

A STUDY ON DETERMINANTS OF ENERGY EFFICIENCY AND ENVIRONMENTAL STANDARDS IN SPINNING INDUSTRIES OF TIRUPPUR AND VIRUDHUNAGAR REGIONS- A NECESSITY FOR SECTOR CONTRIBUTION FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

In India, the unsustainable growth of manufacturing industries poses a major environmental threat nowadays and has been functioning in an unmanageable energy crisis. Particularly, the second largest manufacturing sector in a country namely, textile sector is affected by both these problems. From the last two decades, this industry has been developed very rapidly in various forms like Handloom, power loom, textile and spinning, processing, garment and hosiery. As far as the spinning industries are concerned, at the national level, 2049 large and medium textile mills are functioning in India. Out of these, 893 large and medium textile mills are located in Tamil Nadu. Among these 18 are cooperative spinning mills, 17 National Textile Corporation Mills and 23 Composite Mills are important. Specifically, in Tiruppur and its adjacent area called Coimbatore regions, there are around 10,115 small, medium and large scale industries located in its five taluks namely Coimbatore (North), Coimbatore (South), Mettupalayam, Sullur, Pollachi. In other spinning industrial area namely Virudhunagar region of Tamil Nadu, there are 54 spinning mills are functioning. The spinning capacity of these industries is 14.75 million spindles with a labour force of about 2.17 lakhs. Nowadays, these textile industries are facing problems like shortage of electricity power and management of air and other pollutions. Due to absence of regular supply of electricity, the textile sector in Tamil Nadu has been affected to a great extent resulting in spinning industries manufacturing yarn, remaining idle. Besides this, due to the absence of separate standards for spinning industries, still there is confusion in putting optimal standards in the regions, so that, the issue of environmental governance in these regions has become an increasingly important concern. Therefore, this study is mainly centered on this crucial and sensitive issue and throws lights on the determinants, which are important to stipulate the optimal environmental standards and find out the means to maintain the level of energy efficiency by spinning industries. It is for this purpose, the researcher has taken into account many determinants which are responsible for sustainable environmental development in the six selected spinning industries in the regions of Tiruppur and Virudhunagar districts, in which the spinning industries are functioning. These determinants used for the basis for enforcement of any legislation for the abatement of pollution and assess the efficiency in energy utilization by the industry. Generally, in many of the medium level industries, there is a lack of infrastructure facilities to handle the pollution and emissions. Through this study, the researcher wants to know the important infrastructure facilities that are needed for pollution control and energy utilization for the spinning industries for the sustainable industrial development.

Key words: Sustainable Development, Energy efficiency, Environmental Standards, Medium level Spinning Industries, Pollution Control Management, Energy Utilization processes

I. INTRODUCTION

Sustainable development has emerged as a new paradigm in industrial development in response to the current discourse of development that overexploits natural environment for economic prosperity and pollution caused by industries. Any development that occurs in a nation should not harm human ecology and surrounding environment in which they live. In this context, we would like to state that any industrial sector

that developed in the country affected the environment, much. According to the estimates of the World Health Organization, it is clearly understood that about two million people die prematurely every year as the result of industrial pollution. Particularly, in India, the textile sectors developed very rapidly in various forms like Handloom, power loom, textile and spinning, processing, garment and hosiery products. As far as the spinning industries are concerned, at the national level, 2049 large and medium textile mills are

functioning in India. Out of these, 893 large and medium textile mills are located in Tamil Nadu. Among these, 18 cooperative spinning mills, 17 National Textile Corporation Mills and 23 Composite Mills are important. Particularly in one of the selected study areas namely, Theni district, there are 20 medium level spinning industries. Likewise, in Coimbatore district, around 10,000 small, medium and large scale industries are found in its located in its five taluks namely, Coimbatore (North), Coimbatore (South), Mettupalayam, Suler, Pollachi (In Valparai Taluk, spinning mills are not found functioning since it is located in a hill area). In other selected study area namely Virudhunagar region of Tamil Nadu, 54 spinning mills are functioning. Likewise, 115 medium and large level spinning industries are functioning in and around Tiruppur region. The spinning capacity of these industries is 14.75 million spindles, and the labour force is about 2.17 lakhs. These textile industries are facing problems like shortage of electricity power and management of air and other pollutions. Due to absence of regular supply of electricity, the textile sector in Tamil Nadu has been affected to a great extent resulting in spinning industries manufacturing yarn, remaining idle.

According to Southern India Mills Association, textile industrial production in Tamil Nadu is down by 20 to 30 percent; all the medium level spinning industries' output has fallen 20 percent. It is reported that entire spinning industries in Virudhu Nagar, Tiruppur, Erode, Palladam have been affected by 2-3 hours official power cuts. Due to this condition, several spinning units were closed down, and the spinning units in Tamil Nadu faced a power cut to the extent of 40 percent. In the last year, 392 units were closed down and around 2 lakh workers' lives were Jeopardized. The production of yarn, which was 4003.33 million kg during 2007-2008, dropped to 3239.17 million kg in the last three years. Many spinning units operate with minimum capacity. They were originally producing three thousand spindles in a day, but at present, they are able to produce only about 800 spindles and due to this problem, the medium level spinning industries have been affected to a great extent. These industries also emit more amounts of ozone depleting gases like carbon monoxide, carbon-di oxide, sulphur-di-oxide, etc. In the spinning industries, air pollution is a major problem. Apart from this, these spinning industries are also leading in emitting cotton waste pollutants like cotton yarn, cloth, knitted fabric

and other grey, white and other colour briefs wastes. A very few industries are only having the textile recycling plant, even though, some quantity of textile wastes which are produced by these industries, are used for cleaning and other purposes. But, the rest of the cotton cloth wastes are merely dumped into the city limit area. It poses a major environmental threat to people who are living in those areas.

