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Assessing the Impact of Industrialization on Agricultural Sector: A Case Study of Pune District Especially Chakan Area

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Abstract
Purpose: *The paper examined industrialization and its impact on agriculture sector in Pune district. The study assessed the growth and impact of industrialization on agriculture sector and investigated various challenges and opportunities before agriculture sector.*
Design/Methodology/Approach: The researcher selected 210 stakeholders (Farmers) from various villages in Pune District especially in Chakan area. Researcher used self-structured questionnaire for primary data collection and purposive sampling method was used. Google form technique was used for data collection through 210 respondents from various villages.
Major Findings: *The analysis of the study showed that industrialization has a notable effect on farmers' income, employment, and productivity in agriculture sector and only a 20% increase in the agriculture sector due to industrialization.*
Practical Applications: This study will be helpful for Teachers, Students and government policy makers in increasing the level of awareness about design thinking and identifying various challenges and opportunities in design thinking.
Originality: *The current study focused on industrialization and its impact on agriculture sectors, including growth of employment, productivity, farmer income, and the perception level of farmers regarding the concept of industrialization.*
Keywords: *Industrialization, Agriculture sector, Employability, Productivity, Farmer Income, Perception level of farmer etc.*

Introduction

Economic development is important factor for developed and developing countries because they can solve burning issues like Poverty, unemployment and low production etc. The government has consistently fostered economic development by utilizing a variety of tactics at different levels to modernize agriculture, grow small and major businesses, grow the service sector, promote domestic and international trade, etc. The important aims and objectives of industrialization, a process that hastened economic growth, are as follows: it influences structural changes in the economy, especially with regard to the use of resources, production functions, income generation, occupational pattern, population distribution, and foreign trade; it also includes social changes. In other words, industrialization seeks to solve issues like starvation, poverty, unemployment, and farmer suicide. Roughly sixteen percent of GDP comes from agriculture. Industrialization and agriculture are two important sectors that have changed both the human history and economy of global. The arrival of industrialization has transformed the way goods are produced, consumed, and distributed, leading to unexpected economic growth and development. However, this transformation has also had far-reaching consequences for the agriculture sector, which is the backbone of many economies, particularly in developing countries. Agriculture is not only a source of food and livelihood for millions of people but also plays a crucial role in maintaining ecological balance, conserving natural resources, and supporting rural development. The effects of industrialization on agriculture have been multifaceted and complex, with both positive and negative consequences.

On the one hand, industrialization has brought technological innovations, improved efficiency, and increased productivity in agriculture, enabling farmers to produce more with less labor and resources. Industrialization has also created new market opportunities, enabling farmers to access global markets and increase their incomes. Industrialization has led to the displacement of small-scale farmers, environmental degradation, and resource depletion.

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The increasing demand for industrial inputs, such as fertilizers and pesticides, has polluted soil, water, and air, threatening the long-term sustainability of agricultural production. Moreover, the expansion of industrial activities has led to land grabbing, deforestation, and habitat destruction, further exacerbating environmental problems. In recent years, concerns about food security, climate change, and sustainable development have brought the relationship between industrialization and agriculture to the forefront of global debates. As the world grapples with the challenges of feeding a growing population, mitigating climate change, and promoting sustainable development, it is essential to assess the effects of industrialization on the agriculture sector. This study aims to investigate the impact of industrialization on agriculture, exploring both the positive and negative consequences.

By examining the effects of industrialization on agricultural productivity, environmental sustainability, and rural development, this research seeks to contribute to the ongoing debate about the future of agriculture in an industrializing world.

Review of Literature

For the present research, the researcher has taken a detailed review of literature with the help of Theoretical Frameworks, positive effects of Industrialization on agriculture sector and negative impact of industrialization on agriculture sector.

Theoretical Frameworks

Modernization Theory: **(Rostow, 1960). T**his theory argues that industrialization and economic growth is caused by improvement in the quantity of the factors of production that country has available i.e. land, labour, capital and enterprise. In the context of the agriculture sector, Modernization Theory suggests that industrialization and technological innovation will lead to increased efficiency, productivity, and economic growth and this theory also suggests that industrialization leads to the modernization of agriculture, resulting in increased efficiency and productivity. Dependency Theory: **(Frank, 1966).** This theory suggests that developing countries are dependent on developed countries for agricultural technology, inputs, and markets. Dependency theory highlights the unequal relationships between developed and developing countries and the need for developing countries to challenge and transform these relationships to achieve economic development and independence. Structural Transformation Theory: **(Lewis, 1954)** Suggests that industrialization leads to a structural transformation of the economy, where labor and resources shift from agriculture to industry and services. Dual Economy Theory: **(Boeke, 1953)** Posits that industrialization creates a dual economy, where a modern industrial sector coexists with a traditional agricultural sector. Lewis Theory of Economic Development: **(Lewis, 1954)** Argues that industrialization leads to economic development by creating a surplus of labor in agriculture, which is then absorbed by the industrial sector. Stow's Stages of Growth Theory: **(Rostow, 1960)**. Suggests that industrialization leads to economic growth and development through a series of stages, including the take-off stage, where agriculture becomes commercialized. Schultz's Theory of Agricultural Development: **(Schultz, 1964)** Posits that industrialization leads to agricultural development by increasing the demand for agricultural products and encouraging farmers to adopt new technologies. Hayami and Ruttan's Theory of Agricultural Development: **(Hayami, Y.,& Ruttan, V. W., 1985)** Argues that industrialization leads to agricultural development by inducing technological innovations and institutional changes in agriculture. Environmental Impact Theory: **(Pimentel, D., & Pimentel, M., 1992)** Suggests that industrialization leads to environmental degradation and resource depletion in agriculture, threatening long-term sustainability. Food System Theory: **(Lang, T., & Heasman, M., 2004)** Posits that industrialization leads to changes in the food system, including the globalization of food trade, the rise of supermarkets, and the decline of local food systems.

