

A STUDY ON APPLICATION OF THE 3 R'S REDUCE REUSE AND RECYCLE IN MANUFACTURING INDUSTRIES OF ASSAM

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Abstract

The aim of this research is to study application of 3 R's in manufacturing industries of Assam. This research topic is chosen for the premise that in the present era due to the excessive pollution and changing climate have gained attention of researcher, as still there remains a considerable challenges regarding environmental sustainability among entrepreneurs. The research has been conducted to answer few important questions on the environmental sustainability and application of 3 R's in manufacturing industries in Assam, to know the various steps taken by entrepreneurs to maintain sustainability in industries by taking into consideration some parameters. An understanding of the parameters as well as application of sustainability will help the entrepreneurs to get awareness and maintain sustainability while dealing in industrial works. Thus, there is the need to carefully understand application of 3 R's in respect of industrial sector and awareness among the entrepreneurs which will be directed towards finding the application of 3R's make entrepreneurs aware of such application.

Keywords: Environmental Sustainability, entrepreneurs, 3R's, Manufacturing industries.

Introduction

Entrepreneurship is the act of an individual who innovates new ideas, finance and transfers them into economic goods. Entrepreneurs can create new organizations and develop a new strategy with the effort of giving an opportunity. A General concept of entrepreneurship is starting a new business to achieve its objectives and goals. Entrepreneurs can be found in small, medium, large enterprises and nonprofit organizations that benefit from the society. Every society depends on entrepreneurial development. Along with them, another new entrepreneur is moving towards the business organization fusing environmentalism with an entrepreneurial spirit, ideas and ecological changes in products and services. Such environmentally concerned and sustainable oriented entrepreneurs are called as "Ecopreneurs" or "Green Entrepreneurs" (Bennet 1991, Barle 1991 and Blue 1990). The

main motive of an entrepreneur is the economic growth of the society and they have always been linked to wealth generation and growth of the economy in modern society (Tilley & Young 2009). But entrepreneurial activities have generated environmental degradation (Cohen & Winn, 2007) and that degradation has a disastrous effect on society and our future generation. Thus, the environmental problem can be minimized through the link between entrepreneurship and sustainable development (Dean & McMullen 2007). So, all the business operators should operate their business in such a way that they upgrade the economy without losing the environmental concern and they always should pay attention to eco- friendly entrepreneurship. This idea has produced a new area of study known as ecopreneurship.

- Concept of Ecopreneurship:

The concept of ecopreneurship or green entrepreneurship or environmental entrepreneurship is very recent and it has been receiving attention from the year of 1990's (Schaper, 2005). The term ecopreneurship is a combination of two-term "ecology" and "entrepreneurship". Ecopreneurship is simply defined as entrepreneurial creativity through environmental effect. "Ecopreneurship is characterized by some fundamental aspects of entrepreneurial activities that are oriented less towards management systems or technical procedures and focused more on the personal initiative and skills of the entrepreneurial person or team to realize market success with environmental innovations." Ecopreneurship or green entrepreneurship comprises an innovative form of business activity whose basic need is the same as an entrepreneur like profitability and development but with an environmental dimension. Entrepreneurial activities are referred to as creative destruction by Joseph Schumpeter (1934). In ecopreneurship, ecopreneurs destroy the typical and traditional production methods, products, marketing structure, and consumption patterns, and replace

them with superior environmental products and services (S. Michal, 2005). Ecopreneurship can be defined as entrepreneurship through environmentally friendly products and services for selling purposes. Ecopreneurs are also socially responsible entrepreneurs. They work for the return on the environment and intends to restore natural resources. They generate new products, services, and techniques that substantially reduce the environmental effect on the society and also increase the quality of life.

