile based applications and Process; • Equipping front-line workers responsible for the delivering services with the advanced technological tools and infrastructure; and, • Reducing the burden of returned applications by continuous assessment of each service delivery from the application point to maturity level.
FOSTERING R&D AND PROCESS OF RE-ENGINEERING IN ONGOING GOVERNMENT SERVICES	At present, the State is thinking of further developing and executing a robust strategy for the allocation of the R&D budget (e.g., focusing on sectors like higher education) and develop a collaborative platform where government, academia/research institutions and industry stakeholders can partner to work in synergy.	• Fostering R&D and Process of Re-engineering in ongoing Government Services; and, • All the government services (requiring a digital interface) will be converted and transform through an end-to-end automation service process.	• To have the best R&D infrastructure in the country; and, • Continuity to the programmes/action plan for fostering R&D and process of re-engineering in Government Services - as per requirement.	• Converting and transforming all the existing government services (requiring a digital interface) through an end-to-end automation service process; • Accelerating and fostering the investment in R&D sector through government initiatives; • Identification of emerging Tech preparedness across key departments; and, • Foster responsible use of emerging technology such as Artificial Intelligence, Machine Learning, Blockchain, 5G, Augmented Reality, Virtual Reality, etc for Social Empowerment.
BUILDING DATA ECONOMY	The state is progressing towards the Digital Transformation. However, few areas need attention. This is to be done by Computerization; Digitization of records; Digitization of silo applications; ensuring informative and interactive websites of all the departments for delivery of services and grievance redressal.	Creation of a Single Citizen ID through computerization, digitization of records, and use of solo applications (digitized services). The government has already initiated working towards achieving this goal.	A complete digital governance will be achieved with the help of building a secured data economy.	• A complete digital governance by 2047 can be achieved with the help of building a secured data economy. For instance, for the creation of a single Citizen ID, the short-term strategies of computerization, digitization of records, and use of solo applications (digitized services) will create a single database, which will further require the development of data security and privacy road-map for the state; • Operationalize the data governance framework to facilitate data sharing within Government entities; and, • Enable protocols for data collection, data harvesting, data privacy, data anonymization, data security, and data preservation that can

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
				help build a data economy.
PUNJAB AS A NATIONAL HUB FOR EMERGING TECHNOLOGIES	The State is lacking behind in generating new opportunities whether for economy or employment along with the provision of efficient delivery of the services. Therefore, there is a need to create a pool of skills and resources considering futuristic technologies through a strategic intervention with the help of a joint-collaboration with tech-corporation.	Creation of a pool of skills and resources considering futuristic technologies through a strategic intervention. The government has already started working on Emerging Technologies and a Centre for Emerging Technologies is being established under the Punjab State e-Governance Society (PSeGS).	Punjab as a national hub state for emerging technologies.	• Exploring the possibility of creating District-Level Emerging Technology Sandboxes to test solutions; • Facilitating adoption of emerging technologies in government at the last-mile; • Creating a pool of skills and resources through a strategic intervention with the help of a Joint-collaboration with department of technical education, higher education, and school education; • Make Punjab the national hub for emerging technologies through creation of large pool of skilled resources on futuristic technologies; • Area-specific focus such as Spatial Data Mapping (GIS), big data analytics, and decentralized data visualization solutions; and, • Partnership with leading tech-corporations to support Emerging Tech Education Cells.
PUNJAB-3 (P3: PRECAUTION, PREPARATION, AND PREVENTION)	The State is putting more efforts to achieve readiness and focus on ensuring the resilience infrastructure with Robust Technological Solutions to withstand Pandemic-Like Disruptions. Punjab was ahead of many states during the Covid-19 pandemic and had established COVA platform which managed the complete data related to Covid for the state which helped in decision making.	Ensuring Resilient Government Infrastructure with Robust Technological Solutions to withstand Pandemic-Like Disruptions.	Continuity to the programmes/action plans Ensuring Resilient Government infrastructure with Robust Technological Solutions to withstand Pandemic-Like Disruptions.	• Ensuring Resilient Government Infrastructure; • Formulating an appropriate strategy for Punjab (Precaution, Preparation and Prevention) based on unique requirements and preparedness; and, • Expansion of State Data Centre and adoption of Cloud.

Indicator	Current Status/Baseline	Target/s 2030	Target/s 2047	Strategies
DIGITALLY TRANSFORMATIVE GOVERNANCE	Despite being instrumental in setting-up the model physical and virtual infrastructure, the governance system is still not fully equipped to be responsive through the available institutional and digital platforms. The existing and traditionally age-old systems, processes and tools are to be replaced that act as barrier to efficient service delivery.	Bringing an era of digitally transformed Punjab by making governance in Punjab completely digital and transformative.	Bringing an era of digitally transformed Punjab by making governance in Punjab completely digital and transformative.	• Bringing an era of digitally transformed Punjab by measuring efficiency through performance matrix; • Process and Procedural Simplification and Transparent Citizen Interface; Departmental Restructuring and Reforms; and Sectoral Reforms; • The transformation in service delivery mechanism aims at Ease of Living with the help of One stop digital platform (For citizens, employees, institutions) and transforming the complete administrative ecosystem; • Adoption of Digital Platform that enables all its users to perform end-to-end front office functions, processes and activities relating to adjudication, regulatory management, alternate dispute redressal (ADR) mechanism including grievance redressal and back office administrative functions, all on a single platform with zero paper, zero footfalls and zero contact; and, • Making "digital" the primary aspect of government service design and delivery and providing requisite infrastructure to achieve the same.

II-A
SAFETY AND SECURITY

For safety and security, the prerequisite condition is how far the system of justice is accessible and perceived to be accessible by the common citizens? The availability of the justice mechanisms may not be sufficient to provide access to legal remedies. Social placement and norms influence the access to and use of infrastructure and services. It is, therefore, essential to address the fear of police and social stigma, safeguard the rights of vulnerable groups and eliminate social exclusion. Safety, security and equitable access to justice are prerequisites for a functional democracy, for the generation of material wealth, the reduction of poverty and the elimination of social exclusion. The State's instrumentality to safeguard the being and material interests of its citizens and people under its jurisdiction are addressed under this section. The criminal justice system shall be gauged on three broad categories in terms of reach and effectivity: accessibility and efficiency; level of physical security enjoyed by the citizens; and the rights of populations affected by crime, namely the accused and the victims.

1. Accessibility and Efficiency

Current Status

Non-reporting: A wide range of social and cultural factors affects the accessibility to the justice system. For instance, there are a number of violations which may not be seen as violative even by the victim, the perpetrator or the larger society. Further, the stigma attached to a particular crime also acts as a hindrance to its reporting. For example, transgression on the female body may not be reported as rape or molestation as it targets the reputation of victims and their families. Similar scenarios inhibit women who are victims of domestic violence. Even suicides of farmers in Punjab are misreported as these are seen by some as acts of cowardice in a patriarchal society. Additionally, farmers' suicides are largely attributed to indebtedness. If this becomes known, it may adversely affect matrimonial alliances. Therefore, there is a need to initiate societal reforms to check these distortions and reduce the gap between reporting and non-reporting of crimes.

Factors for Non-Report and Non-Registration of Crimes

Fear of harassment	Citizens resist visiting the police due to fear of harassment, victimisation by the police and the perception of being unjustly treated.
Complicated procedures	Lack of awareness and poor service delivery make the public hesitant to visit police stations.
Corruption	Fear of having to pay bribes to the police.
Lack of faith in the police	Inattention, lack of responsiveness.
Social stigma	Concerns that the image will be affected if they visit the police station and publicly acknowledge being victimised.
Less serious offences	Petty crime, which is not felt worth the trouble of visiting the police station.
Registration of cases related to the performance of police	Low registration of cases is taken as less crime

Gaps between Reporting and Registration: As the system of justice-delivery is segmented within the police, registration, investigation, and charge sheeting are processed by different departments without accountability for the end results. For the police, the assumption is that the lower the reported crime rate more efficient the policing. So, the strategy has been to reduce the gap between crime reporting and the crime registered.

The percentage of crimes registered to crimes reported remains low. One of the reasons for low registration of crime is that less crime is considered to be the better performance of a police station which induces police personnel to low registration of crimes. As a result, the incidences of petty crimes which are on the increase are not registered only those crimes are registered which are visible and heinous in nature (see Figure 1 in Annexure).

Gap between Registration and Investigation of Complaints: The gap between cases registered and investigated is significant. In the year 2020, 42.3 per cent of the IPC cases registered were disposed of after investigations (see Figure 2 in Annexure). The reasons cited in the Crime in India report included cases withdrawn by the government during investigation, not investigated due to insufficient evidence, the final report being declared as false, or it is submitted as a non-cognizable offence. There is also a lack of capacity with the police in terms of skills, technology and time for investigation.

Gap between Investigation and Chargesheet Rate: The chargesheet rate is very low. In 2020, the charge sheeting rate in IPC cases was only 70.4% (see Figure 2 in Annexure).

Poor Conviction Rate: The quality of investigation and scientifically prepared chargesheet can help to improve the quality as well as increase the conviction rate. The conviction rate in IPC cases was 51 per cent in 2020 **(see Figure 2 in Annexure)**.

Challenges

- Unequal access to Justice.
- Stigma attached to report a crime especially crime against women.
- Gap between crime reporting and crime registered.
- Corrupt practices, and lack of capacity within the criminal justice system in terms of skills, technology and time for investigation.

Short-Term Targets and Strategies: 2030

Targets

- To improve access to the criminal justice system for all sections of society.
- To provide effective complaint registration.
- To develop new indicators other than the number of registration of FIRs for the evaluation of the police station performance.
- To reduce the gap between crime reporting and crime registration.
- To improve the work efficiency of police stations.

Strategies

- To assess the justice, reach and effectivity the indicators like reporting of complaints, registration of cases out of complaints, annual investigation rate followed by the charge-sheeting and conviction by the courts are to be used.
- There is a need to develop some alternate metric for the performance appraisal of the station in-charges, maybe, measured by petty over heinous crime ratio - where high ratio suggests fearless reporting of complainants.
- Effectivity and Accessibility of Justice have to be mapped into three broad categories i.e., to be heard rightfully (fearless reporting of complaints); just action (case

registration, efficient investigation and charge-sheeting); and, Justice Delivery (conviction by the court).

- Encourage citizens **to report the crime in Saanjh Kendras** (Community-Police Resource Centres) fearlessly and without any stigma.
- I.T. application has enabled citizens to report crimes in any of these centres irrespective of the place of occurrence of crime.
- They will be provided with an **electronic receipt** and **unique identity number** for follow-up. This will reduce the gap between non-reporting – reporting and registration.
- A monitoring system to be set up to ensure time-bound filing of chargesheet in the courts.

Long-Term Targets and Strategies: 2047

Targets

- Time bound quality investigation.
- Reduce the time lay between investigation and the charge sheeting and also to improve the conviction rate.
- Engaging the private sector for security responsibilities and devoting limited available human resources for core policing responsibilities like; prevention and detection of crime, investigation etc.

Strategies

- Developing uniform standards and complying with the law in recording FIRs.
- Around four hundred centres shall provide counselling services to resolve disputes related to domestic violence, dowry and various other crimes related to women.
- **To setup separate investigation wings** equipped with skilled and trained human resources and technology at the police station level. Each district shall have an Advance Investigation Wing to investigate heinous crimes in a professional and scientific manner. This will enhance the quality of justice delivery and lead to high conviction rate.

- All police districts have access to well-equipped and well-staffed forensic laboratories where scientific evidence can be quickly analysed and results conveyed to the investigators in a shortest possible time.
- **Strengthening Prosecution Wing**: It is imperative to strengthen the prosecution wing and also develop mechanisms for better coordination between the investigation and the prosecution.
- **Accountability for the outcome:** The head of the prosecution department will be responsible and accountable for falling conviction rates.

2. LEVEL OF PHYSICAL SECURITY ENJOYED BY THE CITIZENS

Current Status

Level of physical security: An inter State comparison of the level of physical security enjoyed by the citizens, shows that the total IPC crime rate (per lakh population) is highest in Delhi, Punjab ranks 19th in overall IPC crime rate and on crime against body Punjab ranked 23rd. It registered a high rate of economic crimes and ranked at 9th among the States and union territories. The registered crime against women and the Dalits is comparatively lower as it is positioned at 26th and 22nd (Crime in India 2020).

Key concerns emerge from this fact file;

(a) Reporting of crime against women and Dalits is low

(b) Reporting of economic crimes is comparatively on the higher side.

Total Crime- Crime Rate: As per statistics in "Crime in India 2020", a publication of the National Crime Record Bureau, Ministry of Home Affairs, the rates of Cognizable IPC and SLL Crimes in Punjab [crime incidence per lakh population]; were 165.2 and 109.4; respectively. The crime rate (incidences per lakh population) is increasing as the total crime (IPC+SLL) rate has increased from 243.3 per lakh population to 274.6

Violent Crime: National Crime Record Bureau in its publication "Crime in India", categorizes; Murder, Culpable Homicide not amounting to Murder and their attempts, Infanticide, Foeticide, Dowry Deaths, Grievous Hurt, Kidnapping and Abduction, Rape and its attempt, Rioting, Robbery, Dacoity and Arson, as “Violent Crime”. Punjab, under

this category in terms of crime rate, ranked "23" among all States and UTs with 20.1 crime rate (see Figure 4 in Annexure).

Economic Offences: Per Lakh Population Prevalence of Economic Offences like; Criminal Breach of Trust, Counterfeiting, Forgery, Cheating and Fraud; was high in Punjab in comparison to other States and UTs as the rate of Economic Offences was 11.6 incidences per lakh population, and Punjab was at 9th place among States and UTs. (see Figure 5 in Annexure)

Cyber Crimes: Cyber Crimes are offences that are punishable under the IT Act, IPC Crimes (Involving Communication Devices as Medium/Target or r/w IT Act), and Offences under SLL (Involving Communication Devices as Medium/ Target) r/w IT Act). In the rate of cyber-crime (1.3), Punjab was at 19th position among States and UTs in 2020 (see Figure 6 in Annexure).

Challenges

- Safe and secure community is one of the main objectives of the criminal justice system. Trust has to be created in the security apparatus, Judiciary and Civil Administration for maintenance of Law and Order. The mechanism for providing accessible, efficient, and accountable delivery of justice has to be strengthened.
- A responsive and accountable police institution effective in combating and preventing crime is the second most important requirement for a safe community. To gauge this empirically some indicators may be used so that target may be set for the future.