Positive and negative effects of Industrialization on agriculture sector

Table No.1. Positive and negative effects of Industrialization on agriculture sector

Positive Impact of Industrialization on Agriculture Sector	Negative Impact of Industrialization on Agriculture Sector
1. Increased Efficiency: Mechanization brought forth by industrialization increases farming operations' efficiency and results in lower labour costs and higher crop yields. **2. Enhanced Productivity:** The use of technology and industrialized agricultural techniques results in higher productivity, which raises food production and lessens the strain on land resources. **3. Improved Market Access:** Farmers can now sell their produce at competitive prices, increasing their revenue, thanks to improved market access brought about by industrialisation. **4. Job Creation:** Processing, agriculture, and associated industries all see an increase in employment as a result of industrialisation. **5. Decreased Post-Harvest Losses:** Modern processing and storage facilities brought about by industrialisation	**1. Environmental Degradation:** Chemical pesticides, fertilizers, and irrigation are used more frequently as a result of industrialisation, which degrades the soil, pollutes water supplies, and reduces biodiversity. **2. Displacement of Small-Scale Farmers:** Because industrialisation promotes large-scale agricultural, rural communities and small-scale farmers are displaced. **3. Non-renewable Resources:** The reliance of industrialisation on non-renewable resources has increased, leading to unsustainable practices and climate change. **4. Loss of Traditional Farming Practices:** Community knowledge, cultural heritage, and traditional farming methods are all being undermined by industrialisation. **5. Susceptibility to market:** The fifth reason for farmers' increased susceptibility to market fluctuations,

help to improve food security by lowering post-harvest losses. **6. Enhanced Competitiveness:** Farmers can now compete on a worldwide scale, which boosts exports and foreign exchange profits. This is made possible by industrialisation. **7. Enhancement of Quality:** The introduction of quality control systems by industrialisation guarantees consistent and superior quality of produce.	price volatility, and economic shocks is industrialisation. **6. Water Scarcity:** As a result of increased water consumption brought on by industrialisation, there is more competition for this finite resource. **7. Soil Erosion and deterioration:** Intensive farming techniques brought about by industrialisation impair soil fertility over the long run by producing erosion and deterioration of the soil.

Research Gap

Numerous topics related to industrialization have been studied, such as future food problems, improper resource utilization, employment issues, the use of traditional methods in industrialization, environmental pollution, the impact of mining on the environment, issues with ground water, etc. However, concerns about farmers' perceptions, feelings about giving land to industrialists, as well as the industrialization and its impact on agriculture sector have not been studied.

Statement of the Problem

Industrialization is an essential for economic development. Fast industrialization has caused in the development of urban centers. Pune District is one of the industrialized districts in Maharashtra. Urban centres are growing rapidly due to rapid industrialization. Growth of urban centres has a great impact on agriculture. Pune district is one of the most industrialized districts of in Maharashtra. Maharashtra government has offered more for industrialist in forming industries in a state it needs to give employment opportunity to its people. When industries increase automatically farmers will not get any chance to cultivate on land and hence, they are (Industrialist & Farmers) prefer good environment.

Research Questions

1. What is the Perception Level of farmers about Industrialization in Maharashtra?
2. What is the relationship between industrialization and agricultural productivity?
3. What are the key drivers of industrialization's impact on agricultural productivity (e.g., technological advancements, labor migration, and environmental degradation)?
4. What are the short-term and long-term consequences of industrialization on agricultural productivity?

Research Objectives

The specific objective of the present research study is **"to assess the impact of industrialization on agriculture sector especially on agriculture productivity".** The other objectives of the study of industrialization and its impact on agriculture sector are as follows:

1. To know the concept of industrialization in detail.
2. To know the perception of farmers about the concept of Industrialization.
3. To quantify the changes in agricultural productivity resulting from industrialization.
4. To assess the impact of industrialization on agricultural employment and labor productivity.
5. To evaluate the effects of industrialization on agricultural land use, soil quality, and water resources.

Significance of the study: There are numerous important reasons to consider when evaluating how industrialization has affected on agriculture sector.

1. **Food Security:** the present research is helpful for to understand the relationship between industrialization and agriculture production.
2. **Economic Growth**: Impact of Industrialization's on agricultural sector affects economic growth, employment, and poverty reduction, making this research is essential and advantageous for policymakers.
3. **Policy Formulation:** the Findings of present research can helpful for policymakers in creating effective policies that diminish negative impacts and enhance positive effects of industrialization on agriculture sector.

Research Hypotheses:

1. H_1: There is a significant difference between perception levels of the farmers regards to the concept of industrialization.
2. H_1: There is a significant relationship between industrial growth and agriculture growth.
3. H_1: There is a significant impact of industrialization on the agriculture sector.
4. H_1: There is a significant impact of Industrialization on agricultural productivity
5. H_1: There is a significant relationship between industrial growth and employment growth.
6. H_1: Industrialization has no significant effect on farmers' income.

Above these hypotheses provide a framework for examining sides of the relationship between industrialization and employment in agriculture sector, productivity and farmers income thereby helping to generate evidence and ideas that support or refuse the research objectives.

Scope and Limitations of the Study

1. This study is restricted to Pune district of Maharashtra only.
2. The opinion of the respondents may not represent the whole population.
3. Only 210 respondents were included in this study.
4. The findings of this study are completely depended on the basis of Primary data given by the
   Respondents, it is uncertain whether or not the respondents' provided data.

5. Majority of the respondents are absence from Formal education therefore; data collected for research are not entirely accurate.

