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Sustainable Practices for the Agricultural Industries: An Environmental Perspective

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ABSTRACT
The growing demands of food and relate products led to replacement of manual means of farming to mechanized farming. Agricultural equipment manufacturing industries play a vital role to promote agribusiness sector of India. Indian farming or the agricultural tools industry spread over the range of equipment utilized for the various tasks throughout the farming value chain. Production of the fundamental farming implements has been basically by the tiny devices along with the village artisans, tiny scale industries as well as the "State Agro-Industrial Development Corporations". Hence agricultural machineries and implements started growing in demand and manufacturing started taking place. It went on increasing and still increasing This further led to influencing environmental pollution in reverse way. This research papers aims to explore the present impact of agriculture implements manufacturing sectors with its effects on environment and pollution and analyze the means and various steps to reduce the same.

Keywords
Agriculture, Agriculture Implements, Environment, Pollution, CSR.

1. INTRODUCTION
With improved cropping strength or the intensity, growers have been accompanied or even mostly changed animate strength with the tractors, power or the energy tillers, electric motors as well as diesel engines [1, 3, 4]. The expansion in electromechanical energy or the power of India has been apparent from the selling of tractors as well as strength tillers, used as a signal to adopt the mechanical ways of agriculture [2, 9, 10, 11]. The category of businesses in India has been dependent on the complete capital expenditure (plant as well as machinery) preferably the quantity of personnel hired. These are

- Large Scale Industries
- Moderate Scope Industries
- Tiny-Scale Industries
- Small Industries
- Cottage Industries
- Village craftsmen.

This particular category had been carried out to assist the small scale devices through incentives as well as advertising assistance. The shortage of labor for farming pursuits has been anticipated to produce manifold in succeeding years [12, 14]. The considerable degree of food costs will imply increase earnings for growers [5, 7, 13]. This can lead to larger paying by the farmers particularly on the options to improve by mechanizing their farming efficiency along with the result [6, 8, 15]. Thus, the need for farming equipment between farmers has been apt to increase considerably in the next 5 years.

2. VARIABLE IDENTIFICATION
A questionnaire was prepared by systematically referring to current research problem portraying similar investigations with variables being identified. It includes the feasibility factor of industry like size, product manufacturing no. of workers work inside the industry, fuel used by industry for manufacturing the product.

Table 1: Company profile variables

Profile	Variables
Company Profile	Industry Size
	Product
	Manufacturing
	No. of Worker Type
	Type of Operation

All the five variables show in table 2.

Table 2: Description of variables

Section	Considered Parameters	Variables
A	9	Type of pollution emission
B	10 Parameters	□ Impact on natural environment □ Impaction on socio-economic environment □ Economic growth
C	4 Parameters	CSR activities by industries
D	13 Parameters	Environmental management plan for industries □ Input/raw material stages □ Processing stage □ Out-put stage
E	7 Parameters	Environment management plan for government □ Implementation □ Governance

2.1 Section A

It includes one variable like type of pollution emission and having nine parameters which show the original source of pollution emitted by the industries.

2.2 Section B

It includes impact of variables on the natural environment, impacts on the social-economic environment and economic growth. It has 13 indicators taken from the literature review.

- Impact on the natural environment: Pollution created by industries in the atmosphere, which causes global warming on the Earth. With this effect, animals and humans have to face natural calamities.
- Impact on socio-economic environment: pollution dispersed by the industries, air, water, and food became contaminated and various types of diseases spread. The fertility of agriculture land also decreases due to the adverse effects of pollution.

2.3 Section C

This section considers various CSR activities performed by industries to improve the living finally, tree plantation by industries that sustain the greenery of the environment is also being included.

2.4 Section D

It includes Environment Management Plan for industries and 13 factors picked up from literature review. Industries should follow the rules of the Environment Management Plan.

2.5 Section E

It includes implementation and governance consisting of two variables and seven indicators as chosen from the review of the literature.

- Implementations: Along with industries, the government should follow the rule of the Environment Management Plan. The government should warn the public about the environment.
- The government should initiate strict action against the industry, which is spreading dangerous quantity of pollutants. The government should undertake the environment audits periodically.

3. SAMPLING

- Population- All the industries which manufacture agricultural implements located in Punjab, Haryana and Delhi NCR
- Sampling method- Based on industry manufacturing unit size. A total of 3 types of industries has been taken for study i. Micro ii. Small iii. Large.
  These industries were selected randomly in Punjab, Haryana and Delhi NCR region.
- Sample size- Data has been collected from 80 agricultural manufacturing implements industries according to their size-wise category by using organized questionnaire.