A. Enforcement status of environmental standards in Tamil Nadu

In controlling the textile pollution, the Central and the State Pollution Control Boards are considered as nodal agencies for regulating the polluting activities. Generally in the regions of Tiruppur and Virudhunagar, Textile sector is considered as an un-eco friendly in terms of emissions and pollution. The quantity of these emissions and pollution are increasing day-by-day. In this regard, the Central government has also given guidelines to the states on various environmental matters. They have been given norms in terms of "do-s" and don't-s. The sectoral policies and programs pursued by the states are usually formulated within the framework of the national policies and guide lines. In Tamil Nadu, the policies and programs under environment policy are usually implemented through Tamil Nadu State Pollution Control Boards (TSPCBs). It has a greater role to play in the states to ensure sustainable development. Its work is based on the knowledge of pollutants, their chemistry and both short and long term effects on the receiving environment. In Tamil Nadu, in order to monitor pollution due to industrial source, the TNPCB categorized the industries as Red, Green, and Orange according to their pollution potential. The highly polluting industries have been categorized as ultra red and red category in order to exercise effective monitoring. Industries in the state are required to obtain the "consent for establishment" and "consent to operation" for the discharge of sewage/trade effluent into any stream or well or in to sewer or land under Water Act 1974 and Air Act 1981. During 2009-2010, Tamil Nadu Pollution Control Board had issued the consent order for the establishment of 7058 industrial units under Water Act and 6986 orders under Air Act. Legal Action has also been instituted against the erring industries for not complying with the pollution control laws. So far, show cause notices to 34,973 industries and closure order to 5417 industries were given. Due to the absence of separate standards for spinning industries, still there is confusion in putting

optimal standards in the regions. Besides this, the issue of environmental governance in these regions has become an increasingly important concern. Governance is about the process by which government takes decisions, and implements them with the participation of the community. The governance is concerned about finding out 1) who is responsible for causing pollution, 2) how they exert their power over those polluting industries and 3) how the government makes those industries accountable and prescribes environmental standards for industries which are polluting the environment. Therefore, this study is mainly centered on this crucial and sensitive issue and also focuses on the determinants, which can stipulate the environmental standards and suggests ways and means to maintain the level of energy efficiency by spinning industries.

B. Statement of the Problem under study

This study is mainly focused on the importance of need to review the determinants, which may lay down certain environmental standards and energy efficiency mechanisms in spinning industry. It is for this purpose, the researcher has taken into account many factors which are responsible for sustainable environmental development in the textile sectors in the regions of Tiruppur and Virudhunagar districts in which the spinning industries are functioning. In this context, the standards refer to the specific parameters quantified previously by the TSPCB with respect to measures for disposal, discharge and emissions of solid, liquid and other ozone depleting gases into the environment and adoption of energy saving practices by the selected spinning industries. These standards are used for enforcement of any legislation for the abatement of pollution and to assess the efficiency in energy utilization by the industry. In many of the medium level industries, there is lack of infrastructure facilities to handle the pollution and emissions. Through this study, the researcher wanted to know the significant facilities that are essential for pollution control and energy utilization for the spinning industries for the sustainable industrial development.

C. Review of related literature

Since the research study deals about the energy efficiency and pollution control management in spinning industries, the researcher gone through many related articles, and initially he got some basic insights from the article entitled, *Promise and Potential* written by T.S. Subramanian. And from this article he collected

some basic information related to the status of textile development in India and Tamil Nadu. The next review which deals about the importance of Extended SCM in textile industry, and as per the article, ESCM is the systematic, strategic coordination of the traditional textile business functions and the tactics across these business functions with green approach within a textile industry and across businesses within the supply chain, for the purpose of improving the long-term performance of the individual industry and the supply chain as a whole (Mentzer et al., 2007). Likewise, Indian textile industry will need to cover a lot of crucial environmental issues and manage the environmental and sustainability concerns (Vivek 2009). As per the author, Banerji, Rajat, Z "because of textile along the Noyyal riverbanks in Tiruppur region, over 100,000 cubic meters of effluents and air pollution let out into river and atmosphere" (Banerji, Rajat 2009). The present textile sector should change its approach into sustainable industrial Development with environmental concern (McDonough 2007)). The author Thangamuthu says that the demand for electricity for the entire state is between 11,000 to 12,000 megawatt, while the supply of position is around 9000 MW and the actual production in the state is about 7,000 megawatt, which means the production –demand gap is around 4,000 to 5,000 Mega Watt. At present the demand availability-gap is 2000-3000 megawatt. It means that Tamil Nadu is in a precarious situation terms of electricity generation (2011).

II. OBJECTIVES

1. To know the background of prescribed environmental standards in textile industries and the regional importance of Tiruppur and Virudhunagar.
2. To study the environmental laws and the present pollution control management in Tamil Nadu.
3. To learn about the availability of pollution management technology and other energy saving practices in the six spinning industries of Tiruppur and Virudhunagar districts of Tamil Nadu.
4. To assess the determinants, which is influencing the environmental standards in textile industries.

III. METHODOLOGY

In this study, the descriptive method study and Survey research were used. The study was conducted by distributing questionnaires to about 60 respondents

who were the stakeholders in the spinning industry sector. The stakeholders were members of the textile associations, personnel of Tamil Nadu Pollution Control Board and employers working in six spinning industries located in the regions of two districts i.e. Tiruppur and Virudhunagar. The selected spinning industries are as follows:

1. Sulochana Cotton Spinning Mills, Palladam Road, Tiruppur.
2. Tiruppur Textiles Private Ltd (Unit 1), Avinasi Road, Tiruppur.
3. Tiruppur Textiles Private Ltd (Unit 3), Anuppar Palayam, Avinasi Road, Tiruppur.
4. Umayal Spinners Pvt Ltd, Virudhu Nagar District.
5. S.A. Anandan Spinning Mill (P) Ltd, Raja palayam, Virudhu Nagar District
6. Muthulaxmi Spinning Mills (P) Ltd, Srivilliputhur, Virudhunagar District.

A structured Questionnaire was used to elicit information and opinion from the respondents. The crucial contents were on fixation of environmental standards and efficiency of energy utilization, water consumption, air pollution and waste water generation and its out-let facilities, eco-friendly techniques used in the industries, using cleaner production technology, principles of corporate social responsibility, compressor air management etc. The study was conducted during July 10th –September 7th 2011. The sample size of 60 was selected and six spinning industries were visited for collecting the primary data. The secondary data were collected from studies, published articles from E-Journals and annual reports of selected industries. Table 1 summarizes the observed parameters in selected six spinning industries. The sample survey had an equal distribution of respondents from all the six selected industries in Tiruppur and Virudhunagar districts.