Sampling and Sample Size

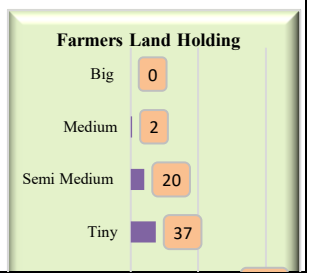
The final questionnaire was prepared using google forms and the study population consisted of farmers in the age group of 20 to 78 years and marginal farmers to big farmers. As it was very difficult to have a proper sampling frame hence, Purposive sampling method was used and questionnaire was sent to farmers through google forms. Researcher collected the data during June - July, 2024 from 230 farmers. A sample size of 210 is considered due to completeness of the questionnaire. Collected data was analyzed using SPSS software.

Data Analysis and Interpretation: This part is divided into three Parts A) Demographic characteristics of respondents B) Secondary data and C) Primary data analysis.

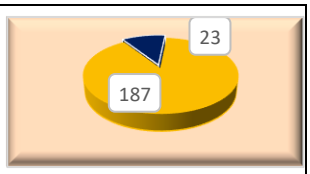
A) Demographic characteristics of respondents: Demographic characteristics of respondents are shown in detail in the following table:

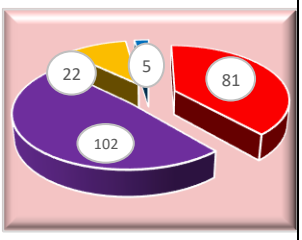
Table No.2. Demographic characteristics & Cross tabulation of perception level of respondents

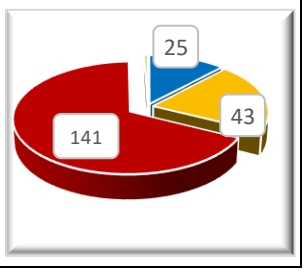
Grouping Variable		Perception Level			Total Freq.	%	Valid %	Cum %	X^2 Valu
		SW	M	Ex					
Farmer	Marginal	27	110	14	151	71.9	71.9	71.9	34.96
	Tiny	21	12	04	37	17.6	17.6	89.5	
	Semi Medium	12	06	02	20	09.5	09.5	99.0	
	Medium	01	01	00	02	01.0	01.0	100	
	Big	00	00	00	00	00.0	00.0	100	
	Total	61	129	20	210	100	100	---	
	Percentage	**29.0**	**61.4**	**9.5**	**100**				



Gender	Male	37	141	09	187	89.0	89.0	89	20.7
	Female	14	07	02	23	11.0	11.0	100	
	Total	**51**	**148**	**11**	**210**	100	100	---	
	Percentage	**24.3**	**70.5**	**5.2**	**100**				
Education	Up to 10	23	51	07	81	38.6	38.6	38.6	81.9
	12th	29	64	09	102	48.6	48.6	87.1	
	Under Graduate	07	12	03	22	10.5	10.5	97.6	
	Post Graduate	02	02	01	05	02.4	02.4	100	
	Total	**61**	**129**	**20**	210	100	100		
	Percentage	**29.0**	**61.4**	**9.5**	**100**				
Age	Up to 25 Yrs.	12	10	03	25	11.9	11.9	11.9	36.13
	26 to 50	21	17	05	43	20.5	20.5	32.4	
	51 to 75	26	112	03	141	67.1	67.1	99.5	
	Above 75	01	00	00	01	00.5	00.5	100	
	Total	**60**	**139**	**11**	210	100	**100**		
	Percentage	**28.6**	**66.2**	**5.2**	**100**				







The above table display demographic Characteristics of the respondents. Majority of farmers (71.9%) are from marginal land holder and the majority operate small or micro farms. Not a single farmer has a large farm; the majority of farmers have medium-sized or semi-medium-sized farms. 89.0% farmers are men. There are 37 farmers classified as "tiny," 141 as "semi-medium," and 9 as "medium." 11.0% farmers are women. There are 14 in the "tiny" category, 7 in the "semi-medium" category, and 2 in the "medium" category. The majority of farmers (89.0%) are male, indicating a significant gender imbalance in farming. 38.6% of farmers have completed at least a 10th grade education. Of them, 23 run little farms, 51 semi-sized farms, and 7 medium farms. 48.6% farmers passed the 12th grade; 29 have small farms, 64 have semi-sized farms, and 9 have medium farms. 10.5% of farmers hold an undergraduate degree; three have medium-sized farms, twelve have semi-medium-sized farms, and seven have tiny farms. 2.4% farmers hold a postgraduate degree, two have tiny farms, two have semi-medium farms, and one has a medium farm. The majority of farmers (48.6%) have completed 12th standard, indicating a relatively high level of education among farmers and only a small percentage of farmers (2.4%) have postgraduate degrees, indicating that advanced education is not common among farmers. 11.9% are under 25 years old. Of these, 12 have small farms, 10 have semi-sized farms, and 3 have medium farms. 21 have little farms, 17 have semi-medium farms, and 5 have medium farms;

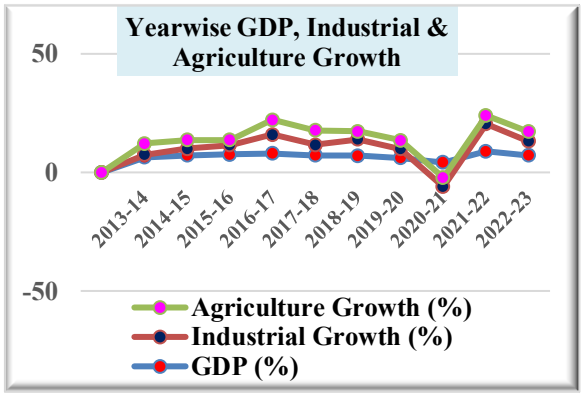
together, these farmers make up 20.5% of the total. 26 farmers have little farms, 112 have semi-sized farms, and 3 have medium farms, making up 67.1% of farmers in this age group and Just 1 farmer, or 0.5% of farmers, is over 75 and operates a small farmer. The majority of farmers (67.1%) are aged between 51 and 75, indicating that farming is an occupation dominated by middle-aged to older individuals. A relatively small percentage of farmers (11.9%) are aged 25 or below, suggesting that young people may be less interested in farming and only a tiny percentage of farmers (0.5%) are aged above 75, indicating that farming is not a common occupation among the elderly. The age distribution of farmers may indicate a need for initiatives to attract younger people to farming.