- Typologies of Ecopreneur

Environmental entrepreneurs are of two types one who has economic orientation and another one is who has the sustainability orientation and those entrepreneurs want help to change or improve the environment (Issak, 2002; Taylor and Walley, 2003; Koestar, 2011). Ecopreneurs are done their business in eco- friendly practices but the entrepreneurs have no ecological consideration to the business. According to (OECD 2011, cited in Mcewn) environmental entrepreneurs are those who either start a green business or making their business green. Some of the different types of ecopreneurs are mentioned in tabular form:

Table 1: *Typologies of Ecopreneurs*

<ul style="list-style-type: none"> • Walley and Taylor (2002) 	<ul style="list-style-type: none"> • Ad-hoc environpreneur- this is a kind of accidental green entrepreneur. They are mainly motivated by financial and are not value driven. They are basically influenced by their personal network, family and friends. • Innovative opportunist- Financially oriented entrepreneur and they are mainly influenced by hard structural drivers such as regulation. • Visionary champion- built their business as per sustainability orientation or principles. • Ethical maverick- this type of green entrepreneur is characterized by sustainability orientation and soft structural influences.
<ul style="list-style-type: none"> • Issak (2002) 	<ul style="list-style-type: none"> • Green Business- existing firm moves towards an environmentally responsible firm. • Green- Green Business- A new business is started by designing green processes and products.
<ul style="list-style-type: none"> • Schaltegger 	<ul style="list-style-type: none"> • Alternative Actors- Businesses exist to support alternative lifestyles.

(2002)	<ul style="list-style-type: none"> • Bioneer (Bio-Pioneer)- Innovators with strong research and development focuses on the high technology sector.
<ul style="list-style-type: none"> • Linnanen (2002) 	<ul style="list-style-type: none"> • Self-Employer- advocate nature-oriented enterprises such as ecotourism. They don't want to change the world by growing their business and they have a low financial drive. • Non-Profit Business- They have a high willingness to influence society but don't want to grow more. • Successful Idealist- In this type of ecopreneur build their business in a balanced way like making money and also making the world a better place. • Opportunist- opportunists are recent entrants among ecopreneurs. They are involved in environmental technology which helps businesses and societies to reduce the environmental load in the air, water, and soil.

Source: Adapted from Making Ecopreneurs- Developing Sustainable Entrepreneurship, Micheal Schaper, 2010.

PROBLEM STATEMENT

Environment change has become a huge issue for every human being. It has become a matter of concern for existence of life on Earth and it is a peak time to take preventive steps against degradation of environment. Industrial sector being a major promoter of pollution, should think about the environmental issues and act accordingly. So the study will be concerned in studying the application of 3 R's in manufacturing industrial sector so as to know the manufacturing industries are taking steps for a sustainable environment and suggest measures to do so.

SIGNIFICANCE OF THE STUDY

The study will prove to be significant because environmental issues remains at the top in recent times. With rapid industrialization in present era, there is increased chemical and toxic emissions. The existence of life depends upon the environment. Air, water, food, etc are obtained from the environment. Human beings use natural resources for the development of the standard of life. In such a case, entrepreneurs have more environmental duties to perform. Therefore, the entrepreneur has obligations

towards protecting the environment. All the processes of survival, reproduction, growth, and development of a living organism is revolved around the environment. This study will highlight the application of 3R's (Reuse, Reduce and Recycle) of manufacturing industries of Assam from a green entrepreneurial point of view.

RESEARCH OBJECTIVES

To study the application of three 'R' Approach-Reduce, Reuse and Recycle used by entrepreneurs in maintaining environmental sustainability and responsibility

Research Query/Hypothesis

The first objective of the study will be met through a research query. To arrive at the objective secondary data is being collected. Being qualitative in nature any type of test of significance will not be used. The following is the research query framed for the objective:

Ho: There is no application of three 'R' approach in manufacturing industries.

H1: There is an application of three 'R' approach in manufacturing industries.

RESEARCH METHODOLOGY

In view of the objectives of the study, the methodology used in this research is elaborated below:-

- **Type of Research** - This research is descriptive, quantitative and qualitative in nature.
- **Research approach** - Observation and Survey technique were the basic approach used in order to know the response of entrepreneurs.
- **Data collection tools** - Both quantitative and qualitative data collection tools are used in this research.
- **Sampling Procedure** - The sampling procedure followed in this study is convenient sampling.
- **Sources of data** - Both primary data and secondary data is used in this research.

(a) **Primary Data** - A structured questionnaire was prepared and the primary data was collected through survey method.