Short-Term Strategies: 2030

- To know how safe is the community, indicators like overall crime rate, violent crime rate, increase/ decrease in a particular form of crime incidences/ rates and crime-related deaths shall be gauged and analysed.
- Safety audits of public spaces shall be undertaken. This shall help to capture the extent and types of crime prevalent in identified public spaces. The capacity building training of the beat officers shall be made a regular feature and Saanjh committees and Saanjh advisory boards constituted under SAANJH Programme at the district,

subdivision and police station levels are to be involved in the identification of such areas which are prone to violent conflicts. The platform of Saanjh shall be used to provide conducive environment for mediation amongst conflicting parties.

The Saanjh Committees shall be empowered and activated to prevent recurring of conflicts and take proper precautions to protect the vulnerable spaces, target groups, symbols and individuals.

Long-Term Strategies: 2047

- **Violent Conflict Management:** Conflict can be managed by studying and capturing the nature and level of interaction between various religious/caste/ethnic groups and also correctly gauging the role of various actors in terms of their ideological positioning, and material stakes and political affiliations. Another level of intervention would be the mobilisation of the larger community and the initiation of communication with the parties involved in the conflict.
- **Violent Conflict Defence:** At the time of eruption of a conflict in a locality, the police and the locality shall act as a defence group and provide protection to the member of the locality by setting up check-points, patrolling the locality and insulating one locality from the other through social fencing with the help of volunteers and youth members. This would greatly check penetration by criminals or anti-social elements and control the spread of conflict in their locality.
- **Crime Management to Crime Prevention:** Crime activity mapping pertains to identifying the nature and rate of crime. It also notes places vulnerable to crime and susceptible criminals. Mapping for crime prevention includes attributes of the perpetrators, spatial and potential targets along with the factors that cause the occurrence of the crime.
- **Institutional Alternatives:** These institutional alternatives function within the demarcated domains of the three institutions of the police, the judiciary, and prisons. For instance, in police, community policing programmes, have been adopted by the police in most States in India in an effort to involve the community as a participant in policing activities.

The most widespread alternative that has been institutionalised in Punjab is the community policing programme **SAANJH**.

Community policing in Punjab has been initiated with improved programmes seeking citizen participation in crime prevention. *Lok Adalats* have been instituted to help relieve the pressure of cases in courts through arbitration and to provide quick relief to the people. These alternatives subsidise formal structures and improve public perception of safety in their areas.

3. CRIME AGAINST VULNERABLE SECTIONS

Current Status

- Crime Against Children: Crime against children per lakh population (IPC and SLL collectively) was 24.3 in 2020, and Punjab was in 22nd position among all the States and UTs (see Figure 7 in Annexure). IPC Crimes against Children in this category comprises all heinous crimes like Murder and its attempts, Murder with Rape, Abetment of Suicide of Child, Infanticide, Foeticide, Exposure and Abandonment, Simple Hurt, Grievous Hurt, Kidnapping and Abduction of Children, Human Trafficking of Children, Selling and Buying of Minors for Prostitution, Rape and its attempt, Assault on Women with Intent to Outrage her Modesty, Insult to the Modesty of Women and other crimes punishable under the Indian Penal Code (IPC). The rate of IPC crimes against the children in Punjab was 15.5 in 2020.
- Crime Against Women In the 2020 rate of Crimes Against Women, (IPC and SLL both), the rate of such incidences per lakh population in Punjab was 33.8, stood 26th in ranking among States and UTs (see Figure 8 in Annexure). Exclusively, under the IPC, heinous crimes against women like; Murder with Rape/ Gang Rape, Dowry Death, Abetment to Suicide of Women, Miscarriage, Acid attack and its attempt, Cruelty by Husband and Relatives, Kidnapping and Abduction, Human Trafficking, Selling and Buying of Minor Girls, Rape and its attempt, Assault on Women with Intent to Outrage her Modesty and Insult to the Modesty of Women, comprises the category "Crimes Against Women under IPC". Punjab, with rate of 28.5 incidences of such crime per lakh population, was at the 20th position among all States and UTs in India.

- Crime Against Senior Citizens Unsafe society, specifically vulnerable sections like; women, children, and senior citizens, raise various question on law-and-order management. Senior citizens also become victims of different crimes as they are also one of the soft targets of criminals. In 2020, Punjab was at the nineteenth position in India with 10 incidences of crime against senior citizens per lakh population. The senior citizens faced all sorts of dreadful crimes like Murder, Culpable Homicide and their attempts, Hurt, Assault on Women with Intent to Outrage her Modesty, Kidnapping and Abduction, Rape, Theft, Extortion, Robbery, Dacoity, Criminal Trespass, Forgery, Cheating & Fraud and Criminal Intimidation, and various other crimes punishable under IPC.
- Crime Against SCs Punjab ranked "22" in incidences of crime against Scheduled Castes per lakh population. In 2020 the rate of crime against SCs was 1.9.
- One of the striking aspects of Punjab is that scheduled castes constitute the highest percentage among all the Indian States. About 80 per cent of the Dalits in Punjab live in the rural areas where caste divisions are relatively stronger. However, Dalits to some extent are economically self-sufficient as compared to Dalits in other States. Punjab recorded 165 incidences of crime against SCs in 2020 at the rate of 1.9 incidences of crime committed against 100,000 SCs.

Challenges

- Children, in general, need to be protected from exploitation because they are always dependent on their elders and have little opportunity to raise their voice. The physical and mental immaturity of children makes them vulnerable to exploitation and abuse.
- Since children represent the most valuable asset of a nation, the provision of a safe and stimulating environment to them with protection against cruelty, neglect and exploitation should be a matter of serious concern for every society. The trends in crime against children have rendered them the most vulnerable targets. The rapid

increase in the magnitude of incidents of such crime calls for greater involvement of the community as a whole.[1]

- Women's safety is one of the most debated issues worldwide and is intrinsically linked to the crime against women. In India, police records show incidences of crime against women are increasing. Earlier crimes like rape, molestation, eve-teasing, sexual harassment, etc were not reported due to the social stigma attached to them. But now the situation is changing, though gradually. Women do get harassed, stalked, molested, at workplaces, on the roads and even in educational institutions. The problem of eve-teasing on the roads especially around crowded markets, malls, multiplexes and educational institutions leads to a lot of agony in the minds of women including girl students.
- The issue of the safety of women and girls needs to be addressed effectively. A multi-pronged strategy is required to tackle this problem. The Skewed sex ratio, stereo typed projection and representation of women in media, patriarchal mindset, and other factors also lead to an increase in incidents of assault on girls and women.
- The State agencies, especially the police, have an important role in creating an environment where common citizens especially women feel safe. Punjab Police has paid special attention to these issues and created facilities for women where they can get their grievances redressed.
- Dalits are most vulnerable to caste-based atrocities despite preventive measures in the form of constitutional provisions regarding enforcement of civil rights and specific measures through the enactment of the Protection of Civil Rights (PCR) Act, 1976 and the Scheduled caste and Scheduled Tribes Prevention of Atrocities (PoA) Act, 1989.
- **Relief to the Victims of Crime:** This is an important dimension to measure the nature of the functioning of the criminal justice system towards the creation of a sense of entitlement in justice delivery among the victims of crime especially among the vulnerable sections.

[1]Child Abuse in Punjab, 2001.

Short-Term Targets and Strategies: 2030

Targets

- Specialized units to deal with the victims from vulnerable sections.
- To reduce the crime against vulnerable sections of society.
- To facilitate the vulnerable section in reporting crime and getting justice
- To develop a mechanism which insulates them from re victimization and treats them sensitively as per their specific needs while investigating.
- To plan their relief, and rehabilitation and provide them compensations meant for them as per law.

Strategies

Strategies For Children

- Specialized child protection units to deal with child victims.

  Relief Measures: The foremost task of a relief strategy is to limit the effects of the abuse and restore the children to effective functioning in the community. The relief strategy shall have the following three dimensions;

  To capture the social and psychological profile of the abused;

  To change coping of the abused that is the therapeutic process.

  To transform those mechanisms, which produce or exacerbate problems that is the process of environmental control.

  Efficient Service Provider Mechanism The efficient mechanism of availability of services may be evolved. Setting up of child helplines accompanied by active backup support of mental health specialists and sociologists would ensure timely and efficient assistance to those in crisis. About 50 per cent of the children victims of sexual abuse were deprived of prompt medical and psychological assistance after the assault. Had timely aid been provided to these abused children many long-lasting repercussions would have been diluted.

Mental and Physical Health Services To provide appropriate health services and establish structures to relieve distress, anxiety, depression helplessness and hopelessness.

Behaviour-oriented training to the parents and caretakers of the abused children in child management skills, modelling and counselling. This kind of treatment programme has been found to be quite successful for such children.

Mobility Emergency child protection teams should be organised at the district level to investigate and intervene in the cases of child abuse.

Need to Place Child away from Pathogenic Environment To provide adequate protective care and custody of children, and to those who have experienced abandonment, abuse, neglect and related conditions, strategies need to be evolved.

Possibility of Using Significant Others as Change Agents Since the family and other informal groups have a fundamental role in providing the necessary psycho-social support, parents, caretakers and teachers can be trained to act as change agents. Typically such training focuses on helping the parents and teachers to understand the child's problem and learn to reinforce adaptive behaviour.[2] Such tasks have low feasibility and practicability in pathogenic structures such as families of child prostitutes, beggars and labour where parents can be considered one of the abusing agencies.

Environment to Ensure Formation of Pressure Groups Child support groups at the village, block and district levels, constituting teachers, social workers, NGOs and community representatives, can serve children in distress. These pressure groups can also be helpful in changing the existing community attitude from rejection and stigmatization of the abused to that of empathy and acceptance.

Rehabilitation Measures: The rehabilitation services should work to restore the abused child's self- confidence and competence. Instead of following the custodial approach, the rehabilitation strategies should adopt multi agency community-oriented approach.

[2] Forehand, R., Rogers, T., McMohan, R.J., Wells, K.C., and Griest, D.L. (1981). Teaching Parents to modify child behavior problems: An examination of followup data J. Pediat Psychol. 6(3)-313-32.

Institutional Mechanisms: A crucial frontier in rehabilitation involves the strengthening of community support structures and thus, alleviating the conditions that deprive the children of stimulation, motivation and opportunities. Sensitization of the local support organisations is essential to make them aware of the implications of child abuse.

Educational institutions can go a long way in providing rehabilitative counselling and vocational training to children. Special coaching provisions need to be made for children who are either drop-outs or have never been to school.

Community caretakers should aim at creating a safe and dependable play and recreation environment for the children — a therapy to reduce their levels of threat perception.

Appropriate participation of the abused children in the development and operationalisation of programmes which are to serve their needs, should be ensured.

Sincere rehabilitation efforts are needed to assist these unfortunate children in overcoming the disabling effects of being abused.

Integrative Measures: The task of integrative strategies is to restore the children to effective functioning in the community. Integration involves creation of a cohesive support structure to aid the abused children in confronting social challenges.

Changing Community Attitude: Social isolation and rejection emerged as major hazards being faced by all categories of the abused. They are often treated with stigma, distrust and hatred which interferes with their ability to cope with the trauma. A vast majority of children involved in the study have expressed their desire for social assimilation. Community sensitivity needs to be ensured through support structures such as panchayats, NGOs, local and religious bodies.

Ensure Participation of Children: The needs and aspirations of the abused children should be given prime consideration in evolving an intervention strategy for them. The transition from institutional setting to the community should be smooth for those who are placed in observation homes and prisons.

Strategies for Women

- **Women Police Station:** Women Police Stations have been notified and are functional where issues pertaining to women are handled, which includes registration of the case and subsequent investigation of the same. The majority of these women police stations are staffed with the women police force.
- **Women Safety Apps:** For the safety and security of women, a women safety mobile App to be launched. The main feature of this App would be as follows:

  By pressing the 'HELP' button on her mobile phone, a woman can send alerts to her relatives, 181 police helpline, District Control Room concerned SHO, DSP of Subdivision and other police officers.

  The user can take pictures of unsafe places and can send these pictures to the Police control room. These geo-tagged pictures along with meta data will be received in Police Control Room and Police can further analyse this information and take necessary remedial steps like enhanced patrolling, getting street lights installed in the area, etc. This will help in the prevention of crime in the area.
- **Helpline** A centralised helpline with a special focus on women's issues and the overall safety of women to be set up. The basic aim of this helpline is to provide succour and relief to women in distress situations without any delay. The facility of recording each and every call through a voice logger will be built in this helpline. The complaints received at this helpline will be classified as per their urgency and sensitivity. These complaints will be immediately sent to Districts and Commissionerates, who in turn would take immediate action on such complaints. A feedback mechanism would be introduced at this helpline where the satisfaction level of the complainant is compiled.
- **Identification of Black Spots** Identification of black spots where crime against women like eve-teasing, molestation, rapes and other crimes are more prevalent in the cities and villages.
- **Installation of CCTV Cameras and Street Lights** CCTV cameras to be installed and frequent police patrol to be undertaken on these black spots.

- **Women Patrolling Squads** Special women patrolling teams are being constituted for carrying out patrolling around schools, colleges, marketplaces, malls, multiplexes and major crime spots where the majority of victims are women.
- **Safe Public Transport** Public and private bus transport to be equipped with the GPRS system to monitor their movement. Efforts to be made to replace normal taxis with Radio-Taxis in the cities for stricter regulation.
- **Road Code and Conduct** Traffic rules like a violation of traffic lights, triple riding, over speeding, drunk driving, etc to be strictly imposed to check intimidation of women on the road.
- **Community Police Oversight** State-wide community-police oversight is proposed to be activated to build public pressure on anti-social elements so as not to indulge in such activities, this would be followed by launching awareness campaigns. These community-police oversights (CLGs) are in existence and attached to each police station, Deputy Superintendent of Police Offices at the sub-division level and SSP level at the district.
- **Complaint Tracking in Cyber Crime Unit** The cybercrime unit shall have an online **complaint** system to track the obscene messages and calls leading to the mental harassment of women.
- **Easy Access to Reporting of Crime:** For women to seek police assistance without any fear, an online complaint **system and Mahila Mitras at SAANJH Kendras** are being introduced at the police station, sub-division and district levels which will be jointly run by the civil society and the police.
- **Services for victims:** Basic services like medical aid to be made available to the victims. They will be cared for at the SAANJH Kendras at the Thana, sub-division and district levels.
- **Recording of the Statement of the victim:** Gender violence victim's Statement to be recorded by a woman police officer. The Victim's medical examination is to be conducted by a woman medical officer. The Victim is to be provided with immediate

medical aid for any physical injuries suffered. Victim to be provided with immediate counselling for the psychological trauma suffered by her.