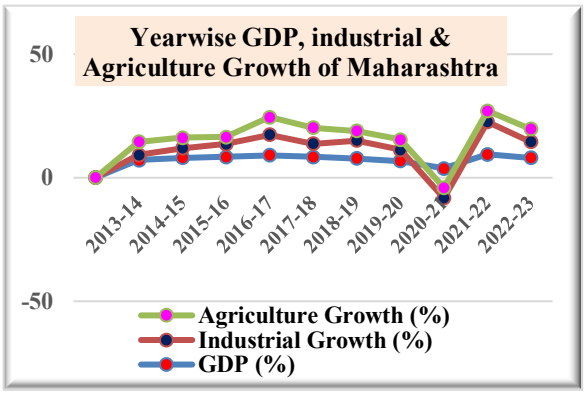
B) Secondary Data Analysis

Table No.3. Impact of Industrial Growth on Agriculture Growth

Sr. No	Year	India			Maharashtra		
		GDP (%)	Industrial Growth (%)	Agriculture Growth (%)	GDP (%)	Industrial Growth (%)	Agriculture Growth (%)
1	2013-14	6.4	1.1	4.7	7.1	2.1	5.3
2	2014-15	7.2	2.8	3.7	8.1	3.9	4.2
3	2015-16	7.6	3.9	2.2	8.5	5.1	2.9
4	2016-17	8.0	7.9	6.3	9.1	8.3	7.1
5	2017-18	7.2	4.4	6.1	8.5	5.3	6.4
6	2018-19	7.0	6.9	3.4	7.8	7.2	3.9
7	2019-20	6.1	3.8	3.7	6.8	4.5	4.1
8	2020-21	4.2	-10.3	3.9	3.8	-12.1	4.3
9	2021-22	8.9	11.5	3.6	9.5	13.1	4.5
10	2022-23	7.2	5.9	4.1	8.1	6.5	5.1
Average Growth (%)		**6.98**	**3.79**	**4.17**	**7.73**	**4.39**	**4.78**

(Source: Directorate of Economics and Statistics)





GDP growth rate of India has fluctuated between 6.1% and 8.9%, due to the COVID-19 pandemic significant decline in GDP growth rate and a subsequent recovery in 2021. GDP growth rate of Maharashtra has generally been higher than India's GDP growth rate ranging from 6.8% to 9.5%.Agriculture growth rates in both India and Maharashtra have been relatively lower, ranging from 2.2% to 6.3% and 2.9% to 7.1%, respectively. Industrial growth rates have been more volatile, with significant declines in 2020 due to the pandemic and subsequent recoveries in 2021.

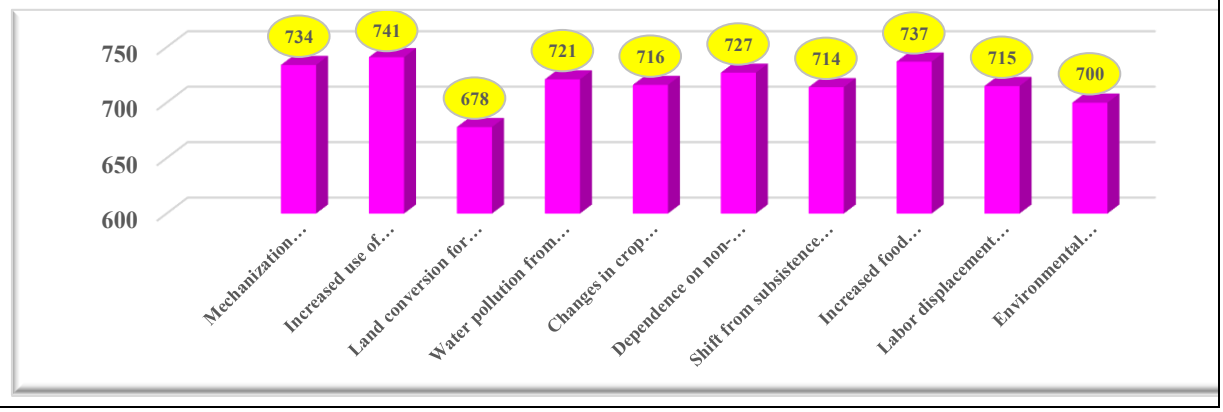
1. Maharashtra's GDP growth rate is constantly higher than India's overall GDP growth rate.
2. Agriculture growth rates are similar for both India and Maharashtra, indicating similar trends and challenges.
3. Industrial growth rates are more volatile for Maharashtra compared to India, indicating a more significant impact from the pandemic and subsequent recovery.