A. Regional Importance of the Study Areas

In the selected study areas, Tiruppur city has recently been upgraded as a Corporation. This city is located on the banks of the river Noyyal. Many textile mills and engineering industries are present around the city. It is the country's largest exporters of yarn and knitwear. They are well known for textile manufacturing industries. It is referred to as "Textile Valley of India". The city accounts for 90 percent of India's cotton

knitwear export and contributes over Rs.12,000 Crore worth of foreign exchange. Several spinning units, knitwear units running on power looms depend on 700 odd dyeing units situated in and around Tiruppur. Most of the dyeing units used to discharge untreated effluents in the Noyyal river passing through Tiruppur. Many stakeholders, besides NGO's have been complaining about the deleterious effects of discharging untreated effluents from the dyeing units.

Table 1. Determinants of energy efficiency and pollution management of spinning industries

Selected Determinants of Energy and Water Utilization	Determinants of Pollution Control Management
The efficiency of energy utilization and energy saving practices in the spinning industry	Suitable strategy used in the industries for controlling the air pollution and other liquid wastages disposed from the industries
Reasons for inefficiency in utilizing the electricity resources in the spinning industry	Functional efficiency of pollution control enforcement agencies
Level of water usages in the region by the textile industries	Specific reasons were mentioned for failure of the pollution controlling machineries in the spinning industry
Possibilities of implementing the extended supply chain management practices	Specific technology used for controlling pollution and maintaining the temperature and humidity
Possibilities of installing the cleaner and energy efficient technology	Possibilities of using eco-friendly technology
Available infrastructure facilities in monitoring the energy efficiency and utilizing of energy saving practices in spinning industries	Requirement of the other facilities for the fixation of environmental standards

Virudhunagar region also has many spinning Industries and a large number of yarn and fabrics units, Jaysons Industries etc. This region covers Srivilliputhur, Rajapalayam, Kovilpatty etc. The spinning mills of this region is involved in the production of dobby fabrics, self design yarn, fabrics and exports of poplins, drill, twill, satin stripes, ottoman, surgical glows and condoms. The textile industries in the region emit more air pollution. It affects in and around the Virudhunagar districts. Power shortage is a major problem in the region. Due to the various production level problems in the region, many medium level spinning industries have been closed.

IV. SURVEY RESULTS AND DISCUSSION

The main objective of the present study was to examine the factors or determinants for stipulation of environmental standards and energy efficiency in the spinning industries. To achieve the results, the specific objectives were framed and the researcher administered Questionnaire, which had 23 questions, and there were 60 respondents. Through their opinions, the researcher had the opportunity to know the determinants and the factors that could play a major role in recommending the environmental standards and making spinning industries as energy efficient. For analyzing their opinions and response, the researcher used the statistical tool i.e. percentage analysis. The data interpretation and discussion clearly showed the respondents' opinions regarding the factors, which were essential for the establishment of environmental standards which covered both energy efficiency practices and pollution control management in spinning industries:

A. Factors or determinants essential for improving the energy efficiency in spinning industry

The researcher tried first to get answers from the respondents regarding the factors or determinants essential for bringing efficiency in existing energy utilization and saving practices in spinning industries, by inviting them to specify their opinion about the strategy that they considered more suitable for improving the utilization in spinning industry. All the answers which got from the respondents through questionnaire were converted into percentage by using of SPSS (Statistical Package for Social Sciences). The following were the statements which we gave to the respondents and the answers which we got from them, and the first statement was,

1. The efficiency of textile machinery can be improved by

Table 2. Opinions of Respondents for Energy utilization

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Reducing voltage drop	12	20
2.	Reducing voltage imbalance and avoiding poor contacts within circuit breakers	18	30
3.	Optimizing machine speed	16	27
4.	Using of quality belts	14	23
5.	Others	0	0
	Total	60	100

Among the 60 respondents, the majority (30%) of the respondents opined that using voltage balance and avoiding poor contacts within circuit breakers could help in improving the energy utilization in spinning industries. The next significant percentage (27%) of the respondents expressed optimizing the machinery speed would help in this regard.

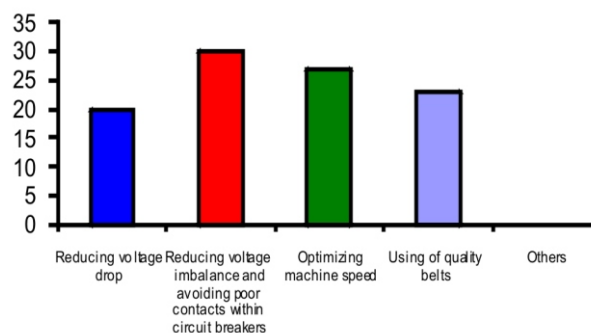


Fig. 1. Opinions of Respondents for Energy utilization

2. In the present situation, bringing any modernization of the industry is very tough.

Table 3. Opinions of Respondents for modernization

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	36	60
2.	No	14	23
3.	Can't Predict	10	17
	Total	60	100

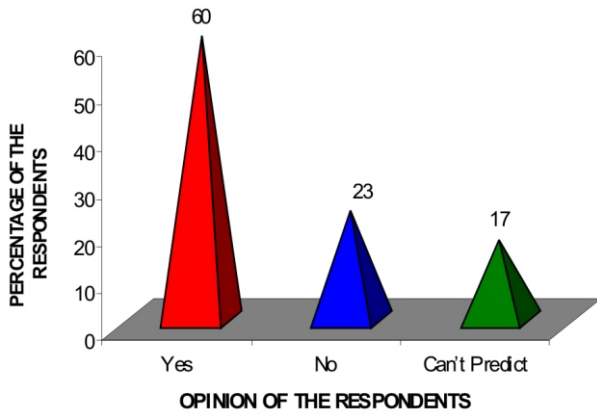


Fig. 2. Opinions of the respondents for modernization

Table 4. Opinions of Respondents of water usage

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	It is high amount of water wasted daily unnecessarily	13	22
2.	It is low amount of water, which is not enough to meet a day today need.	16	27
3.	It is optimal level of resource, which is necessary for factory function of these units	29	48
4.	Others	2	3
	Total	60	100

Among the 60 percent of the respondents, 37 percent of the respondents stated that modernization in their industries was tough and 23% of the respondents answered positively.

3. You are one among the leading textile industries and you together used around 100 million litter per day in your point of view,



Fig. 3. Opinions of the respondents of water usage

To the question regarding the amount of water resource used by the leading textile industries, the majority of the respondents (48%) said that, it was the optimum level (100 million liters) of resource, which was necessary for the functioning of their units. The remaining 27% of the respondents informed that it was insufficient water, which was not enough to meet even for day-to-day need.