- **Victim Relief Mechanism:** A comprehensive end-to-end procedure for victim care by pooling resources of police and medical emergencies would be drafted and staff stationed in victim relief centres of **SAANJH Kendras** will play an important role in providing care to a victim of crime.

- **Victim Relief Centers:** Victim relief centers have been started in all Saanjh Kendras, especially at all the Police Station level Saanjh Kendras in the State. Police Station Level 'Saanjh Kendras', subdivision level Saanjh Kendras and district level Saanjh Kendras act as nodal points in Punjab Police for relief to victims of crime in the following areas:

  Counselling of victims of crime especially children/minors, victims of sexual/crime, victims of matrimonial/domestic violence, etc.

  There are numerous provisions in various laws/rules which stipulates awarding of compensations to victims of crime by various authorities like District Legal Services Authorities, President Motor Accident Claims Tribunals, Deputy Commissioners of concerned district etc. In following cases:

Type of Cases and Authorities for Sanctioning Compensation

Sr. No.	Nature of Case	Authority for sanctioning compensation
1	Untraced accident cases	National Solatium Fund scheme / Deputy Commissioner of district
2	SC/ST (Prevention of Atrocities) Act, 1989	Deputy Commissioner of district / District Social Welfare Officer
3	Acid Attack victims	Deputy Commissioner of district / District Legal Services Authorities
4	Victims of general crime like rape, murder etc.	District Legal Services Authorities

Long-Term Targets and Strategies: 2047

Targets

- To make the invisible crime against vulnerable sections visible and detaching the stigma about reporting some crimes like; rape, sexual harassment etc., by mass awareness.

- To sensitize personnel who administer the three pillars of the criminal justice system police, courts and prisons about the need and care and safety of the vulnerable sections of the society.
- To sensitize and train the staff administrating the criminal justice system to unlearn their biases which they retain through cultural conditioning.
- To facilitate the vulnerable sections in reporting crime and getting justice.

Strategies

- As a deterrence, it is proposed that where charges have been framed in the courts against the accused relating to rape and sexual harassment, the accused should not be entitled to State's incentives till he is acquitted by the court. These entitlements include various verifications by police like character, no objection to travel abroad, income, caste certificates, renewal or issuance of driving, passport and other licenses.
- All institutions like schools, colleges, government departments, private enterprises, public and private transport have to implement revised **Model Gender Code of Conduct** to check sexual harassment. The model gender code of conduct to be prepared in consultation with the various stakeholders.
- **Quick Delivery of Justice: Quality Investigation and Fast Track Courts**

    1. Each police station to have a separate Investigation Wing
    2. Each district has an **Advanced Investigation Wing** with the latest technology to investigate the heinous crimes in a professional and scientific manner.
    3. **Criminal Case Monitoring System** to be developed to enable victims, investigators, prosecutors, judges and even the defence counsel to keep track of the movement of cases through the criminal justice system from the time of lodging the FIR till the conclusion of trial/appeal and release of the convict after completing the sentence.

- **Development of Standard Operating Proceduresfor Victim Care:** Immediate care of the victim of crime needs to be prioritised to reduce the trauma related to physical or psychological injuries to reduce fatality after the crime. Standard Operating

Procedures to be developed for post-crime victim care. These SOPs will be designed specifically to gender and extent of causality for every point of contact for the victim.

4. POLICE MODERNIZATION, STRENGTH AND INFRASTRUCTURE

Current Status

Punjab has only one forensic lab as per Data on Police Organization, BPRD 2020. There are 41 servers, 4319 personal computers and 854 laptops with the Punjab State Police Department. Punjab police also have 2399 CCTV cameras, 46 speedometers and 789 breath analysers. There are 16,285 family quarters available with the Punjab Police out of these 38 are for DySP and above rank, 854 for ASI to Inspector and 15,393 for constable and head-constables.

The number of police personnel sanctioned strength **[Civil + District Armed Reserve (DAR)+ SPL. Armed +IRB] in State** in 2020 were 96,297 and it comes to 321 police personnel per lakh population. Whereas in the case of civil police the rate of police per lakh population is only 236.34. (BPRD, 2020, Pg 64)

Physical Infrastructure of Police stations: For Crime Prevention and Management: As per data provided by BPRD 2020, Punjab had 430 sanctioned police stations, 70,901 civil police personnel.

Challenges

- Punjab is a border State that had faced terrorism for a number of years. Foreign powers still want to cause disturbances in the State. There have been instances of cross-border infiltrations of terrorists. There are incidents in the past when terrorists from foreign lands entered deep into the territory of Punjab and even managed to cause harm to the general public, police, and security forces. Smuggling of arms, ammunition, narcotics, and other contrabands in Punjab by persons and drones across the border is also increasing.
- Dropping of arms in Punjab's border villages using drones presents a serious problem. The **anti-drone mechanism** is the foremost need.

- The digitization of the police work and police-public interaction process in all services-related matters will curb corruption, and enhance accountability and promptness. There shall be an e-office platform for internal police working, and an e-platform for police-public interactions for request and delivery of police services enabled with the citizens' feedback system to be used in improving accuracy and efficiency in police response.
- There is demand for an increase in the strength of police personnel however proper human resources management of present strength is also an issue.
- Modernization of the police department in terms of infrastructure, and technology is required.
- There is a lack of commitment among police personnel.

Short-Term Targets and Strategies: 2030

Targets

- To improve police presence
- To open the required number of police stations and deploy an optimal number of personnel per police station for effective police administration and the development of some statistical method based on some indicators to find the optimal numbers.
- Digitization of the police record.
- Intensive use of technology.
- Upgrading skills and recruitment of skilled personnel.
- Provision of anti-drone tech and thermal imaging cameras for district police of border districts Ferozepur, Tarn Taran, Amritsar, Gurdaspur, Pathankot, and Fazilka.
- Paperless work of the Police Department.

Strategies

- Procurement of Anti Drone technology.
- There is an urgent need to keep active surveillance of public places and vital installations to ensure safety and security in the State. For the furtherance of this

objective State police need to be equipped with **CCTVs, Drones,** and other latest modes of surveillance. CCTV cameras would be installed in all public places, on all major inter-district and intra-district roads, and on all places of importance comprising police stations, district secretariates, and others. Moreover, drones with night vision shall be procured for the police of these districts, to conduct effective search operations in any targeted area and to give them an operational advantage in case of any infiltration. These drones will be helpful to gain aerial vantage points for crime scene work, search and rescue efforts, accident reconstruction, crowd monitoring, and more.

- There shall be an Intelligent Database Integration setup to enable sharing of data from all smart surveillance systems and to draw a centralized intelligent linkage of relevance to security. Database analytics produced from the above setup after processing data from various databases and live data streams will generate real-time actionable inputs for crime prevention and detection. This setup will make use of technologies like Machine Learning, Deep Learning, and Artificial Intelligence and shall assist police offices in effective decision-making in the field through the implementation of different algorithms. This technology will also assist in sentiment analysis for crime prediction.
- An Intelligent Traffic Management System with analytic response system for dedicated handling of vehicular traffic data feeds. The indicators such as police station–population ratio, police personnel- population ratio and police presence per sq km etc. are to be used to determine the adequate police presence.
- All above components will be managed from an **Intelligent Command Control and Coordination Centre (**ICCCC) at the district level. ICCCC will be based on a **Dedicated Data Network** for transmission of captured and generated data relevant to law enforcement. The cyber security module will be implemented which takes care of all backdrop exploits, hacks and threats to these **Intelligent Command Control and Coordination Centres (ICCCC)** for uninterrupted functioning.
- Six districts of Punjab; Ferozepur, Tarn Taran, Amritsar, Gurdaspur, Pathankot, and Fazilka, share their boundaries with the territory of Pakistan. By 2030 in all these

districts **Intelligent Command Control and Coordination Centre (ICCCC)** will be established. Drones equipped with zoomed cameras enabled with night vision, thermal imaging, and 3D mapping software to offer GPS-enhanced precision shall be procured for these districts.

- Best available technology and infrastructure will be procured to establish these centres. Training of the field police officers will be done to make these centers operate within the stipulated timeframe.
- **A thermal imaging** camera can be a useful technique for police especially to work in dark conditions in low-lit forest areas near borders. Thermal image cameras small hand-held units can be helpful in detecting humans and delivering a “heat picture” of a “heat map” of the area under search in case of some suspicious movement. These cameras can be used to track the motion of suspects in the darkened building. Such technology will be helpful in life-saving in search and rescue missions.
- Immediate plans need to be worked out to provide buildings for the police stations which do not have their own and equip them as per the current requirements. As the first step in this direction, the police stations in dilapidated conditions will be repaired immediately.
- Most of the police stations are to be located in new buildings. The police station space will be re-engineered to give them community orientation, and provide space for efficient management systems, victim relief centres, dignified detention cells and accessible police service delivery.
- Transparent recruitment of skilled manpower and regular training to improve efficiency of police personnel besides developing competency in area of emerging concerns.
- Digitizationof Police Stations record.
- Facilities for the visitors like respectable sitting arrangements, drinking water, waiting rooms for the visitors, communication rooms, separate washrooms for women, and parking to be ensured.

- More humane conditions for the detainees are ensured which are in tune with the recommendations of the National Human Rights Commission and verdicts of the courts.
- Vehicles for SHO and staff for daily duties. In order to face the hi-tech criminals and e-offenders, the mobility, communication, forensic kits and weaponry of the policemen at the police station level is being implemented.
- More Forensic Labs
- Forensic Kits: Future of the police in the country lies in extensive forensic applications as the tech-criminals are far ahead of the policemen in the use and abuse of technology. The Police station being a base unit will accordingly have to be equipped with the gadgets and devices for effective sealing and coverage of the scenes of crime, lifting, preserving and transmitting evidence for expert reports.

Long-Term Targets and Strategies: 2047

Targets

- Digital governance in police stations.
- To improve working conditions of the staff
- To improve the efficiency of policing, by enhancing the commitment of police personnel, by improving their living and working conditions.
- Leveraging expertise available in the private sector and through public-private partnerships for developing solutions to emerging security challenges like rogue drones, and cyber security.
- By 2047 development of indigenous anti-drone technology. Provision of thermal image cameras for police of all districts.
- Decision-making on service requests by the public without human intervention through artificial Intelligence based on intelligence data available with the police department. E-platform for the public to request all services.

Strategies

- By 2047 the **Intelligent Command Control and Coordination Centre (ICCCC)** will be established in the whole of Punjab.
- Relevant training to the staff will be provided.
- Dedicated research and development shall be induced in the State for the invention of anti-drone tech.
- Procurement of artificial intelligence-based technology and development of such digital platform and training of staff.
- Proper space allocation for the staff and office infrastructure, living and working conditions for the staff at the police station level need comprehensive attention as these affect their morale and efficiency directly.
- Computerization of record-keeping-Initiatives undertaken in this direction needs fine-tuning and integration with the national network grids and State network grids. Inter-departmental communication issues are being addressed comprehensively. The National Crime Record Bureau-supplied packages such as CIPA and CCTNS be integrated for intra and interdepartmental operations to be in tune with the E-Governance Policy of the department.
- **Setting up of new and re-demarcation of the Police Stations:** In the Punjab Police Act, Section 13 stipulates that the State Government may, on recommendation of the Director General of Police, create, by notification in the Official Gazette, as many police stations and outposts as may be deemed necessary in a police district, duly keeping in view the population, area, crime situation and the workload in terms of the law and order situation and the distance to be covered by the inhabitants to reach the police station.If population coverage of one lakh is to be taken as one the base to set up police stations, Punjab may open more police stations as per requirement.

  The conventional criteria may not suffice to meet the citizen needs like tourism, migration, traffic density and/or locational specificities like historical place, heritage site, national and State highways and other strategic locations, and/or nature of crime like terrorism, ethnic conflicts, and social violence. It may be more appropriate to set up police stations that would be commensurate with the citizen needs, locational specificities and nature of crime.
- **Procurement of** artificial intelligence for investigation, crime detection and surveillance.

5. CONTROLLING DRUG ABUSE

Current Status

The drug problem is basically a social problem which needs to be tackled by the State and the society. However, it is not easy to know or to study as to what proportion or percentage of the total population in a State is addicted to the psychoactive substances.

There is no scientific data available on the number of addicts in Punjab as most of the studies conducted were on drug addicts. In 2001, the study conducted by Dr. Neerja and Vasudha Goyal of the Institute for Development and Communication, with a sample size of 4,335 addicts, observed that 79 per cent of the drug addicts were youth. Similar studies done by P.S. Verma (2010) with a sample size of 1527 addicts and R.S. Sandhu (2013) with sample size of 600 addicts, mentioned that around 73 per cent of the drug addicts were youth. From these studies, a misconception was erroneously inferred ass if 70 per cent of the youth of Punjab were drug addicts. However, it is not to deny the enormity of the problem.

Challenges

- Drug trade and drug abuse have their own dynamics. Drug trade has international dimensions, regional context and local sites. Punjab is a transit route for international drug trade with 536 kms of border with Pakistan. Heroin is smuggled from across borders as a part of the Golden Crescent Triangle. In other words, it originates from Afghanistan to its final destinations in USA, Europe and Canada. It has its regional context, as drugs like opium, poppy husk, charas and ganja, etc., are traded from the States of Himachal Pradesh, Madhya Pradesh, Rajasthan, etc. For the misuse of prescription drugs, such as, tablets, syrups, injections the same are supplied by some chemists and other peddlers.

  In view of these varied sources of drug supply, a composite plan has to be launched.

- The Central and the States governments have to form a consortium with multi-agencies coordination between Central Bureau of Narcotics, Directorate of Revenue Intelligence, Customs and Central Excise, etc., and State enforcement agencies have to effectively intervene to reduce the supply of drugs, at three levels, i.e.

international drug trade, to break the cycle of inter State trade from the source to the consumers by crop eradication and control, and misuse of prescription drugs. For the demand side, the prevention and curative institutional framework and activities are to be planned.