C) Primary Data Analysis: Data collected through questionnaire were analyzed in the following table:

Table No.4. Impact of Industrialization on the Agriculture Sector

Sr. No	Statements	VH	H	M	L	VL	Total	Score	Mean
H1: There is a significant impact of industrialization on the agriculture sector.									
1	Mechanization replaces traditional farming methods:	139	50	11	06	04	210	734	3.5
2	Increased use of chemical fertilizers and pesticides	141	51	10	04	04	210	741	3.5
3	Land conversion for industrial purposes	120	48	21	12	09	210	678	3.2
4	Water pollution from industrial runoff:	131	53	16	06	04	210	721	3.4
5	Changes in crop selection and monoculture	129	51	21	05	04	210	716	3.4

6	Dependence on non-renewable resources	134	53	14	04	05	210	727	3.5
7	Shift from subsistence to commercial farming	124	60	17	04	05	210	714	3.4
8	Increased food processing and packaging	145	42	13	05	05	210	737	3.5
9	Labor displacement and rural migration:	129	56	12	07	06	210	715	3.4
10	Environmental degradation and loss of biodiversity	120	57	21	07	05	210	700	3.3
Total		**1312**	**521**	**156**	**60**	**51**	**2100**	**7183**	**3.4**
Percentage (%)		**62.5**	**24.8**	**7.4**	**2.9**	**2.4**	**100.0**	**---**	**---**
Cumulative Percentage (%)		**62.5**	**87.3**	**94.7**	**97.6**	**100**	**---**	**---**	**---**
Chi- Square Value		***(df=4. X2 Value= 129.51, p= 0.0001 < 0.05)***							



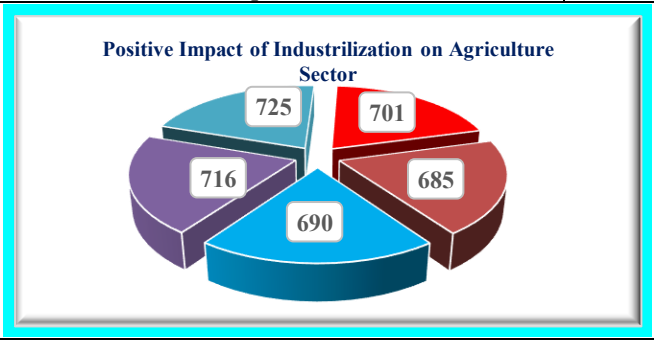
Above table no show 62.5% respondents are agree for the very high impact of industrialization on agriculture sector and only 02.4% respondents (Farmer) are agreeing for the very low impact of industrialization on agriculture sector. The cumulative percentage of the data indicates that the percentage of the first three categories is 94.7%, which indicates a significant impact of industrialization on the agriculture sector. The majority of respondents agree with the increased use of chemical fertilizers and pesticides, machinery and technology replacing manual labor and traditional farming practices and food processing and packaging in the agriculture sector due to industrialization.

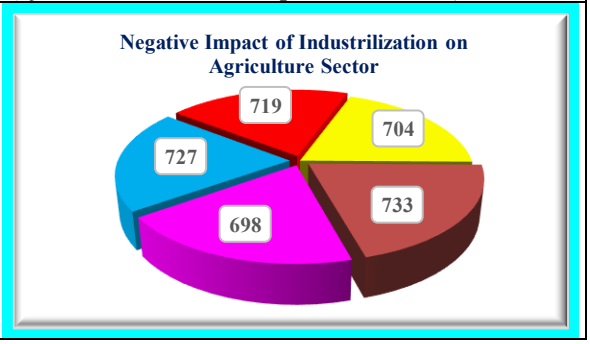
Directional Hypothesis: Industrialization has a significant impact on agricultural productivity, leading to both positive and negative effects.

Table No.5. Impact of Industrialization on agricultural productivity.

Sr. No	Statements	VH	H	M	L	VL	Total	Score	Mean
H_1: There is a significant impact of Industrialization on agricultural productivity.									
Positive Impact									
1	Increases agricultural productivity through mechanization and technology adoption.	129	49	13	12	07	210	701	3.3
2	Irrigation systems and water management technologies introduced	119	53	18	14	06	210	685	3.3
3	3. Use of chemical fertilizers and pesticides in industrialized agriculture boosts crop production.	126	46	19	10	09	210	690	3.3
4	Promotes high-yielding crop varieties and improved seeds, leading to increased productivity.	133	46	19	08	04	210	716	3.4
5	Increases better storage and transportation facilities.	135	48	18	05	04	210	725	3.5
Total		**642**	**242**	**87**	**49**	**30**	**1050**	**3517**	**3.3**
Percentage (%)		**61.1**	**23**	**8.3**	**4.7**	**2.9**	**100.0**		
Cumulative Percentage (%)		**61.1**	**84. 2**	**92.5**	**97. 1**	**100**			
Chi- Square Value		***(df=4. X2 Value= 118.08, p= 0.0001 < 0.05)***							
Negative Impact									
6	Soil degradation and erosion, reducing agricultural productivity.	129	42	27	08	04	210	704	3.4
7	Over-reliance on chemical fertilizers and pesticides therefore, harms soil health and decreases productivity.	138	49	14	06	03	210	733	3.5
8	Water pollution from industrial activities	127	49	17	09	08	210	698	3.3

	reduces crop yields								
9	Loss of biodiversity, leading to reduced crop resilience and lower productivity.	142	38	19	07	04	210	727	3.5
10	Displacement of small-scale farmers and traditional farming practices	135	48	14	07	06	210	719	3.4
Total		**671**	**226**	**91**	**37**	**25**	**1050**	**3581**	**3.4**
Percentage (%)		**63.9**	**21.5**	**08.7**	**3.5**	**2.4**	**100**	**---**	**---**
Cumulative Percentage (%)		**63.9**	**85.4**	**94.1**	**97.6**	**100**	**---**	**---**	**---**
Chi- Square Value		***(df=4. X2 Value= 131.96, p= 0.0001 < 0.05)***							