4. The main reason for failure in running the textile industries in your region.

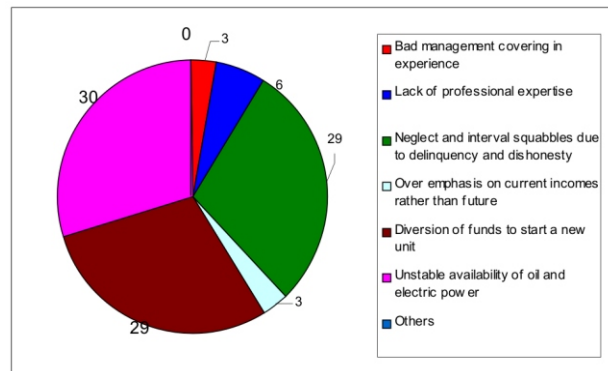


Fig. 4. Opinion of Respondents for the failure of running Industries

Table 5. Opinions of Respondents for failure of running Industries

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Bad management covering in experience	2	3
2.	Lack of professional expertise	4	6
3.	Neglect and interval squabbles due to delinquency and dishonesty	17	29
4.	Over emphasis on current incomes rather than future	2	3
5.	Diversion of funds to start a new unit	17	29
6.	Unstable availability of oil and electric power	18	30
7.	Others	0	0
	Total	60	100

Regarding the statement, “the main reason for failure in running the textile industries in your region”, Thirty percent of the respondents revealed the fact that the unstable availability of crude oil and electric power were the main reasons for the failure of running the industries in the two regions, followed by 29 percent expressing neglect and internal squabbles to delinquency and dishonesty. The remaining 29 percent stated that sudden diversion of funds to start a new textile unit was the cause.

5. The textile industry of Tiruppur / Virudhunagar has failed to initiate a comprehensive energy saving and emission reduction programme for sustainable production and consumption

Table 6. Opinions of Respondents for sustainable production

S. No.	Opinions of the Respondents	Frequency	Percentage
1	Strongly agree	19	32
2.	Agree	22	37
3.	Neutral	8	13
4.	Disagree	3	5
5.	Strongly disagree	8	13
	Total	60	100

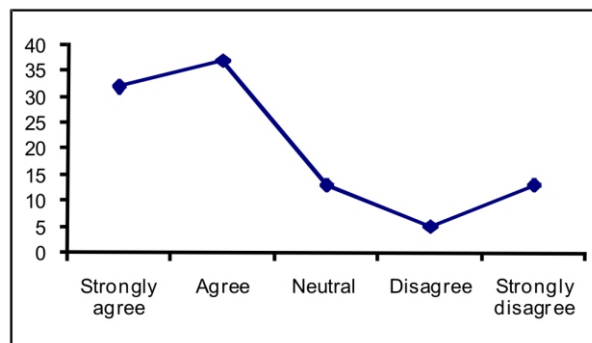


Fig. 5. Opinions of Respondents for sustainable production

The above table shows that the textile industries of Tiruppur and Virudhunagar have failed to initiate a comprehensive energy saving and emission reduction programme for sustainable production and consumption, and to this question, the majority (37%) of the respondents agreed with the contention, and the next majority percentage (32%) strongly agreed with the contention of the researcher.

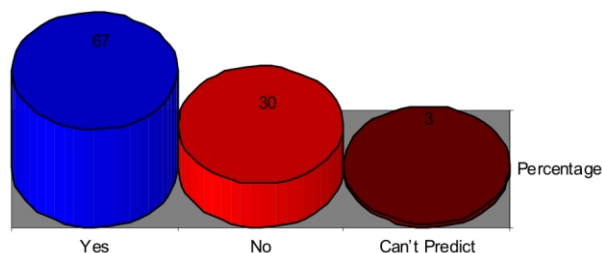


Fig. 6. Opinions of Respondents for energy saving

6. Extended supply chain practices (ESC) may be a correct strategy for energy saving and emission reduction.

Table 6. Opinions of Respondents to energy saving

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	40	67
2.	No	18	30
3.	Can't Predict	2	3
	Total	60	100

Sixty -seven percent of the respondents said that the supply chain practices was an acceptable strategy for energy saving and emission reduction, and 30 percent answered negatively.

7. It is also the best way of monitoring energy efficiency and environmental standards in spinning industry.

Table 7. Opinions of Respondents for monitoring energy efficiency

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	To conduct periodical environment audit	6	10
2.	Periodical preparation of CSR of textile industry	8	13
3.	Optimizing spinning machinery speed	18	30
4.	Concentrating on automation and power quality issues of spinning industry	6	10
5.	Utilization of alternative power energy	2	3
6.	All of the above	20	34
	Total	60	100

The above table shows the percentage of the respondents who gave their opinion for the statement that “the best way of monitoring energy efficiency and environmental standards in spinning industry”.

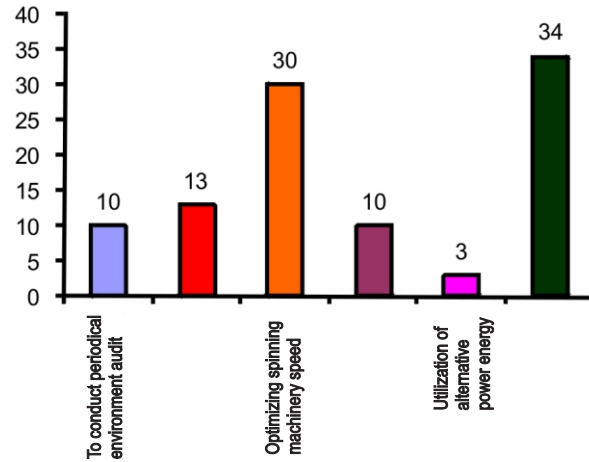


Fig. 7. Opinions of Respondents for monitoring energy efficiency

The Percentage and the opinions of the respondents are given below:

- (i) Conducting a periodical environmental audit (10%)
- (ii). Periodical preparation of corporate social responsibility of textile industry. (13%)
- (iii) Optimizing spinning machinery speed (30%)
- (iv) Concentrating on machinery automation and power quality issues of spinning industries. (10%)
- (v) Utilizaion of alternative power energy. (3%)