Short-Term Targets: 2030

- **Institutional Framework for Policy and Coordination** An apex body has to be constituted at the State level headed by the Chief Minister consisting of experts from specialisation in medicinal and socio-psychological fields. This board shall formulate policies, put in place coordination and monitoring mechanisms and initiate evidence-based research on substance abuse.
- **Narcotics Control Bureau:** Narcotics Control Bureau is to be established by the State order to effectively deal with the drug issue in an integrated and organic manner so as to ensure better co-ordination between Punjab Police and other government departments. The Bureau is to be headed by an IGP rank officer who is assisted by two officers in the rank of DIG and four Zonal AIGs stationed at Amritsar, Jalandhar, Ludhiana and Bathinda. Apart from other duties for controlling smuggling/trafficking of drugs in Punjab, the Bureau will also focus on completely unearthing the multi-model and multi-layered network of smuggling from across the border
- **Grass-root Level Drug Control Institutions** The village level drug control set up consisting of the village Sarpanch, Patwari, Aanganwadi workers, community influentials, police post in-charge, school principals be constituted to undertake activities that would curb addiction at the village level: The VDCs would report to the BDCs. Their major activities may include: Identify the addicts of the area, as well as the suspected drug suppliers.
- **Supply-Side Initiatives** On the supply-side multipronged enforcement-oriented initiatives shall be taken. Main focus of enforcement agencies shall be to target drug cartels involved in smuggling of drugs especially those dealing in heroin, synthetic drugs and precursor elements.

- **Seizures of Synthetic Drugs** Another focus of enforcement is to check inflow of synthetic drugs. The major recoveries of methamphetamine (ICE) and other precursor elements like ephedrine and pseudoephedrine which are used for manufacturing of 'ICE'. These precursor elements form the raw materials for the manufacture of medicines by pharmaceutical firms, but are illegally diverted for the manufacture of synthetic drugs.

  Special focus and action shall be taken against persons involved in the illegal selling of pharmaceutical origin intoxicants.

Long-Term Targets: 2047

- **Family Credit System**

  Support for Drug De-addiction

  Drug addiction is a social evil and the social stigma attached to it leads to the under-reporting of the extent of the problem of drug abuse and a number of addicts. Since the families hide the information pertaining to drug addicts thereby making the de-addiction efforts insufficient and ineffective. In order to combat this problem, there is a dire need to promote the reporting about the presence of drug addicts in the family. Therefore, it is proposed to incentivize the family which reports about the drug addicts and register them with the de-addiction centres (**See Table 1, in Annexure**).

- **Preventive and Curative Approach**

  Health Systems

  Early detection of high-risk individuals would be integral in catering to the health needs of the abusers. Given the addicts' lack of awareness about detoxification or rehabilitation services especially in the villages, it is necessary to initiate programmes to reach drug abusers to assist them to get treatment. These may be prompted through the existing institutions such as village Panchayats and Youth Clubs, etc., who not only provide information and create awareness but also motivate drug abusers so that they avail treatment themselves.

Treatment Measures: De-addiction and Rehabilitation Centres

Establishing drug de-addiction centres across all districts of Punjab. This could be done under the supervision of civil surgeons to provide free and better medical treatment. These centres could also be opened at places where there exists a density of work-force, migrant workers, labourers and student population.

Encourage community initiatives like community-based rehabilitation centres.

Development of proper referral systems so that the rural population knows where to avail services of drug relief.

Establish vocational courses in the de-addiction centres as part of the rehabilitation process.

Effective coordination among various support providers such as panchayats, municipalities, social workers, hospitals or health centres, police etc. to restore normal functioning among the abused.

De-addiction

Punjab Government has created infrastructure for de-addiction/de-toxification of consumers of drugs. Need to open Model De-addiction Centres in all districts under supervision of specialised faculty of various medical colleges.

Rehabilitation

A comprehensive long term rehabilitation policy is to be put on ground so that this menace is permanently eradicated.

On the demand side, the State and the society should work together for making **drug detoxification and recovery support system accessible to the victims**. A drug-free zone for the recovery and skill development rehabilitation centres to make youth productive have to be set up.

Promoting Prevention of Drug Abuse in Schools

Schools can play an important role in preventing drug abuse as teachers often are the first to detect warning signs of possible drug problems such as poor school attendance or declining academic performance. Effective school programmes teach

young people to resist drugs by developing skills – personal and social interaction, conflict resolution and assertiveness.

Prevention efforts begin early and continue through adolescence when the pressure to drink, smoke and use drugs greatly increases. Mobilising health workers such as the Anganwadi workers to address the students on the harmful effects of substance abuse etc. Some space should also be provided in the syllabus about substance abuse at the primary school level so that students may be taught the effects of drugs right at the formative stage of their life **(See Table 2 in Annexure)**.

Reaching youths outside school

An environment could be created which enables these young people to participate in activities that would help wean them away from drugs. **Recreational activities, youth clubs promoting rural sports are some of the ways in which young people can be kept occupied. Space can be allocated by the village panchayat to build a gym or sporting arena. One particular sport could be promoted among the youth of the village.** Nehru Yuva Kendra Sangathans (NYKSs) have instituted youth clubs at block levels and periodically organise sports activities such as wrestling and other rural sports in the villages with the help of young volunteers.

Reaching High-Risk Groups

Targeted prevention services can effectively reach people at high risk for drug problems who otherwise may be impervious to universal prevention efforts offered in schools and other community settings. These include children of substance abusers, IDUs, juvenile offenders, young labourers, slum dwellers, etc. This group needs specialised awareness programmes. Family members could prove to be an effective source of awareness about the harmful effects of substance abuse.

Community Approach and Not Political

Creating awareness in the community about the ill-effects of substance abuse is essential from two view points. One, substance abuse being a social problem, can be best tackled by involving the community. This ensures support of the community leaders, opinion-makers, parents and teachers and also creates an environment forcing the authorities to take stringent measures for supply reduction.

II-B
INTELLIGENT TRAFFIC MANAGEMENT SYSTEM

Introduction

The road network is increasing at a rapid pace along with the number of road users within the State of Punjab. This ever-increasing traffic flow leads to traffic congestion and jams, giving rise to an increase in the cost of transportation as well as affecting the routine lives of people residing in the State.

It is essential to have Short Term, Medium Term and Long-term Intelligent Traffic and Transportation systems in place to ensure the planned development of transport infrastructure to meet the expected transport demand in the horizon year.

The availability of public transport with adequate Intelligent Transportation System infrastructure is missing in the State; if present, then the rapid public transport system is not able to fulfil the demand of commuters through the existing modes of the transportation system. An intelligent traffic management system enables road users to be better informed and to make safer, more coordinated, efficient and smarter use of transport networks. It provides a user interface for different modes of transport to improve the efficiency of road transport and traffic management.

The Intelligent Traffic Management System has a solution to many problems related to traffic and transportation which exist in today's scenario or in the upcoming decades, but there are also many challenges to achieving a fully functional, practical, and integrable ITMS network.

Current Status:

Punjab has a total of 76393.452 Km long Road network, out of which 64878 km is of link roads only, which falls under 154 market committees. Link Roads are the lifeline of the rural economy of any State. Punjab Mandi Board is the nodal agency for Link Road works in Punjab State, and Administrative Approval for Link Roads schemes is issued by Punjab Mandi Board.

Further looking into road category-wise crash data, 65% of the total road fatalities occurred on National and State Highways, both comprising 5.64% of the total road length in Punjab. The accidental death rate on National Highway in Punjab is 0.44 per kilometre/year and on State Highway is 1.43 per kilometre/year.

Road accident causes fatalities, injuries, disabilities and hospitalization with severe socio-economic costs across the country. Consequently, road safety has become a major problematic concern both at the national and international levels. Road accidents were ranked number nine in causing casualties in 1990 in the world and are further expected to rise to number three by the year 2025.

- **The Urban-Rural Scenario**: On the basis of the location of road accidents, in 2020 a total of 5203 accidents occurred, out of which 2212 (43%) occurred in the urban areas and 2991 (57%) in rural areas of Punjab. Urban areas of Punjab have a higher concentration of road accidents compared with the urban areas. In the year 2019, the percentage of road accidents in urban areas share in road accident fatalities was 41%. This trend of increasing road accidents is continuing in urban areas.
- **Day and Night Fatality Aspect**: As per the time slot-wise distribution of total road accident fatalities in Punjab, the critical time slot for Punjab is between 6 PM to 9 PM in the evening resulting in 745 fatalities out of a total of 3898 fatalities. From midnight 12 AM to 9 AM, are relatively safer hours to travel. In 2020 time slots which start from office hours 09 AM till 09 PM, comprise 70% (2773 fatalities) of total road crash fatalities (3898 Fatalities).
- **Status of Non-Motorized Traffic in Punjab**: In Punjab, nearly 45 per cent of the traffic mix on roads comprises non-motorized vehicles, including pedestrians, cycles, cycle rickshaws, animal-driven carts and others. Despite their huge concentration, the necessary road infrastructure for their safety is ignored while designing and planning. As a result, the traffic situation in cities in Punjab is rather complicated, and special focus needs to be given to non-motorized vehicles.
- **Status of State Road and Railway Connectivity**: As of 2020, in Punjab, there were a total of 301 traffic police personnel posted in 27 police districts on different ranks (Report on Punjab Road Accidents and Traffic 2020, Punjab Police).

The Rail Track used for public transport is route track, which is 2265 route kilometres in the State, accounting for nearly 3.3 per cent of the total railway network in India. Punjab ranks third in terms of route km per 1000 sq. km of area, with more than 45 route kilometres per 1000 sq. km. This is more than double the national average of 20 route kilometres per 1000 sq. km. The railway density in terms of route km per lakh population, the State has around 8.19 route km per lakh population, which is more than the national average of 5.44. (Source: Indian Railways Civil Engineering Portal (ircep.gov.in)). But looking at the growth of the rail network in the State, post-Independence Punjab had 1500.40 Km of rail length, which increased to 1777.28 Km in the year 1980. Further, increased to 2252 Km by the year 2015 and went up to 2265 in the Year 2020. So, the growth of the rail network in the State had been progressive at first but slowed down and become stagnant. The Malwa region and border areas of Punjab are not having direct rail connectivity with the capital of the State.

The technological advancement for railways in terms of the public transport system is slow. The fast-speed rails and electrification of rail routes are yet to be done in parts of the State. Route enhancement and better route planning of trains on existing routes are not in place. Less reliability, safety and lack of hygiene are the other factors which are pushing users to go for other modes of transport.

Challenges

- **Shortage of Skilled Manpower**: There is a shortage of skilled manpower capable of addressing an issue related to road safety and traffic management.
- **Lack of innovative and technological solutions**: In Punjab to manage traffic efficiently, there is an urgent need for innovative and technologically advanced solutions.
- **High Ratio Disparity between Traffic police Personnel available per vehicle**: The number of Traffic police personnel (301) to manage 1,17,51,440 registered vehicles are very less as per BPRD Norms.
- **Boon or Bane? National and State Highways:** 65% of the total road fatalities (2550 fatalities) occurred on National and State Highways, both comprising 5.64% of the total road length in Punjab.

- **Non-Motorized Traffic**: In Punjab, nearly 45 per cent of the traffic mix on roads comprises non-motorized vehicles and 25% of total road accident fatalities (924 deaths) occurred related to these vehicles.
- **High Ratio Disparity between available Public Transport means per Individual**: Less number of accessibilities to public transport in terms of public bus service, there are only 80 buses per 10 lakh population available for intercity operations, whereas the national target is to have 500 buses per ten lakh population.
- **Limited Hour Availability of Public Transport**: Public transport system for rural and regional setup is not available during the late hours.
- **Left-out Border region with No Railway Connectivity**: Existing railway transport infrastructure is not catering to connecting all regions of Malwa and the border area directly with the State capital.

Short-term Strategies: 2030

- **Traffic Management and Employment Generation**: Recruitment of field experts to identify and highlight traffic management and safety issues to strengthen the district-level safety committee in 23 districts.
- **Technological Upgradation**: Placement of Video Vehicle Detection System (VVDS) using PTZ cameras and Artificial Intelligence along with Dynamic Traffic Light Sequencing in 22 Urban centres of Punjab.
- **Reducing Ratio Discrepancy between Traffic police Personnel available per vehicle**: Increasing manpower of traffic police to 6700 traffic police Personnels, which are required to manage traffic effectively. (70 % of the required number)
- **Enhancement of the Poor Road Infrastructure:** Enhancing the Road Infrastructure and rectification of road design defects to reduce road accidents (40% of total road Length in Punjab).
- **Initiatives for Non-Motorized Traffic**: Creating Road Network for safe pedestrian and cycling environments in Punjab by 100% (In Municipal Corporations of Punjab).
- **Strengthening Public Transport (both Qualitatively and Quantitatively)**: Increase public transport by 350 buses per 10 lakh population.

- **24x7 Public Transport Connectivity in Rural Areas**: Dedicated public transport feeder bus system integrated with the mainstream mode of transport to cater to 4840 villages connected through link roads (40% of villages in Punjab).
- **Upgradation and Enhancement of Existing Railway Network**: Enhancing and Upgrading the Existing Railway Network of 2265 Km. Electrification of old railway routes and extension of existing railway routes towards the remote area of Punjab.

Long-term Strategies: 2047

- **Engaging Stakeholders**: Placing field experts in every Municipal town to redress issues related to Road safety and transport systems.
- **Technologically Equipped Surveillance**: Use of Varying Road speed limits based upon road congestion in all 22 urban centres. Deployment of micro or nano-satellite for live satellite and position data.
- **Sufficient Traffic Policing**: Increasing manpower of traffic police to the maximum required numbers (9570 Personnels) as per the human population and registered vehicular (100 %) traffic.
- **Promoting Non-Motorized Transport System**: Creating a Road network for safe pedestrian and cycling environments in Punjab by 50% (In the urban centre of Punjab).
- **Promoting Public Transport System:** Increasing public transport by 500 buses per 10 lakh population to meet the national average.
- **Availability of 24x7 Public Transport Connectivity**: Dedicated public transport feeder bus system integrated with the mainstream mode of transport to cater to 12096 villages connected through link roads (100% of villages in Punjab).
- **Railway State**: Construction of a dedicated railway route by the name of the "golden triangle" corridor, which will cover all regions of Punjab and finally by enhancing the connectivity of the regional area with all urban centres and capital of the State.