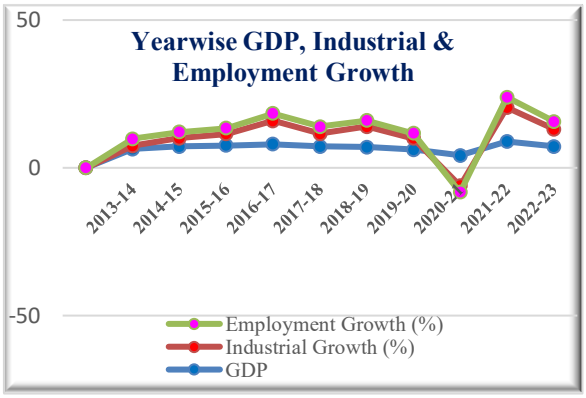


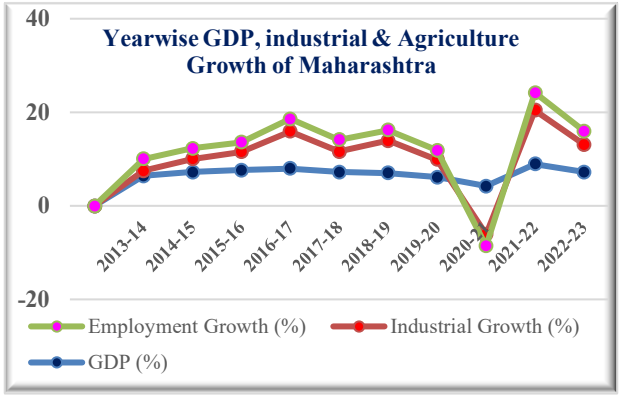
The above table no. Show a survey of the impact of industrialization on agricultural productivity, with 210 respondents rating five statements on a scale from Very High (VH) to Very Low (VL). The mean score for all statements (1 to 5) is 3.3, indicating a generally positive impact of industrialization on agricultural productivity. The total score and percentage distributions show a skewed pattern, with a majority of respondents rating the statements as Very High (VH) or High (H). 92.5% respondents are agreeing for the very high impact of industrialization on agriculture productivity and only 02.9% respondents (Farmer) are agreeing for the very low impact of industrialization on agriculture Productivity. Industrialization has a significant positive impact on agricultural productivity, particularly in areas like increasing efficiency, irrigation, and high-yielding crop varieties etc. 92.5% respondents are agreeing that industrialization increases crop production and improves storage and transportation facilities.

The mean score for all statements (6 to 10) is 3.4, indicating a negative impact of industrialization on agricultural productivity. 94.1% respondents are agreeing for the impact of industrialization on agriculture productivity and only 02.4% respondents (Farmer) are agreeing for the very low impact of industrialization on agriculture Productivity. Agricultural production is adversely affected by industrialization, especially in areas such as soil deterioration, excessive dependence on chemical fertilizers, and biodiversity loss.

Table No. 6. Impact of Industrial Growth on Employment Growth

Sr. No	Year	India			Maharashtra		
		GDP (%)	Industrial Growth (%)	Employment Growth (%)	GDP (%)	Industrial Growth (%)	Employment Growth (%)
1	2013-14	6.4	1.1	2.3	7.1	2.1	2.5
2	2014-15	7.2	2.8	2.1	8.1	3.9	2.3
3	2015-16	7.6	3.9	1.9	8.5	5.1	2.1
4	2016-17	8.0	7.9	2.5	9.1	8.3	2.7
5	2017-18	7.2	4.4	2.3	8.5	5.3	2.5
6	2018-19	7.0	6.9	2.1	7.8	7.2	2.3
7	2019-20	6.1	3.8	1.8	6.8	4.5	2.0
8	2020-21	4.2	-10.3	-2.2	3.8	-12.1	-2.5
9	2021-22	8.9	11.5	3.5	9.5	13.1	3.8
10	2022-23	7.2	5.9	2.6	8.1	6.5	2.9
Average Growth (%)		**6.98**	**3.79**	**1.89**	**7.73**	**4.39**	**2.06**
(Source: Directorate of Economics and Statistics)							



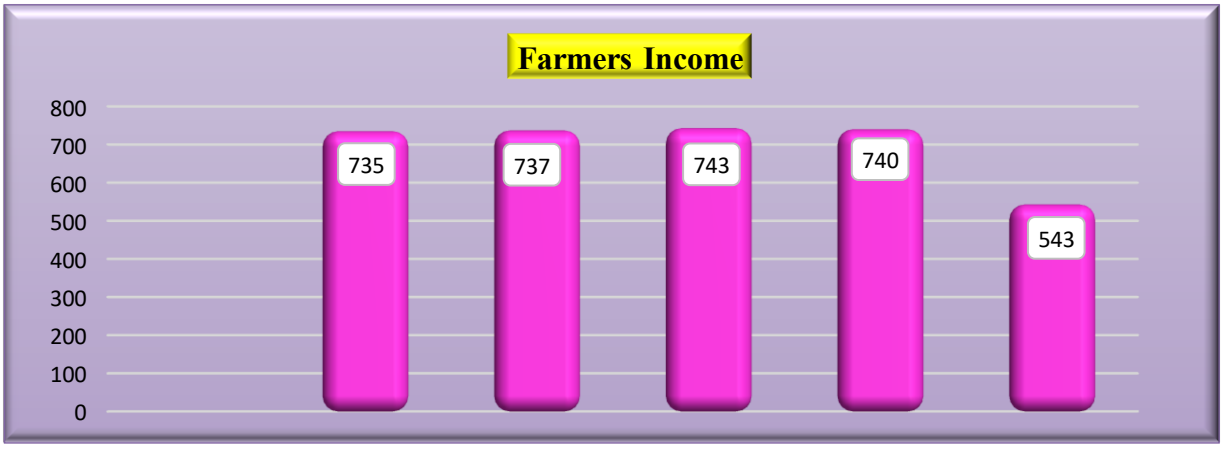


The GDP, Industrial Growth, and Employment growth rates for Maharashtra and India from 2013–14 to 2022–23 are shown in the above table No.6. Averaged GDP growth rate of India is 7.1%, with the maximum level occurring in 2021–22 at 8.9% and the lowest in 2020–21 at 4.2%. India's industrial growth rate averaged 4.5%, reaching a peak of 11.5% in 2021–2022 and falling to -10.3% in 2020–21. The Employment Growth Rate in India reached its highest level of 3.5% in the year 2021-22 and its lowest level of -2.2% in the year 2020-21 and the average growth rate is 2.2%. The GDP expansion rate of Maharashtra is constantly higher than the GDP growth rate of India as a whole. Except for in the year 2020–21, Maharashtra's industrial growth rate exceeds that of India and Employment Growth Rate is similar for both India and Maharashtra, with some fluctuations.

