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ECONOMIC DEVELOPMENT AND ENVIRONMENTAL CHALLENGES: A CASE OF PUNJAB**Dr. JASDEEP KAUR DHAMI****PROFESSOR & DIRECTOR****CT INSTITUTE OF MANAGEMENT & INFORMATION TECHNOLOGY****MAQSUDAN CAMPUS, JALANDHAR****Dr. MANISH GUPTA****ASSOCIATE REGISTRAR****LOVELY PROFESSIONAL UNIVERSITY****PHAGWARA****SANGRAM SINGH****ASST. PROFESSOR****CT INSTITUTE OF MANAGEMENT & INFORMATION TECHNOLOGY****MAQSUDAN CAMPUS, JALANDHAR****ABSTRACT**

The optimum use of the world's resources in accordance with the objective of sustainable development and seeking to shield and preserve the environment is need of the hour. The growing population and economic development leads to various environmental issues. After independence the state of Punjab was powered by Green Revolution, which further generated the various opportunities for industrial and manufacturing sector. Green Revolution and Industrial Development are leading the Punjab economy towards environmental issues. There are several problems in Punjab, particularly pollution of fresh water bodies, air pollution, and lack of proper waste management, deforestation, loss of biodiversity, desertification, water logging, natural disasters and climate change. This paper throws light on the economic development in Punjab and environmental challenges faced by the economy with the help of Environmental Kuznets Curve. The Curve suggests that economic development at the initial stages degraded the environment, but after the certain level, an economy starts improving its relationship with the environment. Externalities are other major factors that influence the environment.

KEYWORDS

environmental issues, environment kuznets curve, pollution.

INTRODUCTION

The pros and cons of economic growth are ferociously debated by economists, environmentalists and other social activists. This paper emphasized some of the environmental challenges faced by the economy from expanding levels of production and consumption. Rapid development leads to various environmental problems also. There is always a tradeoff between economic growth and environmental. Environment is a luxury for developing nations. Sustainable development is the need of the hour. Sustainable development requires the preservation of natural capital. Natural capital includes natural resources, land and ecosystem. If any pattern of development continues to deplete natural capital, then that development is not sustainable. The optimum use of the world's resources in accordance with the objective of sustainable development and seeking to shield and preserve the environment is need of the hour.

This paper throws light on the economic development in Punjab and environmental challenges faced by the economy with the help of Environmental Kuznets Curve. Punjab is the richest Indian state. Being the neighbor of the national capital Delhi, it has a high growth of economy for years. This north Indian state has very affluent neighboring states and cities such as Haryana, Jammu & Kashmir, national capital Delhi, Rajasthan and Himachal Pradesh and Pakistani states of Punjab which has been creating multiple trade opportunities for the people from all walks of life. Punjab occupies 1.5 per cent of the country's geographical area and accounts for more than two thirds of the country's production of food and of hosiery. This unique piece of land covers an area of 50,362 squares kilometers. Punjab stands 2nd on the basis of various socio-economic parameters viz. macro economy, investment environment, infrastructure, agriculture, primary education and consumer markets. The state has been ranked 1st in agriculture, infrastructure, and consumer markets, 5th in macro economy, 7th in primary health services and 10th in primary education and industrial investments. The state has been ranked 5th in term of size, 11th in legal system and 12th in overall economic freedom and 18th in labour regulation. Among the 15 bigger states of India, Punjab stands 2nd in overall competitiveness ranking of the states. Punjab is highly advanced as far as infrastructure is concerned. The high-end communication creates trades, business and employment opportunities for the exporters, industrialists, importers, distributors and suppliers etc. this stats has also high level of manufacturing industries. Punjab is one of the most industrialized states in India. In Punjab industries do play important role in economic development. Basic classifying industries of Punjab are as rural, cottage, medium, and major or large scale industries. (Economic Survey of Punjab)