Annexure

Table 1: Support for De-Addiction

Sr. No.	Parameter	Undertaking/ Self-Declaration	Incentive
1	Registered Drug Addict Members with the Drug De-addiction Centre	Declaration having registered drug addict member with the drug de-addiction centre	Rs 500 per month for one year
2.	Imparting of Skills to Drug Addicts under Recovery and Rehabilitation Programme	Registration with skill Imparting Centres	Rs 1,000 per month for one year
3.	Health Insurance to cover treatment including detox, inpatients and intensive outpatients for substance abuse and addiction	Registration with Ayush Bhavan Bharat with explicit provisions to cover cost of treatment	

Table 2: Elements of School Based Drug Prevention Programme

- Help students recognise internal pressures like anxiety and stress and external pressures such as peer attitudes and media that influence them to use drugs
- Develop personal, social and refusal skills to resist these pressures
- Teach that using drugs is not the norm even though there are others doing it
- Provide appropriate material, including information about the short-term effects and long-term consequences of using drugs
- Use interactive teaching techniques such as role plays, discussions, brain storming and cooperative learning
- Involve the family and the community in awareness programmes

Table 3: Year-Wise Summary of Road Accident Deaths and Injuries in Punjab

Year	Number of Road Accidents Cases Reported	Number of Road Accidents Deaths	Number of People Seriously Injured	Growth/Decline Rate (+/-) in Road Accidental Deaths
2011	6513	4931	4081	-
2012	6341	4820	3997	-2.30%
2013	6323	4588	4383	-4.80%
2014	6391	4621	4127	-0.70%
2015	6702	4893	4414	5.90%
2016	6952	5077	4351	3.80%
2017	6273	4463	4218	-12.10%
2018	6426	4740	3380	6.20%
2019	6348	4525	2655	-4.50%
2020	5203	3898	1737	-13.90%

Source: Report on Punjab Road Accidents & Traffic 2020, By Office of The Director General of Police, Punjab

Table 4: Road Category-Wise Length of Roads in Punjab, 2020

Sr. No.	Road Department	Road Length (In Km)
1	National highway	3639.682
2	State Highways	847.81
3	Major Districts Roads	1848.11
4	Other District Roads	5179.85
5	Link Roads (Managed by PWD)	32890
6	Link Roads (Managed by Punjab Mandi Board)	31988
7	Total Length	76393.452

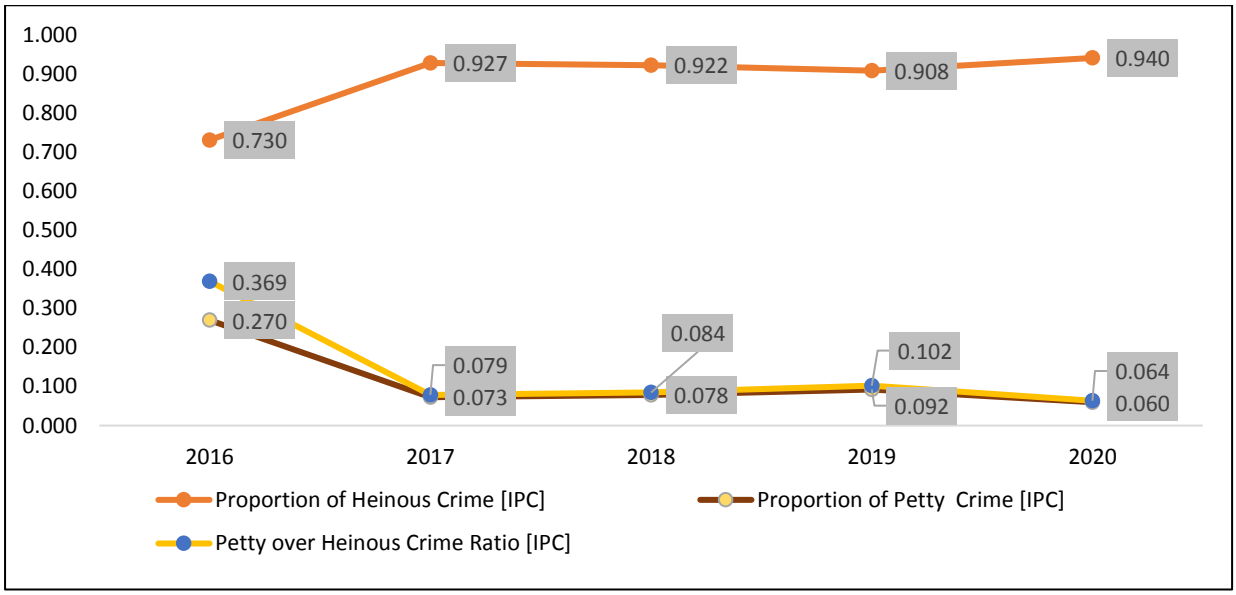
Source – www.pwdpunjab.gov.in, Accessed on 10-07-2022

Table 5: Road Category-Wise Black Spots Distribution in Punjab

Sr. No.	Type of Road	Total
1	National Highways	556
2	State Highways/ODR/MDR	161
3	Municipal Roads/Authority	64
4	Link Roads/Other Roads	17
5	**Total**	**798**

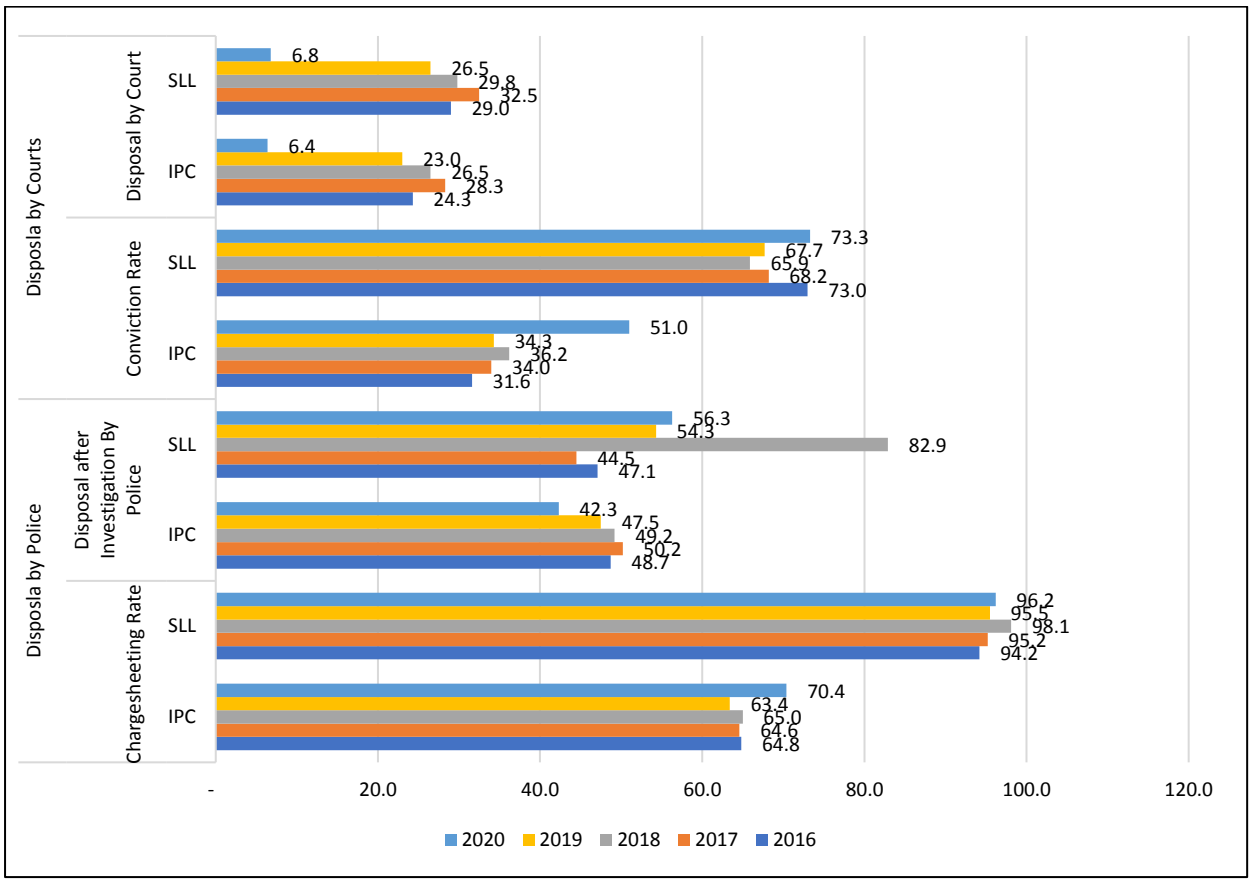
Source – I) Report on Punjab Road Accidents & Traffic 2020, Punjab Police
II) Accident Black Spot Identification and Rectification Program 2019, Punjab Police

Figure 1
Proportion and Ratio of Petty over Heinous Crime Under IPC since Last Five Years in Punjab 2016-2020



Source: Crime in India

Figure 2
Percentage of cases Disposal, Charge-sheeted and Convicted in the last five years from 2016 to 2020