(b) **Secondary Data** - Textbooks, magazine, journals, newspapers, articles, e-journals and different websites.

- **Questionnaire design** - Primary data were collected with the help of a well framed questionnaire. Questions were short, simple and precise with multiple choices, ranking and open ended were used to achieve the desired objective.
- **Sample size** - The study is based upon the sample size of 146, which is 50% of the size of the universe.
- **Analysis of Data** - The data which is collected by using the schedule is analyzed with statistical tools. The recent version of SPSS (Statistical Package for the Social Science) and Ms. Excel 2007 are used for statistical analysis and diagram. Various Statistical tools like Descriptive Statistics, Pearson Correlation and Analysis of Variance (ANOVA) Test are used for data analysis along with frequency table, custom tabulation and diagrams are also used.

- **Pearson Correlation**: Karl Pearson's co-efficient of correlation is also known as Pearson Correlation Co-efficient. This statistical method is practically used for measuring correlation. The value of r , which is the symbol of Pearson's correlation of co-efficient, always lies between +1 and -1. +1 denotes a perfect positive correlation between the variables and -1 denotes a perfect negative correlation between the variables. In the practical field the values of r lie between +1 and -1.

Analysis of Variance (ANOVA): This technique is designed to test when the means of more than two quantitative populations are equally based on sample means. The estimated population is based on the variation between the samples is known as the mean square between the samples and when the estimated population is based on the variation within the samples is known as the mean square within the samples.

- **Periodicity of the Study**: The study covers the period from 2014-2017
- **Tools for data collection** Part B includes Seven questions to know about the awareness of ecological sustainability among entrepreneurs and Part C consists of Six questions developed to assess the extent of ecopreneurship in manufacturing firms and the application of three 'R' approach-Reduce, Reuse and Recycle used by entrepreneurs in maintaining environmental sustainability and responsibility.

DATA ANALYSIS AND INTERPRETATION

Table 1 Table showing percentage of recycled materials used in Industries of Assam

Type of Enterprises	Micro Enterprises		Small Enterprises		Medium Enterprises		Total	
	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)
0-20 (%)	10	15.4	9	13.0	3	25.0	22	15.1
20-40 (%)	9	13.8	2	2.9	0	.0	11	7.5
40-60 (%)	11	17.0	7	10.1	0	.0	18	12.3
60-80 (%)	15	23.1	37	53.6	9	75.0	61	41.8
80-100 (%)	20	30.7	14	20.4	0	0	34	23.3
Total	65	100	69	100	12	100	146	100.0

Source: Field Study 2016-17

Note: Percentage indicates recycled materials used in industrial units

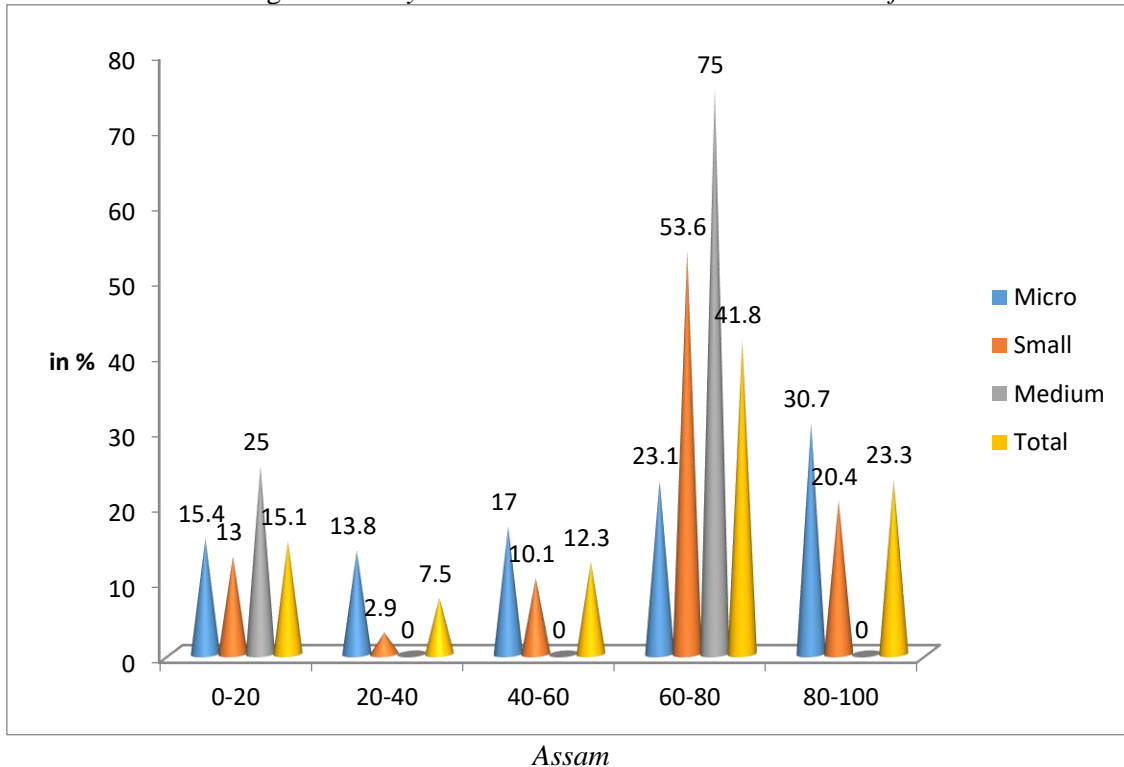
0-20(%) indicates very low level of recycling materials in the industrial units