GROWTH OF INDUSTRIAL SECTOR IN PUNJAB

The state has done remarkably well in the field of agriculture and is now laying emphasis on promoting industrial growth. During 2015-2016, there were 1, 61,400 small scale and 500 large and medium scale industries. The industrial production has more than doubled in both, small scale industries (from Rs. 50963 crore in 2010-11 to Rs. 93000 crore in 2015-16) as well as medium and large scale industries (from Rs. 72284 crore in 2010-11 to Rs. 130500 crore in 2015-16). Various industrial sectors like processed foods, rice, yarn & textile, hosiery, pulp & paper and sports goods depend upon biological resources which are being cultivated and are normally traded. The share of industrial sector (Secondary Sector) to State Gross Domestic Product has increased from 14.78 per cent in 2011-2012 to 14.53 per cent in 2015-16. There are also 225 registered herbal units operating in the State, besides many unregistered units. These are extensively utilizing medicinal plants and herbs which are obtained from various parts of Punjab and adjoining states. The number of large industries in state is going down, the state economy is based on small scale industries mostly food processing industries. There is also clustering of the industrial units in some big cities like Fatehgarh Sahib, Ludhiana, Jalandhar and Amritsar. Jalandhar is popular in making sports goods which is world famous for its quality. (Economic Survey of Punjab, 2016)

GROWTH OF AGRICULTURAL SECTOR IN PUNJAB

Agriculture is the mainstay of Punjab's economy, providing livelihood to over 60 per cent the population in the State. Punjab economy is basically an agrarian economy. Punjab is widely acknowledged 'Granary of India'. However, the hitherto vibrant agriculture sector of Punjab is now facing serious challenges posed by deteriorating natural resource base due to monoculture of wheat and paddy crop rotation, stagnation in yields of principal crops, declining farm incomes and rural indebtedness. As a concomitant of growth, the share of agriculture and allied sector in Gross State Domestic Product (GSDP) has been rapidly declining over the years. The share of agriculture and allied sector in GSDP which was 30.81 per cent in 2011-12 has declined to 27.22 per cent 2015-16.

TABLE NO. 1.1: DISTRICT –WISE DISTRIBUTION AND TYPES OF INDUSTRIES IN PUNJAB

District	Concentration of types of Agro-industries in Punjab
Amritsar	Power Loom Weaving, Wood & Machine Screws, Radio & Transistors, Agricultural implements, Paints & Varnishes and Dyes, Electric fans, Pharmaceuticals, Printing machinery, Textiles, Chemicals, Soap, Acids.
Ferozpur	Cotton ginning and processing, flour mills, milkboard and agricultural implements
Bathinda	Cotton ginning and processing, flour mills
Fatehgarh Sahib	Steel re-rolling, Pump parts, Sewing machine parts, Truck body building
Gurdaspur	Agricultural implements, Conduit pipes, Machine tools, Soap & chemical products, C.I. castings, Brassware
Hoshiarpur	Rosin & Turpentine oil, Paints & Varnish, Sugar, Agricultural implements, Pressure cookers, Paper and Paper board
Jalandhar	Surgical instruments, sports goods, Hand tools, Automobile parts, Cocks & valves, Pipe fittings, Bus body building, Leather tanneries, Ball bearings, Publication, Switch & switch-gears and Rubber goods
Kapurthala	Agricultural implements, Pressure cookers, Fans, Wood & Machine screws, Electrical goods, Rice Mills, Rubber goods, Bolts & Nuts and Diesel engines.
Mansa	Agricultural implements, cotton spinning
Moga	Cotton yarn, rice bran oil, paper
Ludhiana	Bicycles & bicycle parts, Automobile parts, Hosiery goods, Sewing machine & parts, Home appliances, Machine tools, Readymade garments, Hosiery needles, Rubber goods, Label s (Metal & Cotton), Chemical goods, Oil engines, Agricultural implements, Electronic goods, Tractor parts, Cycle tyres/tubes, Plastic goods
Patiala	Automobile parts, Sewing machine parts, Enamelled copper wire, Electrical goods, Bakery machinery, Cutting tools, Biscuits, shoes
Rupnagar	Agricultural implements, Pharmaceuticals, Tractors & Parts, Electronic components, Electrical components
Sangrur	Agricultural implements, Tractor parts, Cycle parts, Sewing machine parts, Milk products, Chilled Rolls
Nawanshahar	Light Commercial Vehicles, Pharmaceutical, Yarn, and Sugar
Muktsar	Cotton yarn, Rice Bran Oil, Paper

Source: Directorate of Industries, Punjab.