Table 3: State vise total number of industries

S.No	State	Number of industries
1.	Punjab	296
2.	Haryana	75
3.	Delhi including NCR	50

Table 4: Represents the government-recognized industries

	Punjab	Haryana	Delhi NCR	Total
Total AEM industries	296	75	50	421
Visited	94	64	10	168
Questionnaire not returned	63	20	5	88
Final Sample	31	44	5	80

Tool of data collection- it was primary data study hence researcher collected a data through organized questionnaire. Collected data through questionnaire has analyzed by SPSS 21 and SPSS AMOS 24 software. In SPSS 21 various test apply based on variable nature.

Table 5: Test apply on collected data for analysis

Test apply on variables	Purpose
Cronbach's Alpha	Checking reliability
Skewness and Kurtosis	Checking outliers
Kolmogorov-Smirnov (KS)	For normality
Descriptive Statistics	Evaluating the frequency of industry variable
Independent t-test	Checking the level of significance about the pollution emission
ANOVA	To checking the variation in population on the basis of industry profile variable in CSR activities and pollution emission

4. DATA ANALYSIS

SPSS AMOSS 24- used for path analysis for establishing the relationship between the model variables to get the regression value.

Table 6: Location of company

	Frequency	Percent	Valid Percent	Cumulative Percent
1 Haryana	44	55.0	55.0	55.0
2 Punjab	31	38.8	38.8	93.8
Valid				
3 NCR area	5	6.3	6.3	100.0
Total	80	100.0	100.0	

Table 7: Industry size wise companies

	Frequency	Percent	Valid Percent	Cumulative Percent
1 Micro	7	8.8	8.8	8.8
2 Small	57	71.3	71.3	80.0
Valid				
3 Large	16	20.0	20.0	100.0
Total	80	100.0	100.0	

Table 8: Product Type wise number of companies

Companies	Frequency	Percent	Valid Percent	Cumulative Percent
1 Micro	11	13.8	13.8	13.8
2 Small	53	66.3	66.3	80.0
Valid				
3 Large	16	20.0	20.0	100.0
Total	80	100.0	100.0	

Table 9: Workers wise companies

		Frequency	Percent	Valid Percent	Cumulative Percent
	1 10-100 nos.	59	73.8	73.8	73.8
	2 101-1k nos.	15	18.8	18.8	92.5
Valid	3 1001-5k nos.	3	3.8	3.8	96.3
	4 Above 5K	3	3.8	3.8	100.0
	Total	80	100.0	100.0	

Table 10: Type of fuel used wise companies

	Frequency	Percent	Valid Percent	Cumulative Percent
1 Steam based	22	27.5	27.5	27.5
2 Electric based	50	62.5	62.5	90.0
Valid				
4 Polluting fuel	8	10.0	10.0	100.0
Total	80	100.0	100.0	

Table 11: Operation type wise companies

		Frequency	Percent	Valid Percent	Cumulative Percent
	1 End to end manufacturer	50	62.5	62.5	62.5
	2 Assembly unit	18	22.5	22.5	85.0
Valid	3 Purchase raw material n manufacture	12	15.0	15.0	100.0
	Total	80	100.0	100.0	

5. DATA NORMALITY

If the dots of Normal Q-Q plots are on line or nearer to line then data is considered to be normal. Data normality has been checked for various statements of pollution emission and 4 statements of CSR practices, as ANOVA is applied on these statements, where data normality is required.

Normality of Pollution Emission Statements

From Figure. 1 to 4 the data normality of pollution emission statements has been checked as T test and ANOVA is applied on these statements in objective no. 1 and 2 respectively.