Table No.7. Industrialization and its Impact on Farmers Income

Sr. No	Statements	SA	A	N	D	SD	Total	Score	Mean
H1: Industrialization has significant effect on farmers' Income.									
1	Industrialization has improved market access and prices, which has raised my income.	149	36	12	7	6	210	735	3.50
2	Profitability has improved and production expenses have decreased due to Sophisticated machinery.	151	33	14	6	6	210	737	3.51
3	Industrialization has led to an increase in my income due to increased competition and market fluctuations.	154	29	17	6	4	210	743	3.54
4	My agricultural income have increased since I switched from conventional to industrial farming methods.	148	38	14	6	4	210	740	3.52
5*	Industrialization has no impact on my income, as I still rely on traditional farming methods and local markets.	21	30	44	35	80	210	543	2.59
Total		**623**	**166**	**101**	**60**	**100**	**1050**	**3498**	**3.30**
Percentage (%)		**59.3**	**15.8**	**9.6**	**5.7**	**9.5**	**100.0**		
Cumulative Percentage (%)		**59.3**	**75.1**	**84.8**	**90.5**	**100**			
Chi- Square Value		***(df=4. X2 Value= 99.35, p= 0.0001 < 0.05)***							

* Negative statement



The mean score for all five statements is 3.3, which is indicating a positive impact of industrialization on farmers' income. The total score of the five-point scale and percentage distributions shows a skewed pattern, with a majority of respondents (75.1%) rating the statements as Strongly Agree (SA), Agree (A). Industrialization has improved market access, prices, profitability, and agricultural yields, leading to increased income for farmers. The average scores and percentage distributions show that industrialization has increased farmers' incomes.

Hypothesis Testing: The researcher utilized SPSS software to run the chi-square test and Correlation for testing hypothesis.

Table No.8. Hypotheses Testing

Hypothesis	test	df	Calculated Value	P value	Comment
1. H_1: There is a significant difference between perception levels of the farmers regards to the concept of Industrialization.	Chi- Square	8	34.96	.0001	**H_0: Rejected**
2. H_1: There is a significant relationship between industrial growth and agriculture growth	Correlation	10	0.20	0.580	**H_1: Rejected**
3. H_1: There is a significant impact of industrialization on the agriculture sector.	Chi- Square	4	129.51	.0001	**H_0: Rejected**
4. H_1: There is a significant impact of Industrialization on agricultural productivity	Chi- Square	4	118.08	.0001	**H_0: Rejected**
5. H_1: There is a significant relationship between industrial growth and employment growth.	Correlation	10	0.959	.000	**H_0: Rejected**
6. H_1: Industrialization has no significant effect on farmers' income.	Chi- Square	4	99.35	.0001	**H_0: Rejected**

1. The perception levels of farmers about industrialization varies significantly. This implies that farmers have different perspectives and interpretations of industrialization, which could affect how they embrace and react to industrialize farming methods.
2. The correlation test examines the relationship between industrial growth and agriculture growth. The calculated value of 0.20 indicates a weak positive correlation between the two variables. However, the p-value of 0.580 is greater than the significance level (usually 0.05), indicating that the correlation is not statistically significant. Therefore, the null hypothesis (H_0) cannot be rejected, and the alternative hypothesis (H_1) is rejected. This suggests that there is no significant relationship between industrial growth and agriculture growth.
3. The Chi-Square test examines the impact of industrialization on the agriculture sector. The calculated value of 129.51 indicates a significant association between industrialization and agriculture growth. The p-value of 0.0001 is less than the significance level (usually 0.05), indicating that the association is statistically significant. Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This suggests that there is a significant impact of industrialization on the agriculture sector.
4. Industrialization has a major effect on agricultural productivity. This shows that agricultural production is significantly enhanced by industrialization, resulting in higher output and efficiency.
5. Agriculture-related employment is greatly impacted by industrialization. According to this, industrialization significantly boosts employment in agriculture by creating more work options and fostering more labour force participation.
6. Industrialization significantly affects the income of farmers. This shows that farmers' income is significantly positively impacted by industrialization, resulting in higher incomes and overall economic advantages.

In summary, the findings indicate that industrialization has a notable effect on farmers' income, employment, and productivity in agriculture sector, but not on the agriculture sector as a whole. Farmers' perceptions of industrialization also varied significantly from one another.