District-wise distribution and types of industries in Punjab has been discussed above. The main industrial districts in Punjab are Ludhiana, Jalandhar, Amritsar and Bathinda. Ludhiana district is known for textile and hosiery products, Jalandhar and Bathinda districts for food products, paper and machinery and textiles. Besides these medium and major industrial units, a large number of small scale and tiny units are also engaged in the manufacture of the same products. Since we have mentioned all the industrial units, but our study is restricted to only six items, these are Yarn and Textiles, Hosiery and Ready Made Garments, Bicycle and Bicycle parts, Leather Products, Sports Goods, and Hand Tools.

TABLE 1.2 MAJOR POLLUTANTS AND THEIR SOURCES

S. No	Major Pollutants	Sources
1	Carbon monoxide	Incomplete fuel combustion (e.g. two/four stroke engines)
2	Sulphur dioxide	Burning of sulphur containing fuel like coal in Power Plants and emission by vehicles
3	Suspended particulate matter	Smoke from domestic, industrial and vehicular sources.
4	Oxides of nitrogen	Fuel combustion of motor vehicles, emission from power stations and industrial furnaces.
5	Oxidants and ozone	Emissions from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons.
6	Lead	Emissions from motor vehicles

Source: Environment Statistics of Punjab, 2012

Major pollutants & their sources have been discussed in above table. There is need of proper disposal of wastes of industries to protect the environment. To promote environmental protection, conservation of natural resources and sustainable development, the state government set up the Punjab Pollution Control Board (PPCB) in 1975 and a division of environment in the Punjab State Council for Science & Technology (PSCST) was established in 1988, which is providing technical assistance to Department of Science, Technology & Environment, Government of Punjab.

TABLE 1.3: CATEGORY WISE AIR POLLUTING INDUSTRIES IN PUNJAB

Name of Industry	Major Air Pollutants
Rice, Sugar, Food Products	Particulates, CO ₂ , SO ₂ , NO _x
Beverages	Particulates, Odour
Cotton/Woolen/Synthetic/Textile/Dyeing etc.	Particulates
Paper Products & Printing	Particulates, mercaptans
Leather & Leather Products	Particulates, Odour
Rubber & Plastic Products	Particulates, Odour, VOCs
Chemical Products	Cl ₂ , HCl, Acid mist, Acid fumes, Hydrocarbons
Non-Metallic Mineral Products	Particulates
Metal Products	Metallic Particulates, CO, SO ₂ , Acid Mist
Transport Equipment & Parts	Particulates
Brick Kilns	Particulates, SO ₂ , CO
Pharmaceuticals	Odour, Particulates
Rolling, forging & galvanizing units	Particulates
Fertilizer, Vanaspati, Thermal, Cement, etc.	Odour, Particulates

Source: Status of Environment Report, Punjab

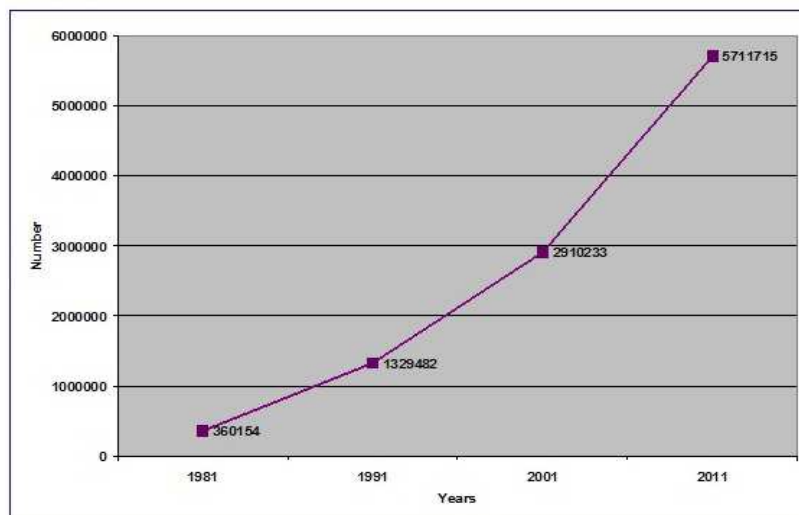
Table 1.3 explains the various air polluting industries in Punjab and major pollutants that effect the environment. Major frequent pollutant in all the cases was Particulate Matter.