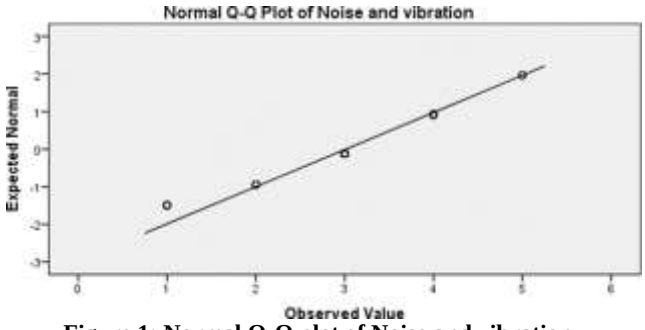

Figure 1: Normal Q-Q plot of Noise and vibration

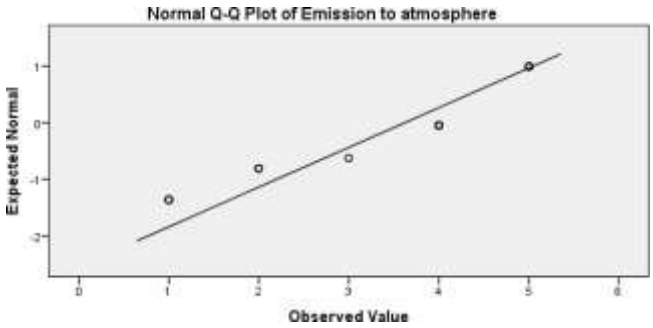

Figure 2: Normal Q-Q plot of Emission to atmosphere

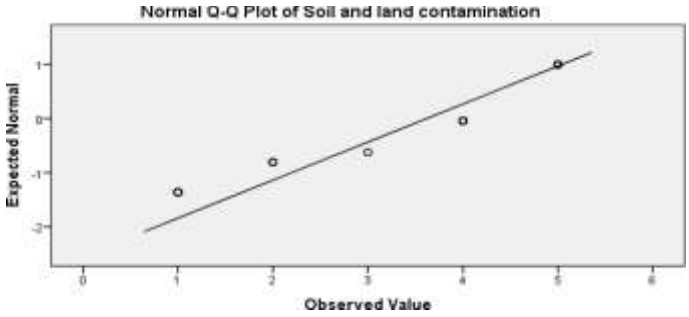

Figure 3: Normal Q-Q plot of Soil and land contamination

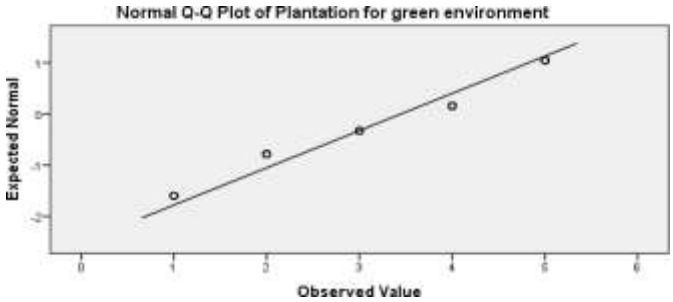

Figure 4: Normal Q-Q plot of Plantation for green environment

6. OBJECTIVE ANALYSIS AND HYPOTHESIS TESTING

First objective- An evaluation of the current scenario of Agricultural product manufacturing industries w.r.t their emission of pollutants and their level of significance Confidence interval- 95%.

Technique used- Descriptive to check the mean values and one sample T test to check the level of emission significance.

6.1 Hypothesis Testing

Table 12: 1st Objective Hypothesis Testing

Sr.no.	Null Hypothesis	Sig. Value	Mean Value	Result
1.1	The level of dust emission is not significant μ≤3.	.000***	3.69	Alternate accepted
1.2	The level of odour emission is not significant μ≤3.	.000***	3.69	Alternate accepted
1.3	The level of noise and vibration emission is not significant μ≤3.	.000***	4.14	Alternate accepted
1.4	The level of emission to atmosphere (fumes/gases) is not significant μ≤3.	.000***	3.63	Alternate accepted
1.5	The level of sewer discharge is not significant μ≤3.	.912	3.01	Null accepted
1.6	The level of water ways discharge is not significant μ≤3.	.000	1.58	Null accepted
1.7	The level of ground water discharge is not significant μ≤3.	.000	1.53	Null accepted
1.8	The level of emission to soil and land is not significant μ≤3.	.000***	3.63	Alternate accepted
1.9	The level of emission to underground storage tank is not significant μ≤3.	.019*	3.40	Alternate accepted

Sig. value- * significant at 1%, ** significant at 5%, * significant at 10%**

Second Objective- To do a comparative analysis of the pollution emission variants on the basis of industry profile variables.

Technique used- ANOVA is used to compare the variance on the various industry profile variables.

Industry Type wise

Table 5.18 shows the mean value of the pollution emission by various industries on the basis of size of companies.

Table 5.19 of test of homogeneity of variance shows that, the variances across all the statements are equal except discharge to waterways.

Table 13: ANOVA table shows that except discharge to water ways

Table 13 Report								
	Industry size							
	1 Micro		2 Small		3 Large		Total	
	Mean	N	Mean	N	Mean	N	Mean	N
Dust	4.57	7	4.12	57	1.75	16	3.69	80
Odour	4.43	7	4.23	57	1.44	16	3.69	80
Noise and vibration	5.00	7	4.79	57	1.44	16	4.14	80
Emission to atmosphere (Fumes/gases)	4.71	7	4.04	57	1.69	16	3.63	80
Discharge to sewer (Foul and storm water)	3.57	7	3.33	57	1.63	16	3.01	80
Discharge to water-ways (River/ sea)	2.00	7	1.56	57	1.44	16	1.58	80
Discharge to ground-water	1.71	7	1.58	57	1.38	16	1.55	80
Soil and land contamination	4.43	7	4.02	57	1.88	16	3.63	80
Underground storage tank	4.57	7	3.68	57	1.88	16	3.40	80