8. You think that energy saving practices in your industries may be followed by the following ways.

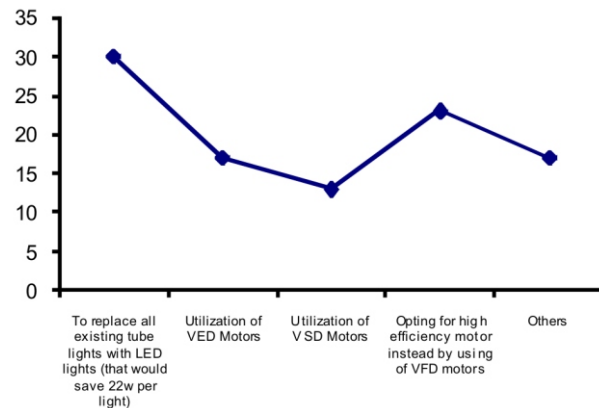


Fig. 8. Opinions of Respondents for electrical components

Table 8. Opinions of Respondents for electrical components

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	To replace all existing tube lights with LED lights (that would save 22w per light)	18	30
2.	Utilization of VED Motors	10	17
3.	Utilization of VSD Motors	8	13
4.	Opting for high efficiency motor instead by using of VFD motors	14	23
5.	Others	10	17
	Total	60	100

Table 9. Opinions of Respondents for Environmental conditions

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	We are not using any humidification plant in our industry	22	37
2.	Even though we have the facilities in our industry, due to its 20–25% of total energy, we are not ready to use it	4	6
3.	Due to poor design and maintenance, temporarily the staff are not using this plant	6	10
4.	We depend on other automatic humidity controllers for maintaining temperature and humidity	18	30
5.	Others	10	17
	Total	60	100

Thirty (30%) percent of the respondents were suggested that the replacement of all the tube lights by LED lights would save 22 watt per light. Twenty-three respondents (23%) said that high efficiency motors, instead of using VFD motors, would increase the efficiency.

9. Humidification plant is operated efficiently to maintain a certain level of temperature and humidity in the industry.

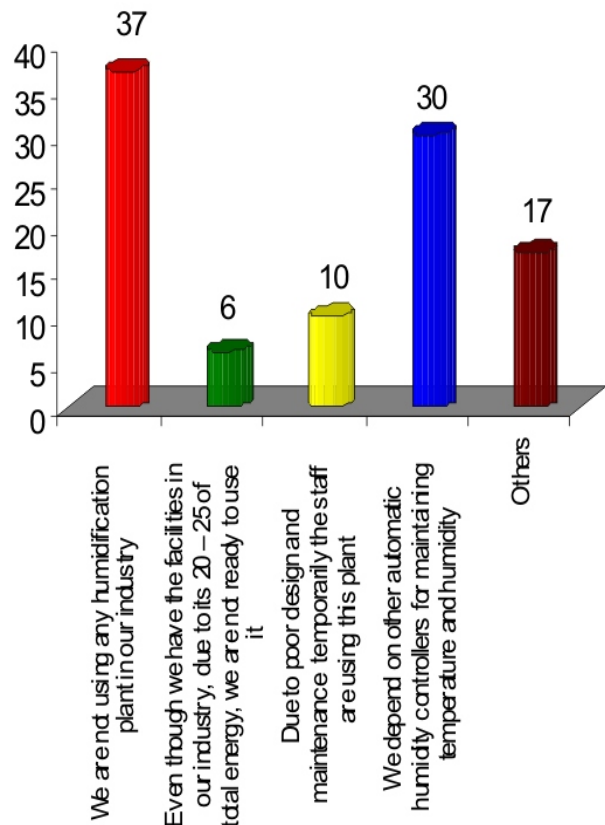


Fig. 9 Opinions of Respondents for Environmental conditions

Thirty seven (37%) percent of the respondents stated that humidification plant was not used in their industries and 30 percent stated that they were depending on other automatic controllers for maintaining temperature and humidity control.

B. Determinants of pollution control management in spinning industry

The following are the statements which contains the tentative statements which covers the factors or determinants which are essential for the pollution management in spinning industries, and they are as follows,

10. Industry failed to introduce successful pollution management strategies

Table 10. Opinions of Respondents for pollution management strategies

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	24	40
2.	No	32	53
3.	Can't Predict	4	7
	Total	60	100

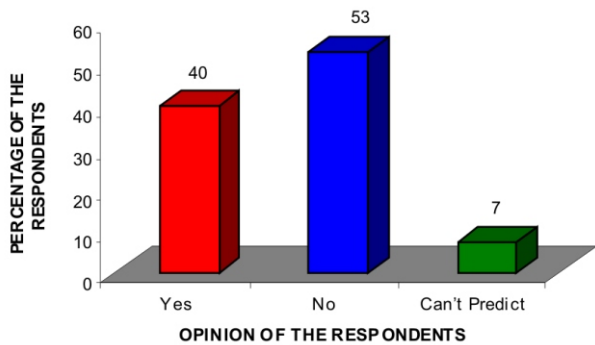


Fig. 10 Opinions of Respondents for pollution management strategies

To the question whether industry should introduce a successful pollution management strategies or not, the majority of the respondents (53%) opined positively and said that industries already introduced pollution management strategy. But, the rest of the respondents (40%) said that so far industries did not introduce any pollution management strategy.

11. One of the following strategies is more suitable for solving the problem of industrial pollution.

Table 11. Opinions of Respondents for Industrial pollution

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Effective effluent treatment	18	30
2.	Change of Production Process	2	3
3.	Bringing the cleaner production technology	20	33
4.	Replacement of older technology	20	34
5.	All of the above	0	0
6.	Others	0	0
	Total	60	100

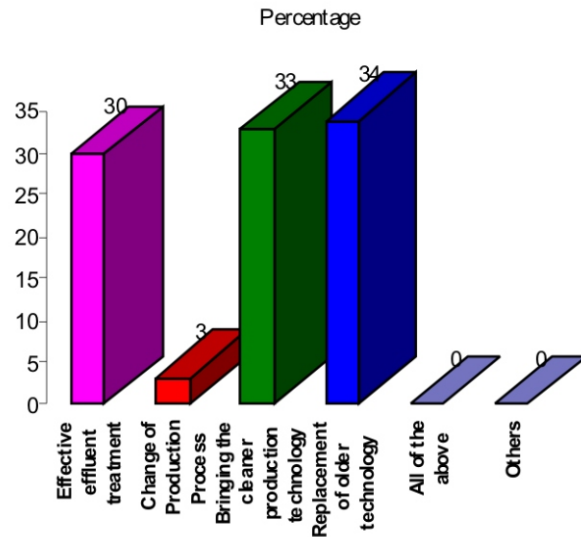


Fig. 11 Opinions of Respondents for Industrial pollution

Regarding the strategy, which is more suitable for solving the problem of industrial pollution, 33% of the respondents opined that bringing the cleaner production technology to the industry might be a good strategy. The other 33% of the respondents said that replacement of older technology was the suitable strategy. 18% percentage of the respondents opined that effective effluent treatment plant might be the correct solution for solving the pollution problems.