20-40(%) indicates low level of recycling materials in the industrial units

40-60(%) indicates average level of recycling materials in the industrial units

60-80(%) indicates higher level of recycling materials in the industrial units

80-100(%) indicates very high level of recycling materials in the industrial units.

Figure 2 : *Recycled Materials used in Industrial units of***Interpretation:**

According to table 1 maximum number of industrial units recycled their materials at high level. It indicates that 80% scrap materials are recycled by the industries. We have found that there is no wastage in plastic industries. All scrap materials are recycled. In case of biscuit production industries broken biscuits are also recycled to new product. In case of furniture

making industries they have no waste. Every waste material can be recycled to another product. 41.8 % industrial units recycled their materials at high level. Out of total respondents 23.1 % of micro enterprises, 53.6 % of small enterprises and 75 % of medium enterprises recycled materials at high level. Dyeing industry, battery, pharmaceuticals, detergent and paint industries units are recycled materials at below 20%. They cannot recycle wastage.

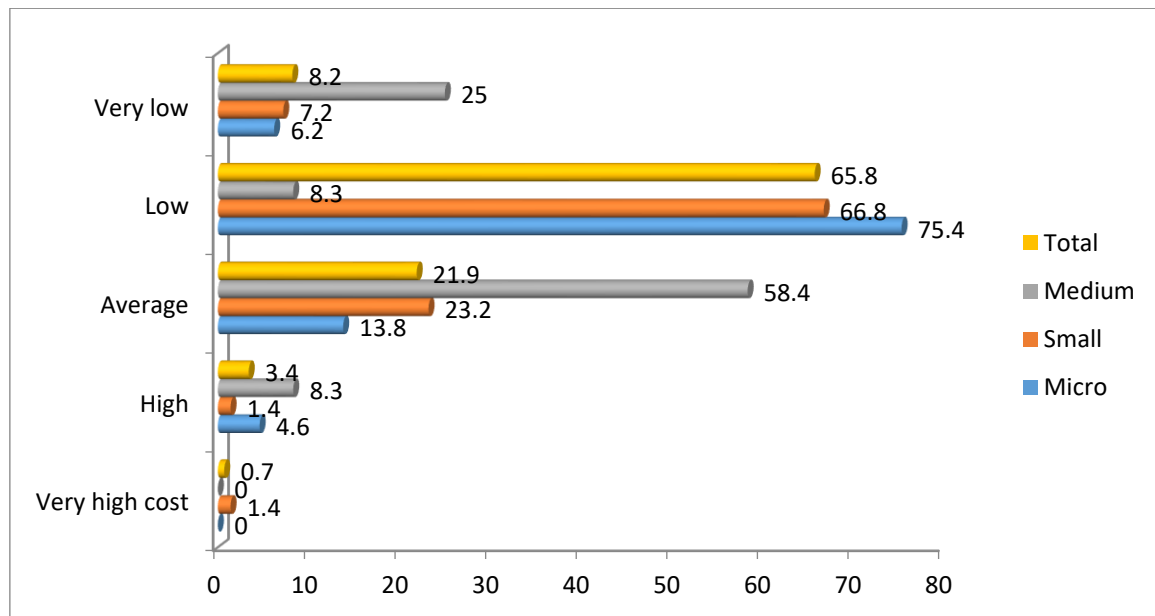
Table 2 *Table showing cost of reuse of materials in Industrial units of Assam*