Source: Crime in India

Figure 3
Crime Rate (IPC) in Punjab

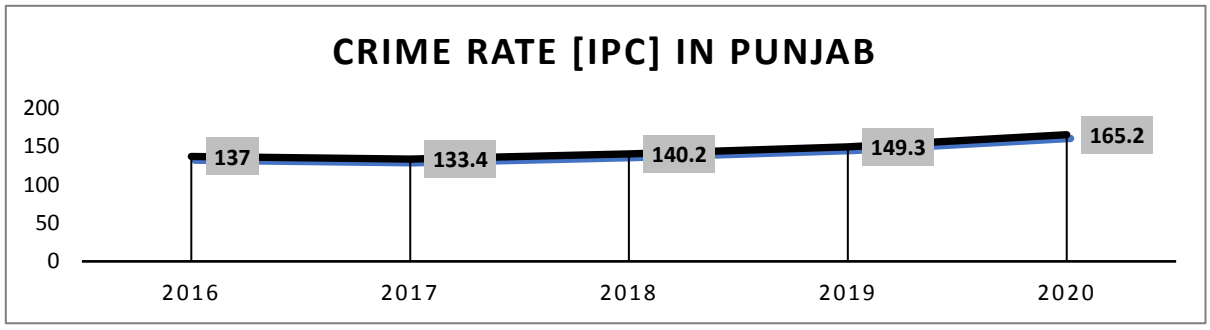


Figure 4
Violent Crime Rate in Punjab

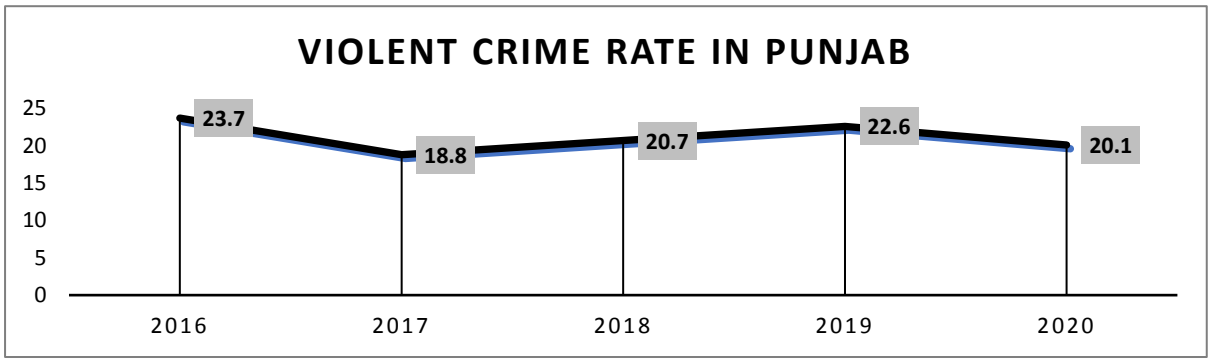


Figure 5
Economic Offences Rate in Punjab

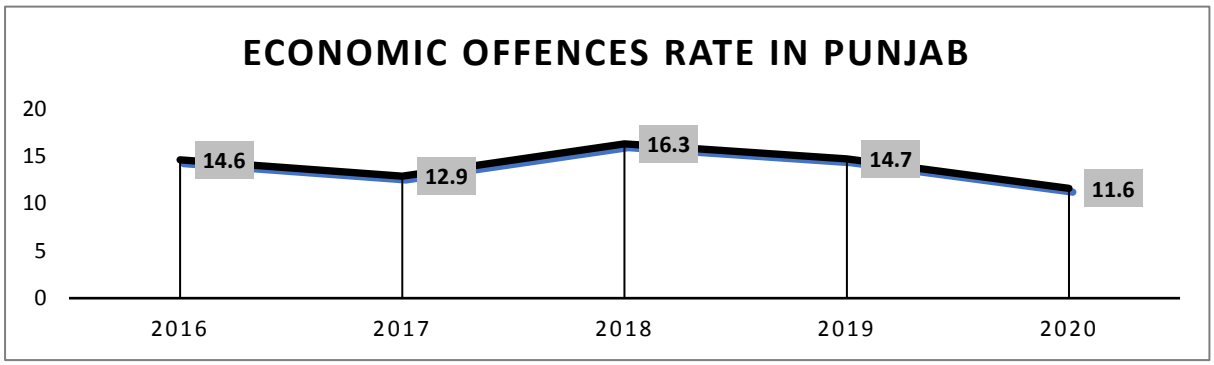


Figure 6
Cyber Crime Rate in Punjab

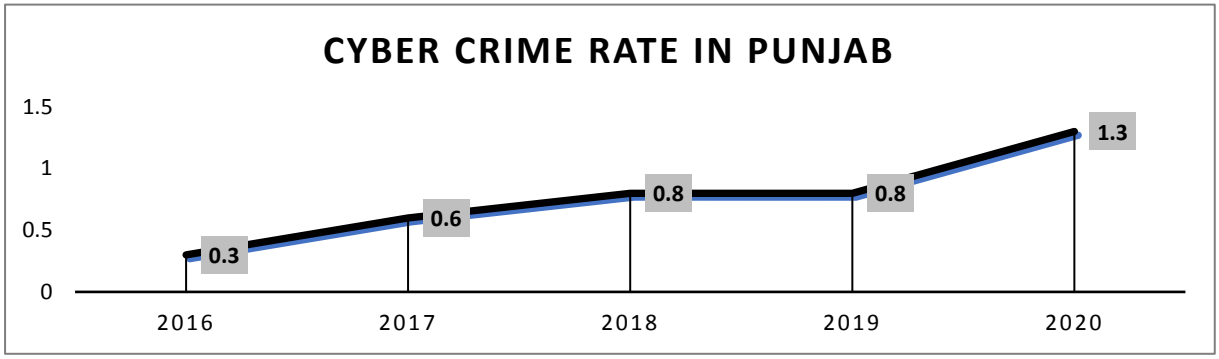


Figure 7
Crime Against Children in Punjab

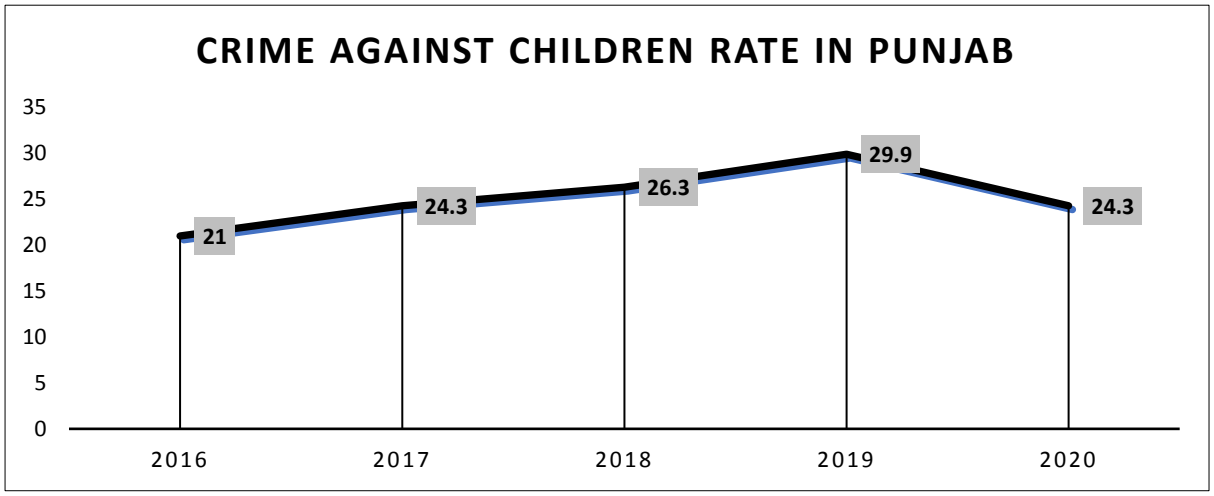


Figure 8
Crime Against Women in Punjab

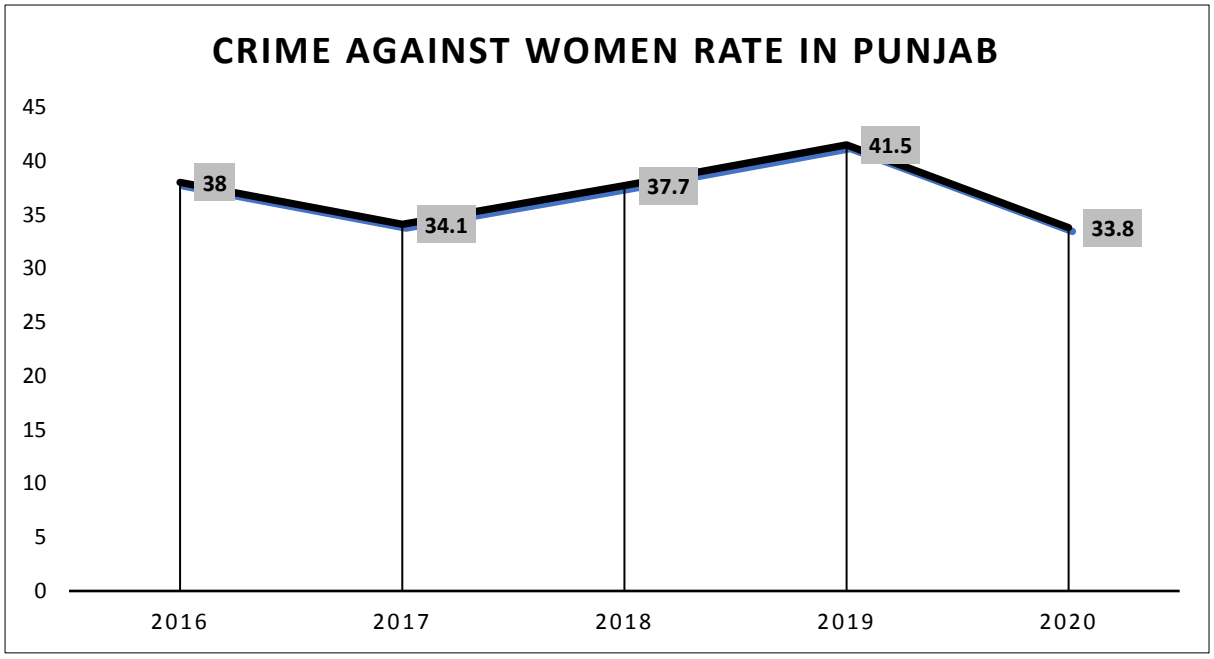
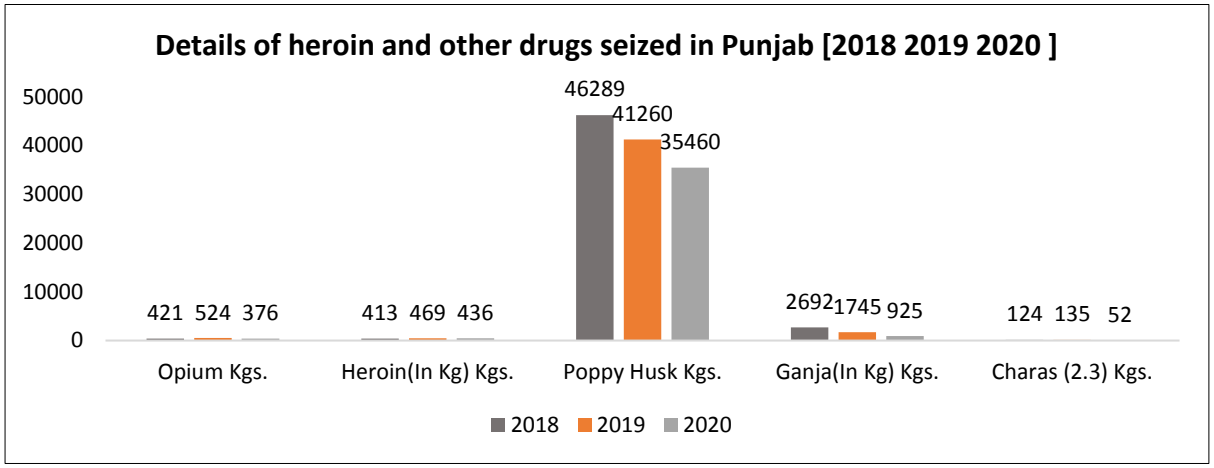
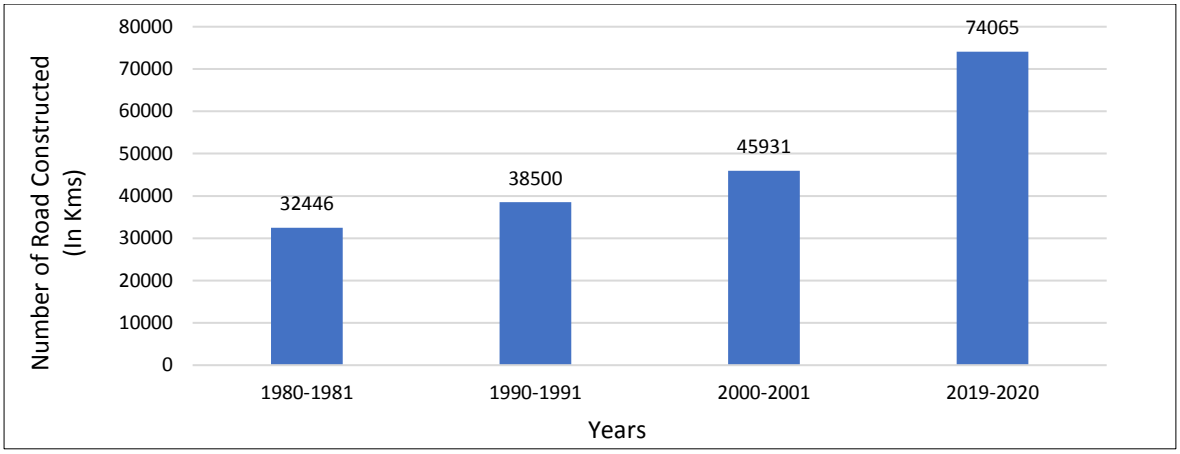


Figure 9
Detail of Heroin and other Drugs seized in Punjab [2018 2019 2020]



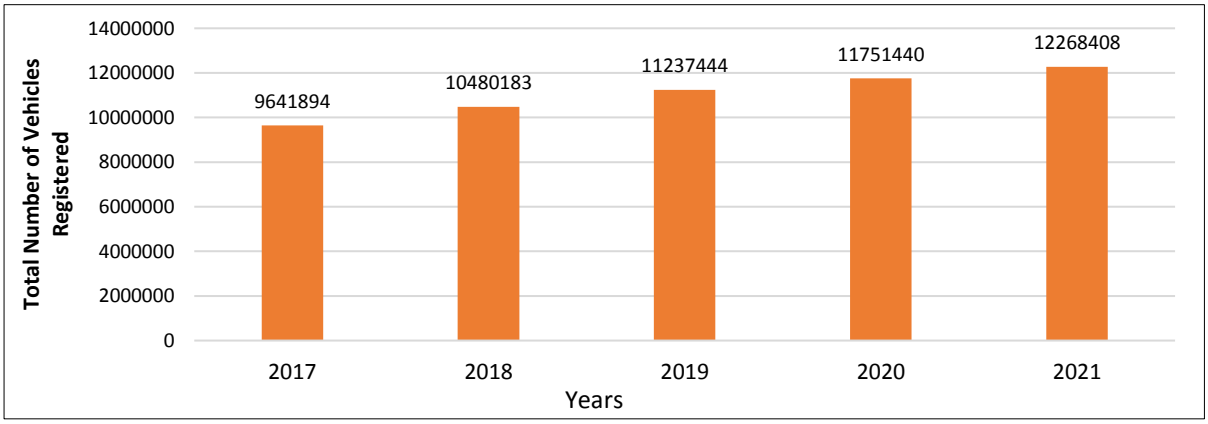
Source: Response by Minister of State, Ministry of Home Affairs GOI to Q. No. 1173 dated 8 December, 2021 in Rajya Sabha

Figure 10
Total Kilometers of Road Constructed in the State of Punjab



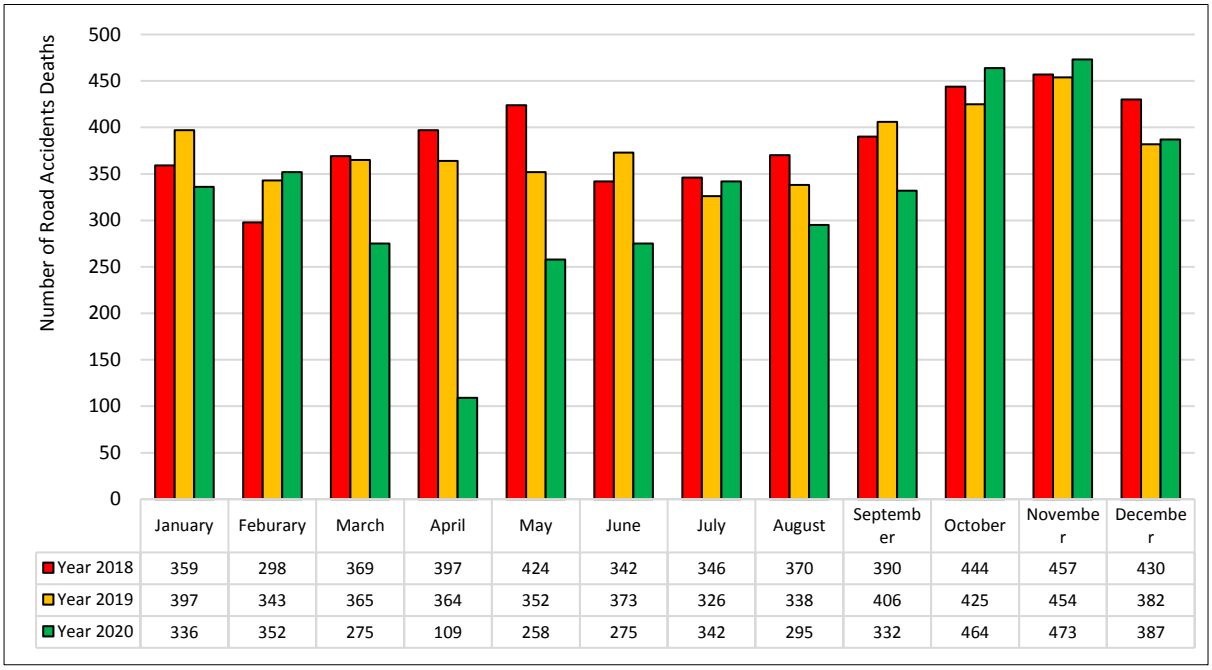
Source – Statical Abstract of Punjab, 2020

Figure 11
Year-Wise total Number of Registered Vehicles in Punjab



Source – PARIVAHAN Web Portal Accessed on 08-07-2022 (https://vahan.parivahan.gov.in/vahan4dashboard)