VEHICULAR POLLUTION

Vehicular emissions are of particular concern since these are ground level sources and thus have the maximum impact on the human population and other biotic components. The major pollutants released as vehicle/fuel emissions are carbon monoxide, nitrogen oxides, photochemical oxidants, air toxics namely benzene, aldehydes, 1-3 butadiene, lead, particulate matter, hydrocarbon, oxides of sulphur and polycyclic aromatic hydrocarbons. (Environment Report, Punjab)

GROWTH OF VEHICLES IN PUNJAB

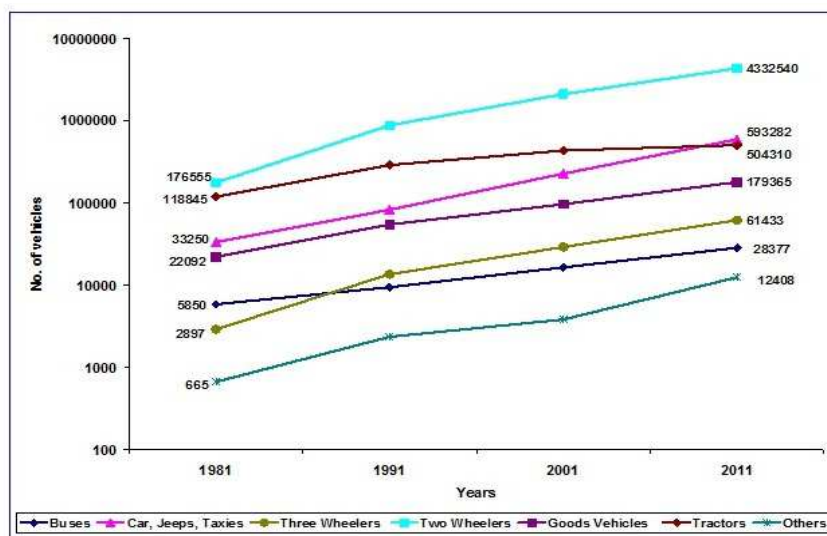
FIG. 1.1



Source: Environment Statistics of Punjab

GROWTH OF DIFFERENT TYPES OF VEHICLES IN PUNJAB

FIG. 1.2



Source: Environment Statistics of Punjab

Industrial towns with a high growth and, therefore, high pollution potential will come in for special attention from the Punjab Pollution Control Board, under a new initiative to deal with pollution in the state. 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 board has also identified more than 6,200 water-polluting and 3,500 air-polluting industries. It will file cases in court against 16 industrial units on grounds of water pollution. Also on the anvil are 24 monitoring stations to measure the level of noise in heavily. (indiaenvironmentportal.org) According to report published in Times of India, "air quality in North Indian cities is 2-3 times worse than cities in South India, which led to a sharp rise in cases of chest and throat disease in India and India has 10 cities in Top 20 most polluted cities in the world including Ludhiana and Khanna.

TABLE 1.4 COMPARATIVE VALUES OF RSPM, SO₂ & NO_x MG/M³ FROM 2013 TO 2016 (Annual Average)

Area	RSPM $\mu\text{g}/\text{m}^3$				Nox $\mu\text{g}/\text{m}^3$				SO ₂ $\mu\text{g}/\text{m}^3$			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
Dera Bassi	111	99	91	97	18	15	15	13	8	6	6	6
Mandi Gobindgarh	164	135	130	126	33	36	36	34	6	7	7	7
Nangal	87	85	83	91	16	12	12	12	5	4	4	5
Bathinda	131	123	111	117	21	17	15	13	8	6	6	5
Patiala	108	103	110	107	16	14	15	13	6	6	5	5
Jalandhar	131	145	150	159	27	26	27	26	13	14	14	12
Ludhiana	203	152	143	139	27	27	26	25	11	10	10	10
Khanna	183	163	123	114	23	23	22	20	12	10	10	10
Amritsar	177	187	185	232	40	40	38	38	13	13	13	14
Sangrur	93	90	98	92	15	13	13	13	5	4	4	4
Faridkot	93	73	90	106	15	11	13	12	6	4	5	5

Source: Environment Statistics of Punjab, Various Issues

Table 1.4 describes the annual average comparative values of RSPM, So₂ and Nox in Major Cities of Punjab from 2013 to 2016. The values of RSPM, So₂ and Nox is average of the locations industrial areas and residential areas.