Major Findings

1. Researcher found that growth rate of GDP of Maharashtra is constantly higher than India's overall GDP growth rate ***($GDP_I < GDP_M$. 6.98 < 7.73)***
2. Researchers found that the growth rate of the industrial sector in Maharashtra is higher than the growth rate of the industrial sector in India. ***($IGR_I < IGR_M$. 3.79 < 4.39)***
3. Researchers found that the growth rate of the agriculture sector in Maharashtra is higher than the growth rate of the agriculture sector in India. ***($AGR_I < AGR_M$. 4.17 < 4.78)***
4. According to present survey research, researchers found that the Maharashtra's employment growth rate is growing at a faster rate than the country as a whole. ***($EGR_I < EGR_M$. 1.89 < 2.06)***
5. Researcher found that there is no significant relationship between industrial growth and agriculture growth. ***(n=10, r = 0.20, p= 0.580 >0.05)***
6. Researchers found that the majority of respondents agree with the increased use of chemical fertilizers and pesticides, machinery and

technology replacing manual labor and traditional farming practices and food processing and packaging in the agriculture sector due to industrialization. ***(df=4. x^2 Value= 129.51, p= 0.0001 < 0.05)***

7. Researcher found that the Industrialization has a significant positive impact on agricultural productivity, particularly in areas like increasing efficiency, irrigation, and high-yielding crop varieties etc. ***(df=4. x^2 Value= 118.08, p= 0.0001 < 0.05)***
8. Industrialization has improved market access, prices, profitability, and agricultural yields, leading to increased income for farmers. ***(df=4 . x^2 Value= 99.35, p= 0.0001 < 0.05)***

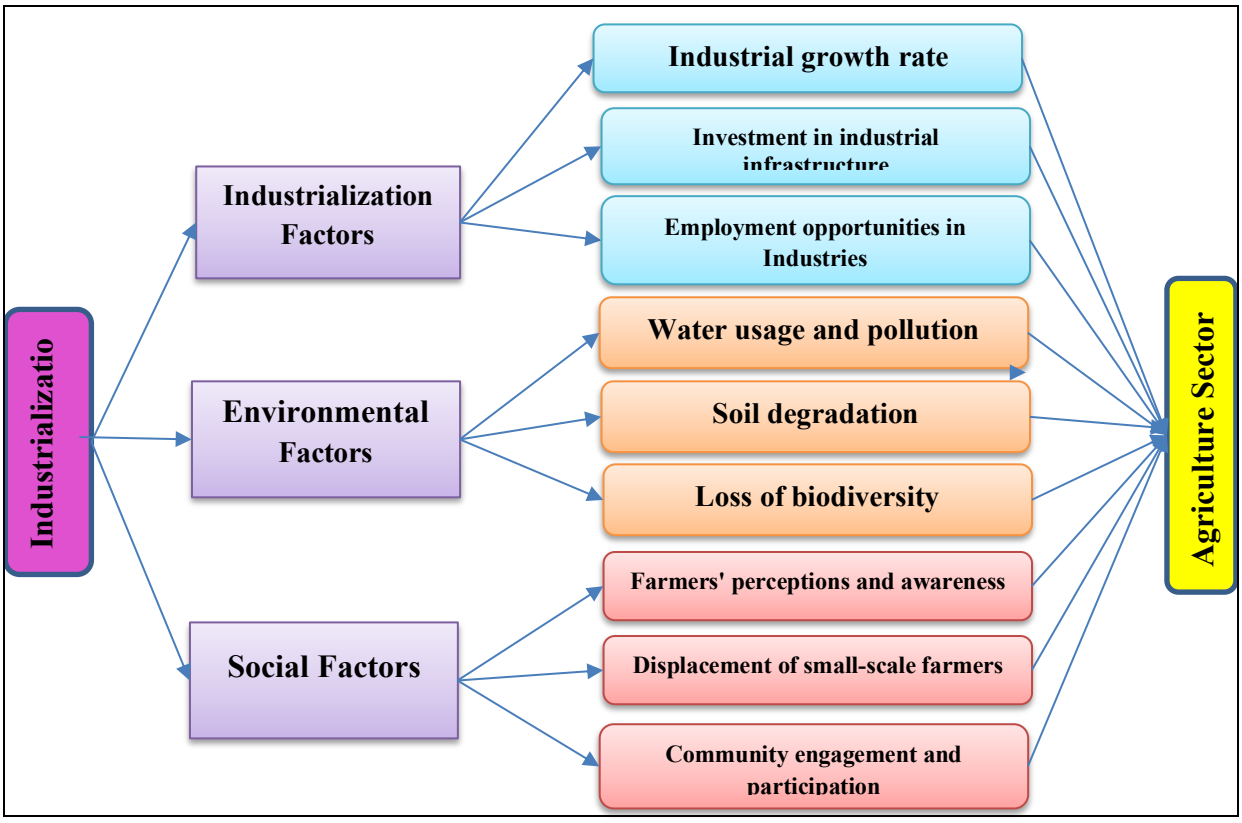
Summary and Conclusion

This study examined how industrialisation has affected Pune district agriculture, particularly in the Chakan region. A number of factors were examined in the study, such as farmers' opinions, agricultural output, jobs, and income. The agriculture industry in the Pune district's Chakan area has been significantly impacted by industrialisation. While there are advantages, such more revenue and production, there are drawbacks, like environmental damage and the loss of small-scale farming. In order to guarantee sustainable development, it is imperative that policymakers and stakeholders tackle these issues and execute approaches that strike a balance between industrial expansion and agricultural advancement.

Limitations of the study and Scope for further research

One of the few limitations of the study is the sampling method. In this study, Purposive sampling method was used to collect the data. Being a non-probability sampling method, generalization of the result could be an issue and future researchers can make use of some probability sampling. Comparative studies across regions or countries with similar industrialization trajectories can highlight best practices and lessons learned in promoting inclusive growth and reducing regional disparities. Further researchers should attempt to make the research area more comprehensive by adding additional farmers.

Proposed Model on Industrialization



Authors Contribution

Prof. Hanumant Marathe came up with the idea and then designed a quantitative framework to conduct this empirical study. Prof. Hanumant Marathe conducted a comprehensive literature review of existing studies, referred to reputed journals and finally prepared a proper research plan for the study. Professor Dr. Zagade Sunil closely monitored and supervised the research.

Conflict of Interest

The author certifies that he has no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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