Type of Enterprises	Micro Enterprises		Small Enterprises		Medium Enterprises		Total	
	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)
Very High cost	0	.0	1	1.4	0	.0	1	.7
High	3	4.6	1	1.4	1	8.3	5	3.4
Average	9	13.8	16	23.2	7	58.4	32	21.9
Low	49	75.4	46	66.8	1	8.3	96	65.8

Very Low	4	6.2	5	7.2	3	25.0	12	8.2
Total	65	100	69	100	12	100	146	100.0

Source: Field Study 2016-17

Figure 2: Cost of Reuse of Materials



Interpretation:

Table 2 show the cost of reuse of materials for converting it into another product. The materials

are reused at minimum cost. Mainly the scrap materials, by products and remnants of materials used after manufacture are recycled to form new products which shows minimization of wastes. Examples are biscuit, plastic industry, printing industries.

Table 3: Use of renewable resources by Industrial units of Assam

Range of use of renewable resources	Micro Enterprises		Small Enterprises		Medium Enterprises		Total	
	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)
0-20 (%)	40	61.6	48	69.6	8	66.7	96	65.8
20-40 (%)	22	33.9	17	24.7	4	33.3	43	29.5
40-60 (%)	1	1.5	0	.0	0	.0	1	.7

60-80 (%)	1	1.5	1	1.4	0	.0	2	1.4
80-100 (%)	1	1.5	3	4.3	0	.0	4	2.6
Total	65	100	69	100	12	100	146	100

Source: Field Study 2016-17

Note: Percentage showing use of renewable resources by industrial units:

0-20(%) indicates very low level of use of renewable resources by the industrial units

20-40(%) indicates low level of use of renewable resources by the industrial units

40-60(%) indicates average level of use of renewable resources by the industrial units

60-80(%) indicates higher level of use of renewable resources by the industrial units

80-100(%) indicates very high level of use of renewable resources by the industrial units