FIG 1.3: COMPARATIVE VALUES OF RSPM IN MAJOR CITIES OF PUNJAB FROM 2013 TO 2016

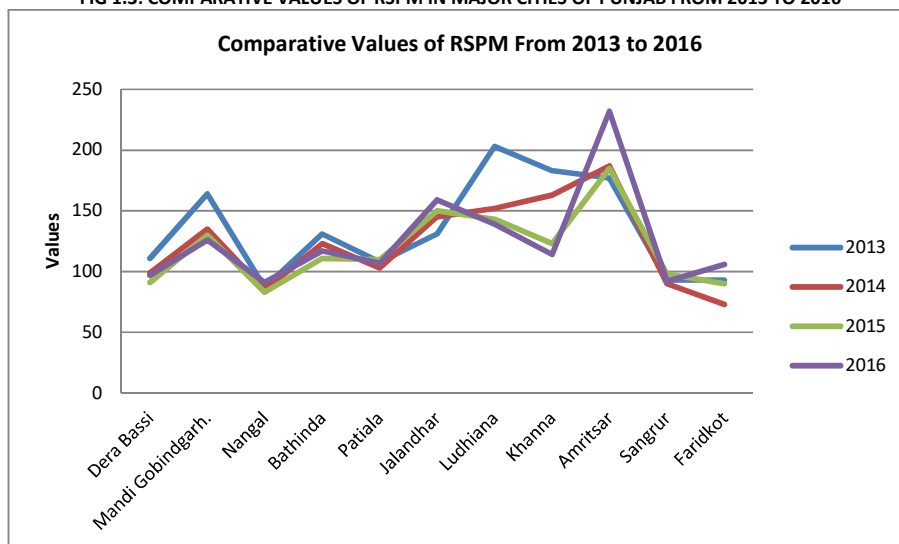


FIG 1.4: COMPARATIVE VALUES OF NOX IN MAJOR CITIES OF PUNJAB FROM 2013 TO 2016

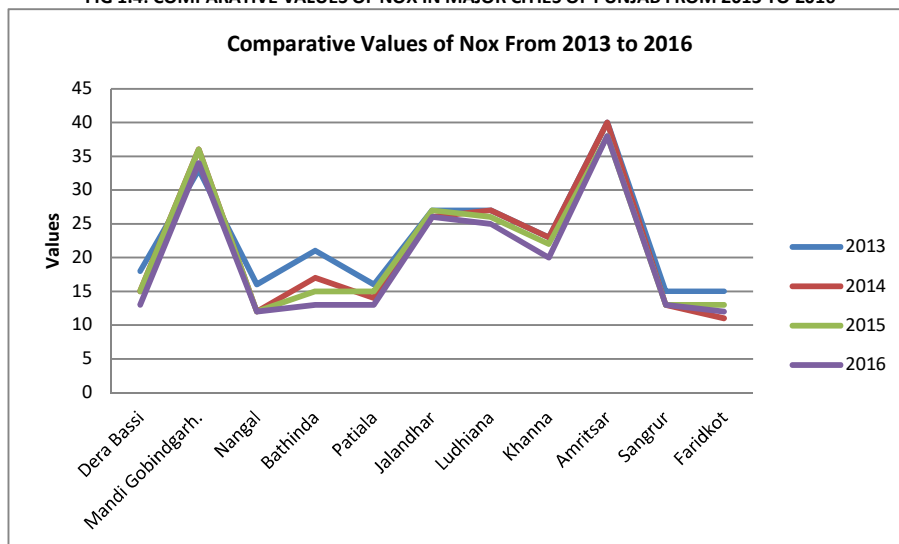


FIG 1.5: COMPARATIVE VALUES OF NOX IN MAJOR CITIES OF PUNJAB FROM 2013 TO 2016

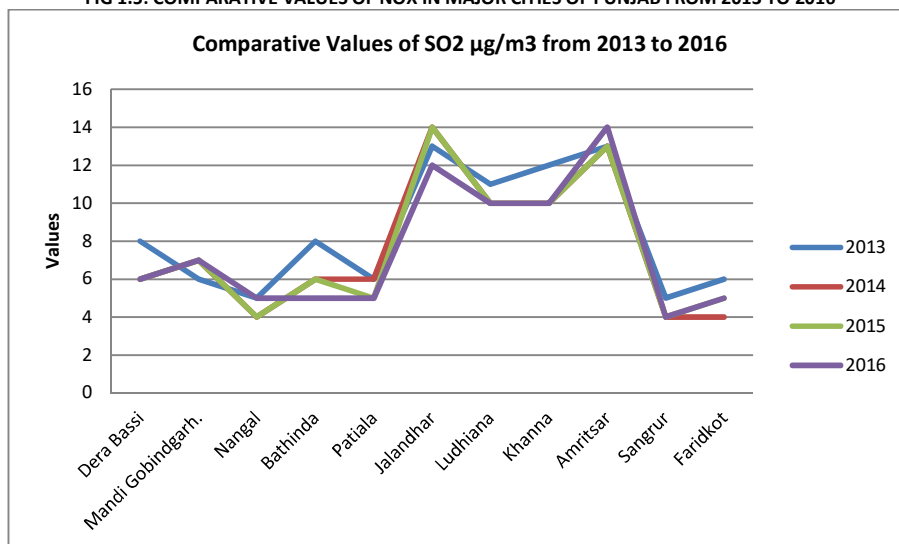


TABLE 1.5: COMPARATIVE VALUES OF RSPM, SO₂, NO_x, GSDP AND PER CAPITA IN PUNJAB FROM 2013 TO 2016 (Annual)

Year	RSPM	Nox	SO ₂	Air Pollution	GSDP	Per Capita Income
2013	135	23	8	166	298581	105143
2014	123	21	8	152	313276	114561
2015	119	21	8	148	331940	126063
2016	125	20	8	153	454398	126606

Table 1.5 describes the comparative values of RSPM, SO₂, NO_x, GSDP and Per Capita in Punjab from 2013 to 2016.

TABLE 1.6: CORRELATION BETWEEN GSDP AND AIR POLLUTION

GSDP	Air Pollution
1	-0.32
-0.32	1

Table 1.6 depicts the correlation between GSDP and air pollution in various major cities in Punjab. The correlation coefficient -0.322 represents inverse relationship between GSDP and air pollution.

TABLE 1.7: CORRELATION BETWEEN PER CAPITA INCOME AND AIR POLLUTION

Per Capita Income	Air Pollution
1	-0.85
-0.85	1

Table 1.7 depicts the correlation between GSDP and air pollution in various major cities in Punjab. The correlation coefficient -0.322 represents inverse relationship between GSDP and air pollution.

CONCLUSION

From the above analysis this has been found that there was an inverse association between GSDP, Per Capita Income and Air Pollution. The correlation coefficient in both cases was negative. As the Environmental Kuznet Curve suggests that economic development at the initial stages degraded the environment, but after the certain level, an economy starts improving its relationship with the environment. (Stern, 2003) Externalities are other major factors that influence the environment. The correlation coefficients supported the Environmental Kuznet Curve