12. Pollution control enforcement agencies function effectively in these regions

Table 12. Opinions of Respondents for function of pollution control agencies

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	24	40
2.	No	26	43
3.	Can't Predict	10	17
	Total	60	100

As per the opinions of the majority (43%) of the respondents, the controlling functions of Pollution control enforcement agencies were not so effective. But, 40% of the respondents gave contradicting opinion that pollution control enforcement agency functioned effectively in controlling the polluted spinning industries. 17% of the respondents did not give any opinion on this particular statement. They told that Tamil Nadu State Pollution Control Board did not fix any separate environmental protection norms exclusively for spinning industries.

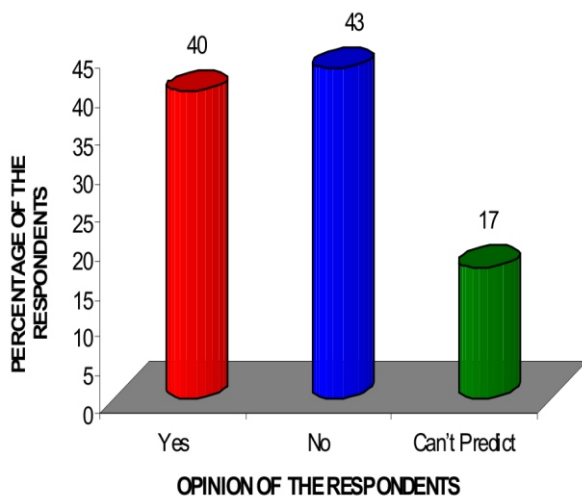


Fig. 12 Opinions of Respondents for function of pollution control agencies

13. The reason for failure of the pollution control enforcement in the Tiruppur / Virudhunagar region.

Table 13. Opinions of Respondents for failure of pollution control enforcements

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Personnel used to indulge in brief and corrupt activities	9	15
2.	Follow a lenient attitude towards some of their favourable industries	18	30
3.	Pollution control enforcement agencies do not have skilled personnel for monitoring the textile pollution activities	14	23
4.	It does not have the advanced technology to monitor the pollution commission in the regions	13	22
5.	Others	6	10
	Total	60	100

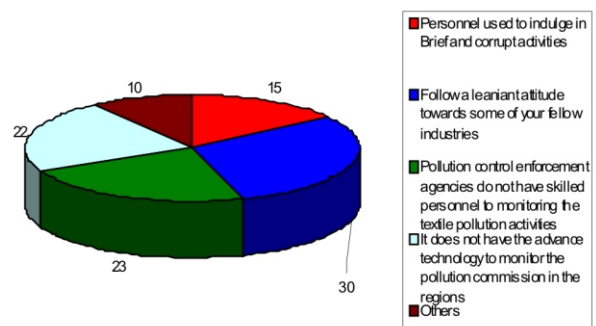


Fig. 13 Opinions of Respondents for failure of pollution control enforcement

The question regarding the main reason for the failure of the pollution control enforcement agencies,

the majority of the respondent told that following of lenient attitude towards the polluted spinning industries was the main reason, 23% percent of the respondents opined that the agency did not have the skilled personnel to monitor the textile pollution monitoring process. 22% percentage of the respondents opined that agency did not have adequate advanced technology to monitor the pollution activities of spinning industries.15% percentage of the respondents said that personnel of TSPCB sometimes indulged in corruption.

14. The existing pollution control practices and the scope for cleaner production approaches among these industrial units are in satisfactory level.

Table 14. Opinions of Respondents for cleaner production approaches

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	12	20
2.	No	44	73
3.	Can't Predict	4	7
	Total	60	100

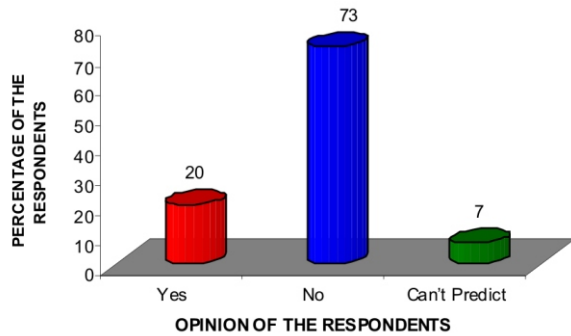


Fig. 14 Opinions of Respondents for cleaner for cleaner production approaches

For the question whether the pollution control practices and scope for implementing the cleaner production technology in selected industries were satisfactory or not, 73% percentage of the respondents opened negatively, that the existing pollution control practices and the scope for of cleaner production technology were not at a satisfactory level and only 20% of the respondents gave positive answer.

15. The textile industry that emits more pollution in the Tiruppur / Virudhunagar region.

Table 15. Opinions of Respondents Emitting pollution Industries

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Textile Dying Industries	29	48
2.	Cotton Spinning Industries	16	27
3.	Ginning Factory	6	10
4.	Apparel Industries	8	13
5.	All of the above	1	2
6.	Others	0	0
	Total	60	100

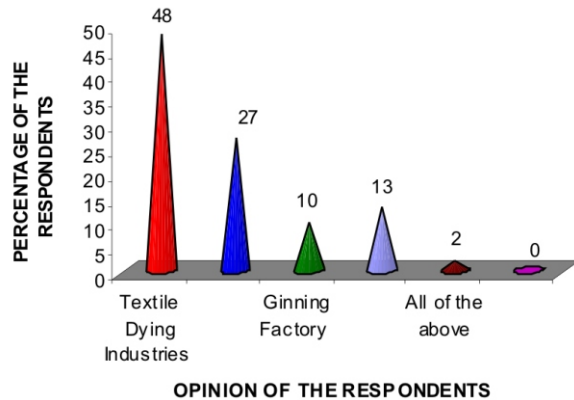


Fig. 15 Opinions of Respondents Emitting pollution Industries

Comparatively speaking, to the statement which industry emitted more pollution, the majority of the respondents (48%) opined that textile dying industries emitted more pollution in the regions and only 27 percentage of the respondents opined that spinning industry emitted more pollution.