Figure 3: *Use of Renewable Resources*

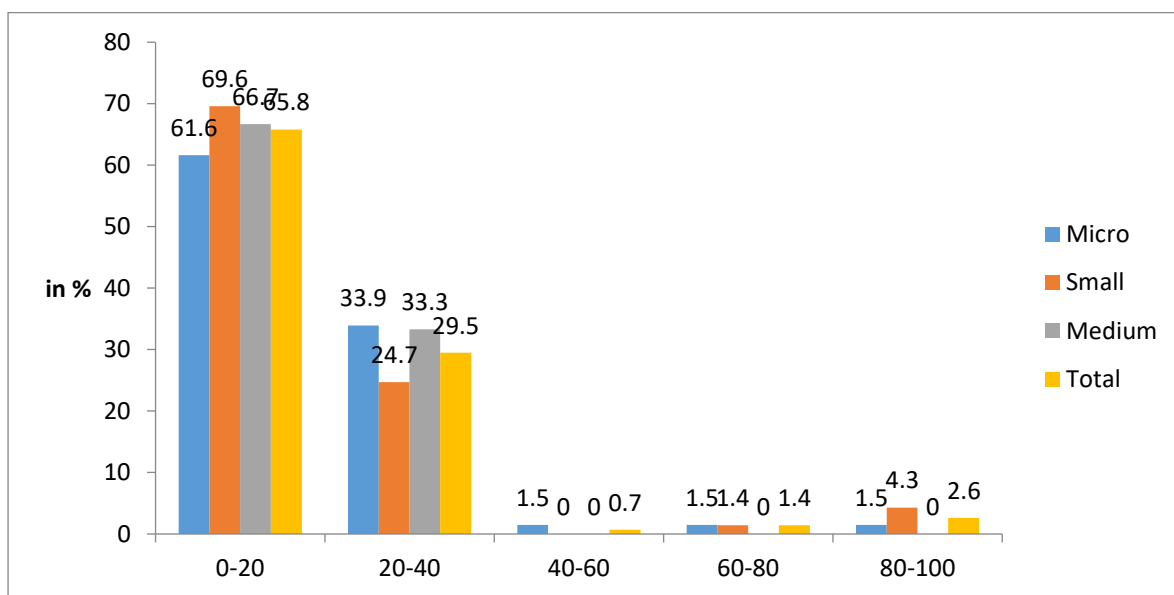


Table 3 shows the use of renewable resources in the industries. Some of the industries use renewable resources in the Industrial Estates of Assam. 65.8 % industries use renewable resources at very low level. It depicts that most of the industries do not use renewable resources in the production process. The industries that use

renewable resources are bamboo products, carton manufacturing industry, ayurvedic medicines, paper products and spice. 29.5 % industries are used renewable resources at low level.

Table 4 *Table showing use of waste materials to reduce the cost of manufacture by the Industrial units of Assam.*

Type of Enterprises	Micro Enterprises		Small Enterprises		Medium Enterprises		Total	
	No of Industrial	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)	No of Industrial units	Percentage (%)
0-20 (%)	4	16.2	6	8.7	2	16.7	12	8.2
20-40 (%)	26	40.0	7	10.1	1	8.3	34	23.3
40-60 (%)	28	43.1	25	36.2	5	41.7	58	39.7
60-80 (%)	4	6.2	16	23.3	4	33.3	24	16.4
80-100 (%)	3	4.6	15	21.7	0	.0	18	12.4
Total	65	100	69	100	12	100	146	100

Source: Field Study 2016-17

Note: Percentage showing use of waste material to reduce the cost of manufacture by the industrial units :

0-20(%) indicates very low level of use of waste materials to reduce the cost of manufacture by the industrial units

20-40(%) indicates low level of use of waste materials to reduce the cost of manufacture by the industrial units

40-60(%) indicates average level of waste materials to reduce the cost of manufacture by the industrial units

60-80(%) indicates higher level of use of waste materials to reduce the cost of manufacture by the industrial units

80-100(%) indicates very high level of waste materials to reduce the cost of manufacture by the industrial units

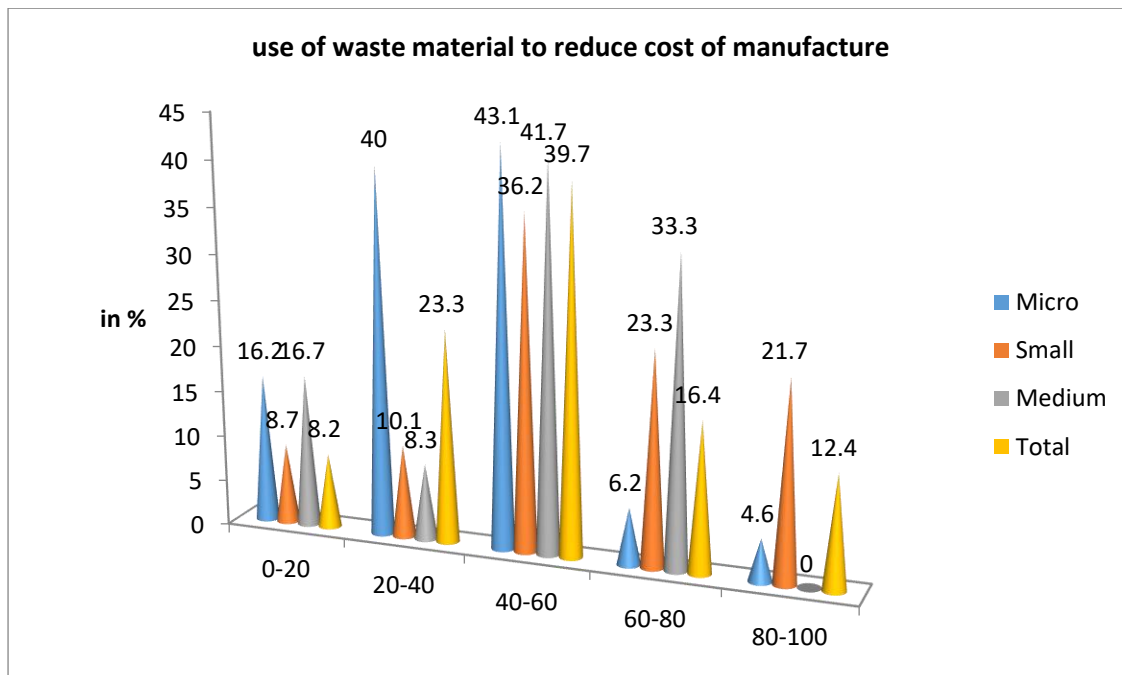
Figure 4: *Use of waste material to reduce cost of manufacture*