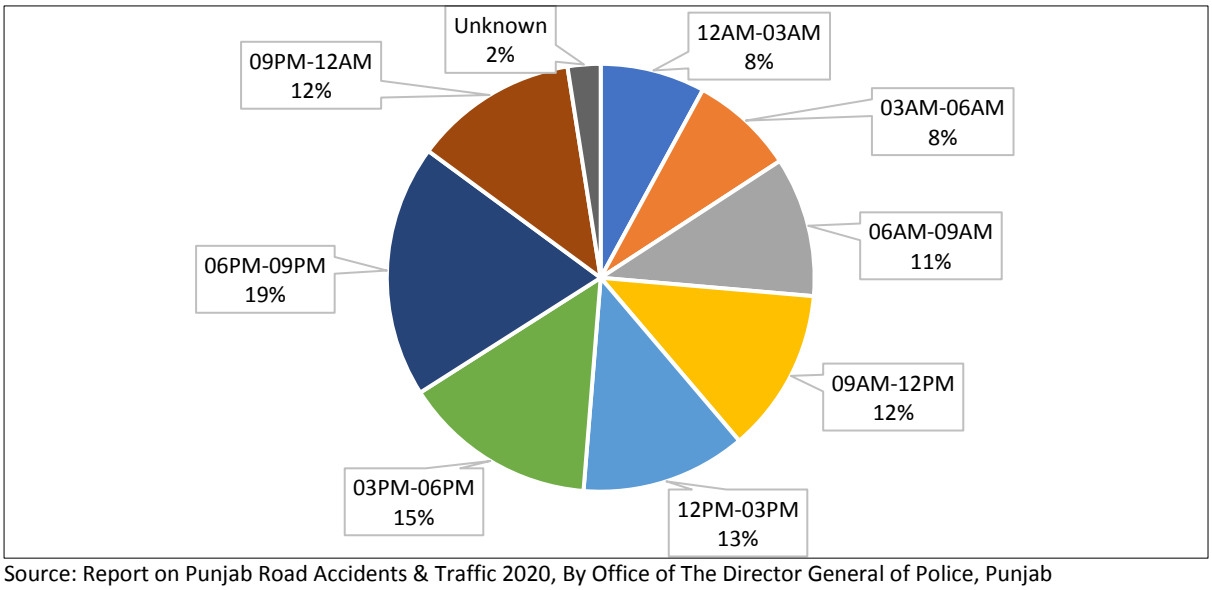
Figure 12
Month-Wise Road Crash Deaths Distribution for the Year 2018 to the Year 2020 in Punjab



	January	Feburary	March	April	May	June	July	August	September	October	November	December
Year 2018	359	298	369	397	424	342	346	370	390	444	457	430
Year 2019	397	343	365	364	352	373	326	338	406	425	454	382
Year 2020	336	352	275	109	258	275	342	295	332	464	473	387

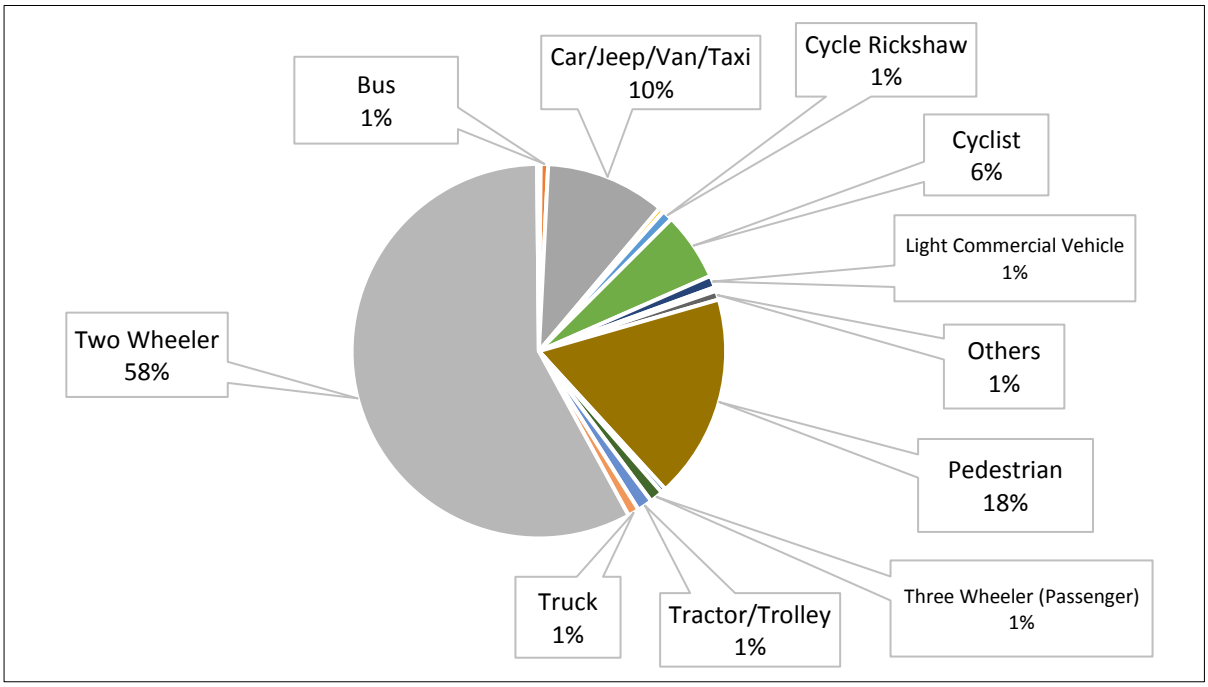
Source: Report on Punjab Road Accidents & Traffic 2020

Figure 13
Time-wise Road accident Fatalities Distribution for Punjab



Source: Report on Punjab Road Accidents & Traffic 2020, By Office of The Director General of Police, Punjab

Figure 14
Road Crash Victim-Wise Accident death Distribution for the Year 2020



Source: Report on Punjab Road Accidents & Traffic 2020

II-A: SAFETY AND SECURITY

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
ACCESSIBILITY AND EFFICIENCY OF THE CRIMINAL JUSTICE SYSTEM	• Non-reporting • Gap between reporting and registration • Low investigation rate 42.3 in 2020. • Charge-sheeting rate 2020; 70.4 • Conviction rate 2020, 51.0	• To improve access to the criminal justice system for all sections of society. • To provide effective complaint registration. • To develop new indicators other than the number of registration of FIRs for the evaluation of the police station performance. • To reduce the gap between crime reporting and crime registration. • To improve the work efficiency of police stations.	• To expedite the investigation. • To improve the rate of charge-sheeting. • To improve the rate of conviction. • Engaging the private sector for security responsibilities and devoting limited available human resources for core policing responsibilities like; prevention and detection of crime, investigation etc.	**2030** • To assess the justice, reach and effectivity the indicators like reporting of complaints, registration of cases out of complaints, annual investigation rate followed by the charge-sheeting and conviction by the courts are to be used. • There is a need to develop some alternate metric for the performance appraisal of the stations' in-charge, maybe, measured by petty over heinous crime ratio where high ratio suggests fearless reporting of complainants. • Effectivity and Accessibility of Justice have to be mapped into three broad categories i.e., to be heard rightfully (fearless reporting of complaints); just action (case registration, efficient investigation and charge-sheeting); and, Justice Delivery (conviction by the court). • Encourage citizens **to report the crime in Saanjh Kendras** (Community-Police Resource Centres). • Providing all District SAANJH Kendras separate buildings. • These new spaces will facilitate women and other vulnerable sections to report crimes without the stigma attached and fearlessly. • A monitoring system to be set up to ensure time-bound filing of chargesheet in the courts. **2047** • Developing uniform standards and complying with the law in recording FIRs. • Around four hundred centres shall provide counselling services to resolve disputes related to domestic violence, dowry-related and various other crimes related to women. • **Separate Investigation: Wing** The strategy being followed is to **separate the investigation wing** equipped with skilled and trained human resources and technology at the police station level.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				• All police districts have access to well-equipped and well-staffed forensic laboratories where scientific evidence can be quickly analysed and results conveyed to the investigators in the shortest possible time. • **Strengthening Prosecution Wing**: It is imperative to strengthen the prosecution wing and also develop mechanisms for better coordination between the investigation and prosecution. • **Accountability for the outcome** The head of the prosecution department will be responsible and accountable for falling conviction rates. At present no one takes the blame if the prosecution does not end in conviction.
LEVEL OF PHYSICAL SECURITY ENJOYED BY THE CITIZENS	• As per Crime in India 2020; rates of Cognizable IPC and SLL Crimes in Punjab [crime incidence per lakh population]; were 165.2 and 109.4; respectively. • Per Lakh Population Prevalence of Economic Offences like; Criminal Breach of Trust, Counterfeiting, Forgery, Cheating and Fraud; was high in Punjab in comparison to other States and UTs as the rate of Economic Offences was 11.6 incidences per lakh population, and Punjab was at 9th place among States and UTs.	• To improve the safety of citizens and improve citizens' confidence in the police department. • To conduct safety and security audits. • To reduce violent crime in society.	• To develop and popularize an alternative dispute resolution system. • To develop standard operating procedures for conflict management. • Focusing on crime prevention.	**2030** • To know how safe the community is, indicators like overall crime rate, violent crime rate, increase decrease in a particular form of crime incidences/ rates and crime-related deaths are to be applied to evaluate the security and safety of the community. • **Safety Audit of** Public **Spaces:** Safety audits of public spaces are planned to identify and categorise public spaces on the basis of their crime proneness and the type of crime to which those areas are prone. On the basis of these audits, all the safety measures will be taken as per the suggestion of public and intelligence input. • **Containing Violence: Specific Tasks** Reducing hostilities by dispelling insecurity among the clashing groups, generated by rumours, stereotypes and generalisations, etc. • **Disputes Resolution Units at SAANJH Kendras:** Saanjh committees and Saanjh advisory boards constituted under SAANJH Programme at the district, subdivision and Thana levels are to be involved in the identification of such areas which are prone to any riots due to some ongoing dispute.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				2047 • **Violent Conflict Management:** Conflict can be managed by studying and capturing the nature and level of interaction between various religious/caste/ethnic groups and also correctly gauging the role of various actors in terms of their ideological positioning, and material stakes and political affiliations. • **Violent Conflict Defence:** At the time of eruption of a conflict in a locality, the police and the locality shall act as a defence group and provide protection to the member of the locality by setting up check-points, patrolling the locality and insulating one locality from the other through social fencing with the help of volunteers and youth members. • **Crime Management to Crime Prevention:** Crime activity mapping pertains to identifying the nature and rate of crime. It also notes places vulnerable to crime and susceptible criminals. Mapping for crime prevention includes attributes of the perpetrators, spatial and targets along with the factors that contribute to the occurrence of the crime. • **Institutional Alternatives:** These institutional alternatives function within the demarcated **domains** of the three institutions of the police, the judiciary, and prisons. Community policing in Punjab has been initiated with improved programmes seeking citizen participation in crime prevention. *Lok Adalats* have been instituted to help relieve the pressure of cases in courts and to provide quick relief to the people. These alternatives subsidise formal structures and improve public perception of safety in their areas.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
CRIME AGAINST VULNERABLE SECTIONS	• Crime against children per lakh population (IPC and SLL collectively) was 24.3 in 2020, and Punjab was in 22nd position among all the States and UTs. • In the 2020 rate of Crimes Against Women, (IPC and SLL both), the rate of such incidences per lakh population in Punjab was 33.8, stood 26th in ranking among States and UTs.	• Specialized units to deal with the victims from vulnerable sections. • To reduce the crime against vulnerable sections of society. • To facilitate the vulnerable section in reporting crime and getting justice • To develop a mechanism which insulates them from revictimization and treats them sensitively as per their specific needs while investigating. • To plan their relief, and rehabilitation and provide them compensations meant for them as per law.	• To make the invisible crime against vulnerable sections visible and detaching the stigma about reporting some crimes like; rape, sexual harassment etc., by mass awareness. • To sensitize personnel who administer the three pillars of the criminal justice system police, courts and prisons about the need and care of vulnerable sections. • To sensitize and train the staff administrating the criminal justice system to unlearn their biases which they retain through cultural training. • To facilitate the vulnerable section in reporting crime and getting justice by developing	**2030** **STRATEGIES FOR CHILDREN** • Specialized child protection units to deal with child victims. • **Relief Measures** The foremost task of a relief strategy is to limit the effects of the abuse and restore the children to effective functioning in the community. • **Rehabilitation Measures** The rehabilitation services should work to restore the abused child's self-confidence and competence. • **Integrative Measures** The task of integrative strategies is to restore the children to effective functioning in the community. Integration involves the creation of a cohesive support structure to aid the abused children in confronting social challenges. **STRATEGIES FOR WOMEN** • **Women Police Station:** • **Women Safety Apps:** For the safety and security of women, a women's safety mobile App is to be launched. • **Helpline** A centralised helpline with a special focus on women's issues and the overall safety of women to be set up. • **Identification of Black Spots** where crime against women like eve-teasing, molestation, rapes and other crimes are more prevalent in the cities and villages. • **Installation of CCTV Cameras and Street Lights** • **Women Patrolling Squads** • **Safe Public Transport** • **Road Code and Conduct** Traffic rules like a violation of traffic lights, triple riding, over speeding, drunk driving, etc to be strictly imposed to check intimidation of women on the road.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				• **Community Police Oversight** State-wide community-police oversight is proposed to be activated to build public pressure on anti-social elements not to indulge in such activities. • **Complaint Tracking in Cyber Crime Unit** The cybercrime unit shall have an online **complaint** system to track the obscene messages and calls leading to the mental harassment of women. • **Easy Access to Reporting** • **Services for victims:** Basic services like medical aid to be made available to the victims. **2047** • **Suspension of State Incentives:** As a deterrence, it is proposed that where charges have been framed in the courts against the accused relating to rape and sexual harassment, the accused should not be entitled to the State's incentives till he is acquitted by the court. • **Model** Gender **Code for Educational Institutions** Each institution like schools, colleges, government departments, private enterprises, public and private transport have to implement revised **Model Gender Code of Conduct** to check sexual harassment. The model gender code of conduct is to be prepared in consultation with the various stakeholders. • **Quick Delivery of Justice: Quality Investigation and Fast Track Courts** • **Development of Standard Operating** Procedures **for Victim Care:** Immediate care of the victim of crime needs to be prioritised to reduce the trauma related to physical or psychological injuries to reduce fatality after the crime.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
POLICE MODERNIZATION, STRENGTH AND INFRASTRUCTURE	• Punjab has only one forensic lab as per Data on Police Organization, BPRD 2020. • There are 41 servers, 4319 personal computers and 854 laptops with the Punjab State Police Department. Punjab police also have CCTV cameras 2399 in numbers, 46 speedometers and 789 breath analysers. • There are 16,285 family quarters available with the Punjab Police out of these 38 are for DySP and above rank, 854 for ASI to Inspector and 15,393 for constable and head-constables. • Civil police rate of police per lakh population is only 236.34.	• To improve police presence • To open the required number of police stations and deploy an optimal number of personnel per police station for effective police administration and the development of some statistical method based on some indicators to find the optimal number • Digitization of the police record. • Intensive use of technology. • Upgrading skills and recruitment of skilled personnel. • Provision of anti-drone tech and thermal imaging cameras for district police of border districts Ferozepur, Tarn Taran, Amritsar, Gurdaspur, Pathankot, and Fazilka, by 2030.	• Digital governance in police stations. • To improve working conditions of the staff • To improve the efficiency of policing, by enhancing the commitment of police personnel, their living and working conditions shall be improved. • Leveraging expertise available in the private sector and through public-private partnerships for developing solutions to emerging security challenges like rogue drones, and cyber security. • By 2047 development of indigenous anti-drone technology. Provision of thermal image cameras for police of all districts.	**2030** • Procurement of Anti Drone technology. • Digitization of police records by 2030. • There is an urgent need to keep active surveillance of public places and vital installations to ensure safety and security in the State for the furtherance of this objective State police need to be equipped with **CCTVs, Drones,** and other latest modes of surveillance. CCTV cameras would be installed in all public places, on all major inter-district and intra-district roads, and on all places of importance comprising police stations, district secretariates, and others. Moreover, drones with night vision shall be procured for the police of these districts, to conduct effective search operations in any targeted area and to give them an operational advantage in case of any infiltration. These drones will be helpful to gain aerial vantage points for crime scene work, search and rescue efforts, accident reconstruction, crowd monitoring, and more. • There shall be an Intelligent Database Integration setup to enable sharing of data from all smart surveillance systems and to draw a centralized intelligent linkage of relevance to security. Database analytics produced from the above setup after processing data from various databases and live data streams will generate real-time actionable inputs for crime prevention and detection. This setup will make use of technologies like Machine Learning, Deep Learning, and Artificial Intelligence and shall assist police offices in effective decision-making in the field through the implementation of different algorithms. This technology will also assist in sentiment analysis for crime prediction. • An Intelligent Traffic Management System for dedicated handling of vehicular traffic data feeds, and an analytics response system will also be part of the above setup. Theindicators such as police station–population ratio, police personnel- population ratio and police presence per