Table 14: Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Dust	.842	2	77	.435
Odour	.806	2	77	.451
Noise and vibration	2.097	2	77	.130
Emission to atmosphere (Fumes/gases)	.755	2	77	.474
Discharge to sewer (Foul and storm water)	.123	2	77	.885
Discharge to water-ways (River/ sea)	4.161	2	77	.019
Discharge to ground-water	1.699	2	77	.190
Soil and land contamination	1.041	2	77	.358
Underground storage tank	1.655	2	77	.198

6.2 Second Objective Hypothesis Testing

Table 15: 2nd objective hypothesis testing (Industry Size wise)

Sr. No.	Null Hypothesis	Sig. Value	Result
2.1	There is no significant impact of industry size on dust emission.	.000***	Alternate accepted
2.2	There is no significant impact of industry size on odour emission.	.000***	Alternate accepted
2.3	There is no significant impact of industry size on noise and vibration emission.	.000***	Alternate accepted
2.4	There is no significant impact of industry size on emission to atmosphere (fumes/gases).	.000***	Alternate accepted
2.5	There is no significant impact of industry size on discharge to sewer.	.000***	Alternate accepted
2.6	There is no significant impact of industry size on discharge to waterways (Rivers/seas)	.103	Null accepted
2.7	There is no significant impact of industry size on discharge to groundwater.	.433	Null accepted
2.8	There is no significant impact of industry size on soil and land contamination.	.000***	Alternate accepted
2.9	There is no significant impact of industry size on underground storage tank.	.000***	Alternate accepted

Sig. value- * significant at 1%, ** significant at 5%, * significant at 10%**

Table 16 of ANOVA table shows that except discharge to water ways and discharge to groundwater all other significance value are less than .05 hence rest of the variables of pollution emission are significantly different from each other or at least one is different from others on the basis of type of product manufactured by industries.

Table 16: ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	62.006	2	31.003	21.472	.000
Dust	Within Groups	111.181	77	1.444		
	Total	173.188	79			
	Between Groups	85.142	2	42.571	37.231	.000
Odour	Within Groups	88.045	77	1.143		
	Total	173.188	79			
	Between Groups	98.097	2	49.049	36.529	.000

Noise and vibration	Within Groups	103.390	77	1.343		
	Total	201.488	79			
	Between Groups	51.387	2	25.694	15.534	.000
Emission to atmosphere (Fumes/gases)	Within Groups	127.363	77	1.654		
	Total	178.750	79			
	Between Groups	24.040	2	12.020	16.252	.000
Discharge to sewer (Foul and storm water)	Within Groups	56.948	77	.740		
	Total	80.988	79			
	Between Groups	.349	2	.175	.494	.612
Discharge to water-ways (River/ sea)	Within Groups	27.201	77	.353		
	Total	27.550	79			
	Between Groups	.456	2	.228	.526	.593
Discharge to ground-water	Within Groups	33.344	77	.433		
	Total	33.800	79			
	Between Groups	38.416	2	19.208	12.090	.000
Soil and land contamination	Within Groups	122.334	77	1.589		
	Total	160.750	79			
	Between Groups	31.401	2	15.700	8.292	.001
Underground storage tank	Within Groups	145.799	77	1.893		
	Total	177.200	79			

Table 17: Homogeneous subsets Tukey HSDa,b Emission to atmosphere (Fumes/gases)

Product Type	N	Subset for alpha = 0.05	
		1	2
3 Large	16	2.06	
2 Small	53		3.92
1 Micro	11		4.45
Sig.		1.000	.447

Means for groups in homogeneous subsets are displayed.

- Uses Harmonic Mean Sample Size = 17.414.
- The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table 18: Homogeneous subsets Tukey HSDa,b Discharge to sewer (Foul and storm water)

Product Type	N	Subset for alpha = 0.05	
		1	2
3 Large	16	1.94	
2 Small	53		3.23
1 Micro	11		3.55
Sig.		1.000	.520

Means for groups in homogeneous subsets are displayed.

- Uses Harmonic Mean Sample Size = 17.414.
- The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table 19: Homogeneous subsets Tukey HSDa,b Soil and land contamination

Product Type	N	Subset for alpha = 0.05	
		1	2
3 Large	16	2.25	
2 Small	53		3.92
1 Micro	11		4.18
Sig.		1.000	.819

Means for groups in homogeneous subsets are displayed.

- Uses Harmonic Mean Sample Size = 17.414.
- The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

7. CONCLUSION

Agricultural Implements manufacturing industries use raw material from the Iron and steel (Base Metal)) industry to produces agricultural machinery products. If we explore the research done in past, a majority of work has been taken on iron and steel industry regarding the environment. These industries are adversely affecting the environment in manufacturing process. This research has tried to add the link that the agricultural manufacturing industry is taking the raw material from iron and steel industry while the iron and steel industry is affecting the

environment in the process of production. For this reason research has also analyzed the relevant reference (objective wise) of manufacturing industries.

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