Table 4 shows use of waste material to reduce cost of manufacture of Industries. 39.7 % industries use waste material average level. Out of total respondents, 43.1% of micro enterprises, 36.2 % of small enterprises and 41.7 % of medium enterprises use waste material at average level. At low level, 23.3 % industrial units use waste materials. Reduce the waste through using paperless work, both side print, skilled labor.

Study the application of three 'R' approach- Reduce, Reuse and Recycle used by

entrepreneurs in maintaining environmental sustainability and responsibility

Null Hypothesis: There is no application of three 'R' approach in manufacturing industries.

Alternative Hypothesis: There is an application of three 'R' approach in manufacturing industries

Descriptive statistics of application of three 'R' approach- Reduce, Reuse and Recycle used by entrepreneurs in maintaining environmental sustainability and responsibility

Type of Enterprises	Sample(N)	Mean	Standard Deviation	Standard Error
Micro	65	4.35	4.288	.532
Small	69	6.43	4.800	.578
Medium	12	4.50	3.503	1.011

Use of 3 R approach by entrepreneurs in maintain environmental sustainability

	Sum of Squares	df	Mean Square	F	Significance value
Between the Groups	154.367	2	77.183	3.834	.024
Within the Groups	2878.818	143	20.132		
Total	3033.185	145			

From the above table we have seen that the p value is .024, which is less than 0.05. we can reject the null hypothesis at 5 % level of significance. The p value is significant and we can probably reject the null hypothesis and inferred that manufacturing Industries of Industrial Estates of Assam applied three 'R' approach. But we have found that there is significant difference among the entrepreneurs regarding the uses of R approach, reduce, reuse and recycle. The above descriptive statistics table shows that the mean score of micro enterprises is 4.35, for small enterprises is 6.43 and for medium enterprises 4.50. Here we found Sum of squares 'Between the Groups' is 154.367 and 'Within the Groups' is 2878.818. The Mean Square 'Between the Groups' is 77.183 and Within the Groups' is 20.132. The calculated F statistic is 3.834. We have found that manufacturing industries reuse their waste material as much they can use. Manufacturing Industries like plastic moulded furniture, plastic company, utensils, bakery, Atta, Suji have no waste. They can recycle their waste into different products. In plastic company wastes products can be the raw material for plastic mug. It also indicates the reduction of cost of manufacture.

FINDINGS OF STUDY

[1] Industries situated in the Industrial Estates of Assam, apply three R approach in their production process. The first approach is to reduce the cost of manufacturing by using waste materials. Maximum 39.7 % of industries use this approach at an average level.

[2] 41.8% of industries use recycle procedures for minimizing the disposal of waste to the environment. In this case, medium Enterprises tops the list followed by small and micro-enterprises.

[3] It is seen that for recycling, the minimum cost is occurred by industrial units. 65.8% of industries, the cost of recycling is minimal. Only 7 % of industrial units have occurred high recycling costs. 3.4 % of industries have a very high cost to recycle the scrap materials in short our study has found that the cost of recycling is average in the whole scenario.

[4] To reduce the cost of manufacturing industries have used waste materials. 39.7 % of industries use waste material at an average level of which micro -enterprises tops the list followed by medium and small -sized industrial units.