16. Establishment of individual treatment plant (or) proper emission outlet is easy by the medium level industries without government assistance

Table 16. Opinions of Respondents for proper emission outlet without government assistance

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	43	23
2.	No	14	72
3.	Can't Predict	3	5
	Total	60	100

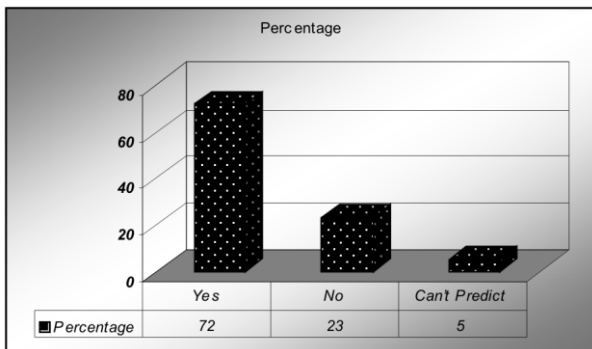


Fig. 16 Opinions of Respondents for proper emission outlet without government assistance

The question regarding establishment of treatment plants or recycle plants and emission outlets was easy without getting any government assistance for the medium level spinning industry, brought two kinds of answers: the majority (72%) of the respondents disagreed with the statement and 23% of the respondents agreed with the statement.

17. Establishment of individual treatment plant (or) proper emission outlet is easy by the medium level industries with government assistance

Table 17. Opinion of Respondents for proper emission outlet with government assistance

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	43	72
2.	No	14	23
3.	Can't Predict	3	5
	Total	60	100

To the question whether the establishment of individual treatment plant or proper emission outlet

without the government assistance in the medium level spinning industry is possible or not, 72% of the respondents opined positively. Only 23 percentages of the respondents opined negatively.

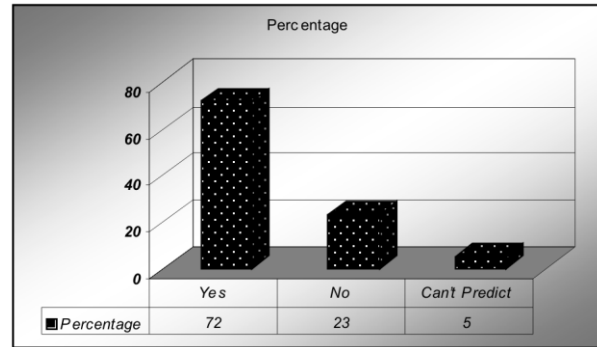


Fig. 17 Opinions of Respondents for proper emission outlet with government assistance

18. Getting sustainable certification for your industry in illegal (or) unsystematic way,

Table 18. Opinion of Respondents for sustainable certification

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	22	37
2.	No	23	38
3.	Can't Predict	15	25
	Total	60	100

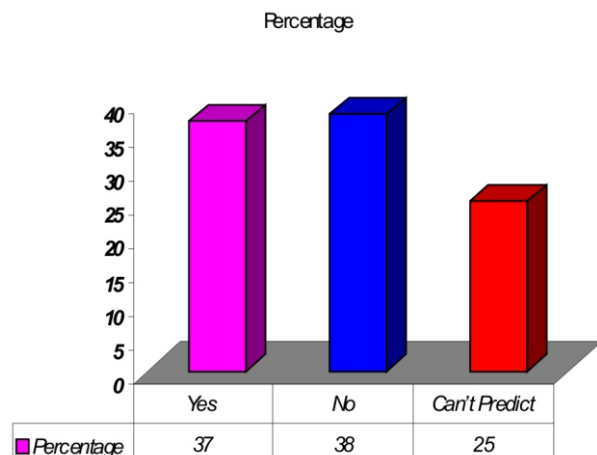


Fig. 18 Opinions of Respondents for sustainable certification

For the question regarding getting sustainable certificate from the standard certification agency by the spinning industries was through illegal or unsystematic way, the majority (37%) of the respondents gave negative answer. The rest of the respondents (37%) gave positive answers that all the industries used to get the standard certification by systematic and legal way.

19. Implementation of cleaner and energy efficiency technologies may also be correct strategy for reducing pollution level in textile industries.

Table 19. Opinions of Respondents for implementation of cleaner and energy efficiency technologies

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	42	70
2.	No	10	17
3.	Can't Predict	8	13
	Total	60	100

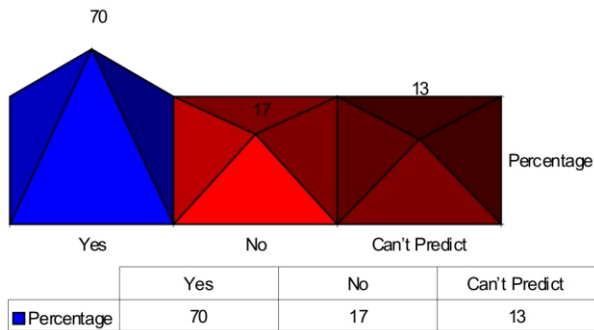


Fig. 19 Opinion of Respondents for implementation of cleaner and energy efficiency technologies

70% of the respondents opined positively for the statement implementation of cleaner and energy efficient technologies might be used for getting dual objectives of controlling pollution and energy saving, only 17% of the respondents opined negatively.

20. One of the following strategy may be a correct solution for reducing the pollution

Table 20. Opinion of Respondents for reducing pollution

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Renewed designing and operation of waste water treatment plants with government support	31	52
2.	Renewed environmental management system and certification	12	20
3.	Periodical preparation of CSR reforms	14	23
4.	All of the above	2	3
5.	Others	1	2
	Total	60	100

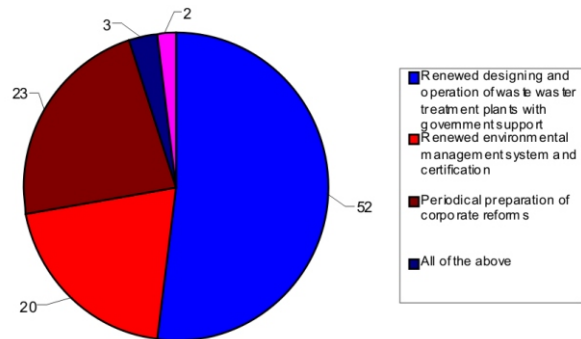


Fig. 20 Opinions of Respondents for reducing pollution

Regarding this question, the majority of the respondents opined that a renewed designing and operation of waste water treatment plants with government support may be a correct solution for reducing the pollution level. The other significant number of respondents told that making periodical preparation CSR reforms might help to reduce the

pollution level emitting from the industries, 20% of the respondents also opined that renewed environmental management system and certification may help to manage the pollution management.