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
		• Paperless work of the Police Department.	• Decision-making on service requests by the public without human intervention through artificial Intelligence based on intelligence data available with the police department. E-platform for the public to request all services.	sq km etcetera are to be used to determine the adequate police presence. • All above components will be managed from an **Intelligent Command Control and Coordination Centre (**ICCCC) at the district level. ICCCC will be based on a **Dedicated Data Network** for transmission of captured and generated data relevant to law enforcement. The cyber security module will be implemented which takes care of all backdrop exploits and hacks and threats to these **Intelligent Command Control and Coordination Centres (**ICCCC) for uninterrupted functioning. • Six districts of Punjab; Ferozepur, Tarn Taran, Amritsar, Gurdaspur, Pathankot, and Fazilka, share their boundaries with the territory of Pakistan. By 2030 in all these districts **Intelligent Command Control and Coordination Centre (**ICCCC) will be established. Drones equipped with zoomed cameras enabled with night vision, thermal imaging, and 3D mapping software to offer GPS-enhanced precision shall be procured for these districts. • Best available technology and infrastructure will be procured to establish these centres. Training of the field police officers will be done to make these centers operate within the stipulated timeframe. • **A thermal imaging** camera can be a useful tech for police especially to work in dark conditions in low-lit forest areas near borders. Thermal image cameras small hand-held units can be helpful in detecting humans and delivering a “heat picture” of a “heat map” of the area under search in case of some suspicious movement. These cameras can be used to track the motion of suspects in the darkened building. Such technology will be helpful in life-saving in search and rescue missions. • Immediate plans need to be worked out to provide buildings for the police stations which do not have their own and equip them as per the current requirements. As

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				the first step in this direction, the police stations in dilapidated conditions will be repaired immediately. • Most of the police stations are to be located in new buildings. The police station space will be re-engineered to give them community orientation, and provide space for efficient management systems, victim relief centres, dignified detention cells and accessible police service delivery. • Transparent recruitment of skilled manpower and regular training to improve efficiency of police personnel besides develop competency in area of emerging concerns. • Digitizationof Police Stations record. • Facilities for the visitors like respectable sitting arrangements, drinking water, waiting rooms for the visitors, communication rooms, separate washrooms for women, and parking to be ensured. • More humane conditions for the detainees are ensured which are in tune with the recommendations of the National Human Rights Commission and verdicts of the courts. • Vehicles for SHO and staff for daily duties. In order to face the hi-tech criminals and e-offenders, the mobility, communication, forensic kits and weaponry of the policemen at the police station level is being implemented. • More Forensic Labs • Forensic Kits: Future of the police in the country lies in extensive forensic applications as the tech-criminals are far ahead of the policemen in the use and abuse of technology. Police station being a base unit will accordingly have to be equipped with the gadgets and devices for effective sealing and coverage of the scenes of crime, lifting, preserving and transmitting evidence for expert reports.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				2047 • By 2047 the **Intelligent Command Control and Coordination Centre (**ICCCC) will be established in the whole of Punjab. • Relevant training to the staff will be provided. • Dedicated research and development shall be induced in the State for the invention of anti-drone tech. • Procurement of artificial intelligence-based technology and development of such digital platform and training of staff. • Proper space allocation for the staff and office infrastructure, living and working conditions for the staff at the police station level need comprehensive attention as these affect their morale and efficiency directly. • Computerization of record-keeping-Initiatives undertaken in this direction needs fine-tuning and integration with the national network grids and State network grids. Inter-departmental communication issues are being addressed comprehensively. The National Crime Record Bureau-supplied packages such as CIPA and CCTNS be integrated for intra and interdepartmental operations to be in tune with the E-Governance Policy of the department. • **Setting up of new and re-demarcation of the Police Stations:** In the Punjab Police Act, Section 13 stipulates that the State Government may, on recommendation of the Director General of Police, create, by notification in the Official Gazette, as many police stations and outposts as may be deemed necessary in a police district, duly keeping in view the population, area, crime situation and the workload in terms of law and order and the distance to be covered by the inhabitants to reach the police station. If population coverage of one lakh is taken as one of the basis to set up police stations, Punjab may open more police station as per requirement. The conventional criteria may not suffice to meet the

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				citizen needs like tourism, migration, traffic density and/or locational specificities like historical place, heritage site, national and State highways and other strategic locations, and/or nature of crimes like terrorism, ethnic conflicts, and social violence. It may be more appropriate to set up police stations that would be commensurate with the citizen needs, locational specificities and nature of crime. • **Procurement of** artificial intelligence of investigation, crime detection and surveillance.
CONTROLLING DRUG ABUSE	• The registration of 6909 FIRs under NDPS Act in 2020.	• Preparing Institutional Framework for Policy and Coordination • Strengthen narcotic control mechanism. • Developing drug control institutions at the field level • Strict enforcement and seizure.	• Reducing demand for drugs. • Targeting socio-economic aspects of drug addiction • Supporting drug de-addiction	**2030** • **Institutional Framework for Policy and Coordination** An apex body to be constituted at the State level headed by the Chief Minister consisting of experts from specialisation in medicinal and socio-psychological fields. This board shall formulate policies, put in place coordination and monitoring mechanisms and initiate evidence-based research on substance abuse. • **Narcotics Control Bureau:** Narcotics Control Bureau is to be established by the Punjab Government in order to effectively deal with the drug issue in an integrated and organic manner so as to ensure better coordination of the Punjab Police with other government departments. • **Grass-root Level Drug Control Institutions** The village level drug control set-up consisting of the village Sarpanch, Patwari, Aganwadi workers, community influencers, police posts in-charge, school principal be constituted to undertake activities that would curb addiction at the village level: The VDCs would report to the BDCs. • **Supply-Side Initiatives** On the supply-side multipronged enforcement-oriented initiatives shall be taken. Main focus of enforcement agencies shall be to target drug cartels involved in smuggling of drugs especially those dealing in heroin, synthetic drugs and precursor elements. • **Seizures of Synthetic Drugs** Another focus of enforcement is to check inflow of synthetic drugs.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				2047 • **Family Credit System** • **Support for Drug De-addiction** Drug addiction is a social evil and the social stigma attached to it leads to the under-reporting of the extent of the problem of drug abuse and the number of addicts. Since the families hide the information pertaining to drug addicts thereby making the de-addiction efforts are insufficient and ineffective. In order to combat this problem, there is a dire need to promote reporting about the presence of drug addicts in the family. Therefore, it is proposed to incentivize the family which reports about drug addicts and register them with the de-addiction centre. • **Preventive and Curative Approach** **Health Systems** Early detection of high-risk individuals would be integral in catering to the health needs of the abusers. Given the addicts' level of awareness about detoxification or rehabilitation services especially in the villages, it is necessary to initiate programmes to reach drug abusers to assist them to get treatment. **Treatment Measures: De-addiction and Rehabilitation Centres** Establishing drug de-addiction centres across all districts of Punjab. **De-addiction** Need to open Model De-addiction Centres in all districts under supervision of specialised faculty of various medical colleges. **Rehabilitation** A comprehensive long term rehabilitation policy is to be put on ground so that this menace is permanently eradicated.

Indicators	Current Status/Base line	Target/s (2030)	Target/s (2047)	Strategies
				Promoting Prevention of Drug Abuse in Schools Schools can play an important role in preventing drug abuse as teachers often are the first to detect warning signs of possible drug problems such as poor school attendance or declining academic performance. **Reaching youths outside school** An environment could be created which enables these young people to participate in activities that would help veer them away from drugs. **Reaching High-Risk Groups** Targeted prevention services can effectively reach people at high risk for drug problems who otherwise may be impervious to universal prevention efforts offered in schools and other community settings. **Community Approach and Not Political** Creating awareness in the community about the ill-effects of substance abuse is essential from two viewpoints. One, substance abuse being a social problem, can be best tackled by involving the community.

II-B: INTELLIGENT TRAFFIC MANAGEMENT SYSTEM

Indicator	Current Status/Base line	Target(2030)	Target (2047)	Strategies
Safe Rural Road Network	Missing or faulty road infrastructure in rural areas leads to high number of road accident, comprises of 57% of total accidents (2991 Accidental cases in Year 2020).	Identification and widening of roads from width of 10 ft to 14 ft in (100% of total link roads)	Retrofitting and quality enhancement of all widened link roads and village roads entering or terminating on major Highways and Village Mandis. (100% of total link roads)	• To provide safe road network with in rural setups contributing toward farming and agricultural activities. • Identification of village and minor link roads contributing toward major agricultural activity and impacting safety of road users. • Widening and retrofitting of existing rural link roads constructed under PMGSY scheme.
Skilled Manpower	No autonomous body working extensively on road safety with in the State.	Hiring of 23 road safety field experts for each district of Punjab.	Placement of field experts in every Municipal town of Punjab	• Recruitment of field experts to identify and highlight traffic management, safety issues at district and municipal level.
Traffic Management Agency (traffic Police)	Number of Traffic police personal (301) to manage 11751440 number of registered vehicles are very less as per BPRD Norms.	Increase manpower of traffic police to 6700 of traffic police personals, (70 % of required number)	Increase manpower of traffic police to maximum required numbers (9570 personals) as per the human population and registered vehicular (100 %)	• To enhance capacity of existing traffic police department. • Increase manpower by hiring in traffic wing along with technical staff in the department, require to manage traffic effectively. • Placement of traffic research wing within the department which are well aware about current available technology,
Technology driven and innovative traffic management solutions	Lack of equipment and technology intervention to ensure safe movement of traffic on roads	Placement of technology-based identification and challan issuing system for every vehicle plying on roads within 22 urban centers of Punjab	Use of Varying Road speed limits for each road based upon traffic congestion data in all 22 urban centers	• To identify latest technology and innovative solutions to ensure safe and efficient traffic management system • Placement of Video Vehicle Detection System (VVDS) using PTZ cameras and Artificial Intelligence along with Dynamic Traffic Light Sequencing

Indicator	Current Status/Base line	Target(2030)	Target (2047)	Strategies
				• Deployment of micro or nano satellite for live satellite and position data.
Universal Accessible and Non-motorised transport	Nearly 45% of the traffic mix on roads comprises NMT user including pedestrians, cycles, cycle rickshaws, animal driven carts, and 25% of total road accident fatalities (924 deaths) occurred related to this category.	100% Non-Motorized Transport friendly roads in all Municipal Corporations.	Create road network for safe pedestrian and cycling environments in Punjab by 60%. (In urban centre of Punjab)	• Allocating dedicated road space for pedestrian footpath and cycle tracks to be used by all kind of NMT road users. • To provide universal accessible roads along with dedicated space for non-motorised transport system on each urban road. • Recommendation to be made for changes in already existing road projects and to redesign upcoming or in process road construction project with ensuring safe NMT road infrastructure.
Public Transport System	Only 80 buses per 10 lakh population available for intercity operations, whereas the national target is to have 500 buses per ten lakh population.	Increase public transport by 350 buses per 10 lakh population.	Increase public transport by 500 buses per 10 lakh population to meet the national average.	• Enhance existing public transport system to induce shift in mode of transportation from private to public. • Placement of new fleet of buses on roads to reduce waiting time of passengers. • Use of Public Private Partnership for financing the program. • Increase in transportation infrastructure spending from GDP of State. • To perform transitional phase development work moving towards Multimodal transport model for future.

Indicator	Current Status/Base line	Target(2030)	Target (2047)	Strategies
Railway Tracks	Existing railway transport infrastructure is not catering to connect all regions of the Malwa region and border area directly with State capital.	Upgradation & Enhancement of Existing railway rail network of 2265 Km.	Construction of dedicated railway route by the name of "golden triangle" corridor which cover all region of Punjab and finally enhancing the connectivity of regional area with all urban centre and capital of the State. (e.g., Chandigarh-Fazilka-Pathankot-Chandigarh)	• To place new railway tracks for better regional connectivity with urban settlements. • Electrification of old railways routes and extension of existing railway routes towards remote /regional areas of Punjab. • Identification of new railway routes for better inter and intra State connectivity and uplifting the potential emerging commercial trade routes.

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