hypothesis. According to Stern, in sluggish economies, emissions-reducing technological change can overcome the scale effect of rising income per capita on emissions. Due to this, considerable diminutions in sulfur emissions per capita have been witnessed in many OECD countries in the last few decades. Punjab economy witnessed major changes after the green revolution and industrialization. During the initial stages of the growth, there was a lack of awareness about environmental issues. In this regard, under Article 48A of the, 42nd Amendment Act under the Indian Constitution, the government of India provided for the protection of environment and forests. As per the Act, "The state shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country". In addition to the above act, under the article 51A of the same amendment, under the fundamental duties of the citizens of India' the act states that 'it would be the fundamental duty of every citizen to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have a natural compassion for living creatures'. The Punjab Pollution Control Board has been monitoring the pollution levels at 20 locations out of which nine are in the residential cum commercial areas and 11 are in the industrial areas. The Punjab Pollution Control Board has laid down guidelines with regard to pollution control for any entrepreneur wanting to set up an industrial unit in the state of Punjab. The Ministry of Forest and Environment has divided the industries in three different categories as per the pollutants being emitted by them. The three categories are: (i) Green Category (ii) Orange Category (iii) Red Category. Joshi et al (2015).

In addition to this Government of India/Punjab spreading information among general public through various national and state level programmes for the protection of environment for the sustainable development of the economy.

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