Findings from Hypotheses testing:

In the study, we design three distinct hypotheses to test the three objectives. The hypothesis includes the null and alternative hypotheses. Below we mention the summary on the test of hypotheses.

H0: There is no application of three "R" approach in manufacturing firms

H1: There is an application of three "R" approach in manufacturing firms.

From the statistical analysis we found that we probably reject the null hypothesis and it implies that that manufacturing Industries of Industrial Estates of Assam applied three 'R' approach. But we have found that there is a significant difference among the entrepreneurs regarding the uses of R approach, reduce, reuse and recycle.

SUGGESTIONS

1. The motto of 3 'R', reduce reuse and recycle should be practiced to the maximum level by enterprises for the conservation of flora & fauna and their habitats in the surrounding areas.

2. Recycled materials can be used in the manufacturing process for more efficiency. The waste of one industry can be the resource for another industry. Thus as a remedy exchange waste is suggested to micro, small and medium enterprises.

3. For the development of environmental sustainability, the Government should give assistance for up gradation of skill and installation of eco- friendly technology to the enterprises.

4. Industries should follow eco friendly measures which are strictly advised by the pollution control board

CONCLUSION

In the case of the extent and use of the R approach, there are some differences among entrepreneurs. It means that there are some differences among the micro, small and medium-size entrepreneur regarding applying and using ecological sustainability in industries. The applying three approaches of R, Reduce, Reuse and Recycle the pollution prevention assessment will be done. The pollution is prevented by using these three approaches. The wastes from every aspect should be minimized by at every level of the production process. The wastes should be minimized by employing skilled workers in the organization. By the skilled worker, the process will be more efficient as compared to unskilled workers. If non hazardous waste can be reused or recycle then the environmental problem will be decreased. In the case of wastewater, the same approach can be implemented. The industry can improve wastewater usage efficiency, reduce generate wastewater and reuse wastewater for another product. The whole process can be implemented by the Government. The Government gives the facility to store the wastewater at the same place by all the industries and then use by another industry. Another process will be a water treatment plant that can be introduced in industries. Another aspect of these three approaches is the cost-benefit approach. If the waste materials are recycled and manufacture another product, then the cost of production automatically will be minimized.

Reference

- [1] Bennett, S.J. (1991). *Ecopreneuring: The Complete Guide to Small Business Opportunities from the Environmental Revolution* (New York: John Wiley).
- [2] Berle, G. (1991). *The Green Entrepreneur: Business Opportunities that Can Save the Earth and Make You Money* (Blue Ridge Summit, PA: Liberty Hall Press).
- [3] Blue, J. (1990). *Ecopreneuring: Managing for Results* (London: Scott Foresman).
- [4] Cohen, B. & Winn, M. I. (2007). Market Imperfections, Opportunity and Sustainable Entrepreneurship. *Journal of Business Venturing*, 22(1), 29-49.
- [5] Dean, T.J., & McMullen, J.S. (2007). *Toward a Theory of Sustainable Entrepreneurship: Reducing Environmental Degradation through Entrepreneurial Action*. *Journal of Business Venturing*, 22(1), 50-76.
- [6] Isaak, R. A. (1999). *Green Logic: Ecopreneurship, Theory, and Ethics*. Kumarian Press
- [7] Linnanen, L. (2002). An Insider's Experiences with Environmental Entrepreneurship. *Green Management International*, 38, 71-80.
- [8] S, Michael (2005). *Making Ecopreneurs Developing Sustainable Entrepreneurship*. Gower E book, second edition, p-01.
- [9] Schaper, M. (2002): *The Essence of Ecopreneurship*. *Greener Management International* 38, pp. 26-30.
- [10] Schumpeter, J.A. (1934). *The Theory of Economic Development* (Cambridge, MA: Harvard University Press).
- [11] Schumpeter, J.A. (1934). *The Theory of Economic Development* (Cambridge, MA: Harvard University Press).
- [12] Tilley, F. & Young, W. (2009). Sustainability Entrepreneurs: Could They Be the True Wealth Generators of the Future? *Green Management International*, (55), 79-92.