21. You think that your industry is using compressed air in various operation within your industrial premises.

Table 21. Opinion of Respondents for usage of compressed air

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Yes	28	47
2.	No	21	35
3.	Can't Predict	11	18
	Total	60	100

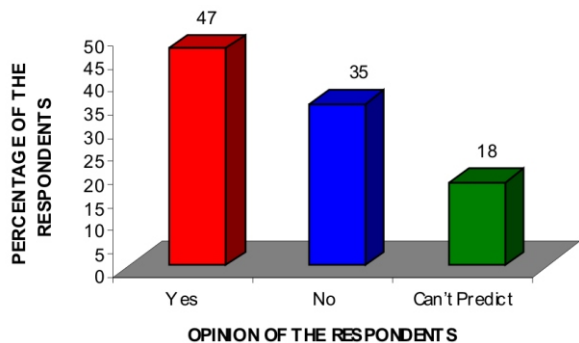


Fig. 21 Opinions of Respondents for usage of compressed air

For controlling air pollution inside the spinning industry, utilization of compressed air machineries might be a correct solution, 47 % of the respondents gave their positive answers. The other 35 % of the respondents opined negatively, that spinning industry need not depend on more numbers of air compression machineries.

22. If you are using compressed air machineries for what reasons you cannot utilize them effectively

Table 22. Opinions of Respondents for inefficient air compressor

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	It consumes about 5 – 10 of its total energy, our industry could not afford this much of energy	12	20
2.	Loss of compressed air occurs mainly due to leakages, pressure drops	14	23
3.	Using of old compressors	22	37
4.	Not having any modern ultrasonic leak-detectors	10	17
5.	Others	2	3
	Total	60	100

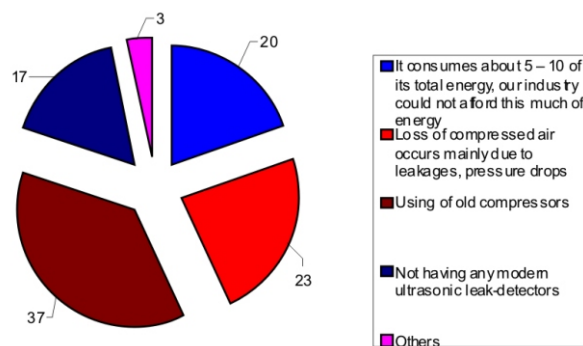


Fig. 22 Opinions of respondents for inefficient air compressor

For clear understanding, whether the usage of compressed air machineries in more number is good or not, 37 percentage of the respondents opined that most of the industries were using the compressor air machines, but all the machineries were old, in those machines, a frequent failure of functions did occur. The other 23 %of the respondents opined that if they used more number of compressed air machineries, there

would be a loss of air due to the frequent air leakage and pressure drops.

23. In your experience, how you can solve the problem and effectively manage the compressed air in your industry?

Table 23. Opinions of Respondents for solving the problem regarding air compressor

S. No.	Opinions of the Respondents	Frequency	Percentage
1.	Effective in-house Maintenance and Periodical Over-Hauling	20	33
2.	Proper Care of Network Pipes	10	17
3.	Pressure Optimization	8	13
4.	Trained staff	10	17
5.	Replacement of Old Compressors	10	17
6.	Others	2	3
	Total	60	100

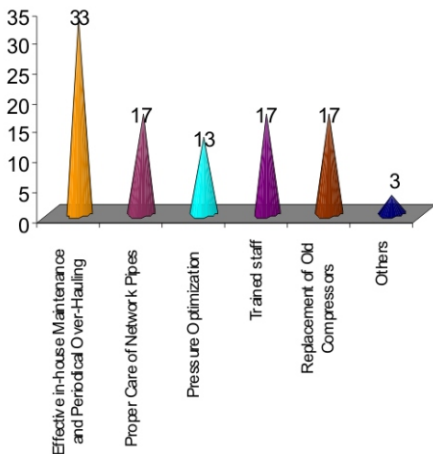


Fig. 23 Opinions of Respondents for solving the problem regarding air compressor

In order to manage the compressor air machineries effectively, a frequent in-house maintenance and periodical overhauling of compressor

machinery would give fruitful result according to 33% of respondents. But, the other 17 % of the respondents opined that replacement of old compressors might be a right solution. The other 17 % of the respondents told that proper care of network would be a correct solution.

V. CONCLUSION

So, it is clearly evident from the above discussions, the researcher came to understand that the stipulation of both environmental standards and the development of energy saving culture in the spinning industry was depended on the availability of necessary pollution control strategies in the industry, installation of cleaner and energy efficient technology, implementation of extended supply chain practices, management and handling of modern technology which were used in controlling pollution and utilizing of energy resources. Apart from these, the pollution control enforcement agency should monitor the pollution emitting industries and should prescribe the environmental standards exclusively for the spinning industries. Since the TSPCB has not yet prescribed any separate environmental standards for the spinning industry, it is difficult to assess the optimal environmental standards to the selected spinning industries. Among these, there is no uniformity in the available infrastructure facilities and technology used for energy saving and pollution control techniques. It was also found that the techniques used by the industries differed from each other. From the broad and extensive research work conducted by experts, the researcher understand that there were many energy saving and pollution control techniques like compressed air leakage- detecting techniques and humidity control mechanism etc, which were used in the spinning industries located in other countries like China, Pakistan and Zimbabwe, were absent in the selected industries. Therefore, the selected spinning sectors should try to introduce the latest technologies in controlling the liquid and air pollution and energy saving techniques. Since, the selected industries were medium level industries, they could not install or introduce any modern, sophisticated energy saving and pollution control technology. In this regard, these selected industries have to depend on the State and the Central Government's assistance to replace all the present outdated technology and introduce a new and innovative energy saving technology for pollution controlling plants. With these approaches and

strategies, spinning sector can substantially contribute to the sustainable environmental and industrial development in Tiruppur and Virudhunagar regions.

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