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AWARENESS AND ATTITUDE TOWARDS GREEN MANAGEMENT PRACTICES AND CLEAN TECHNOLOGY AMONG THE OWNERS OF GRANITE QUARRIES AND PROCESSING UNITS IN TAMIL NADU, INDIA

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Abstract

Macro developments such as urbanization, climate change, depletion of resources and rapid economic growth drive the need for investments in clean technologies. As a result, the investment in clean technology has been gaining momentum during the last 20 years. However, the main thrust in the clean technology area is to create awareness among the stakeholders to promote the widespread use of the technology. The awareness alone can push the market to implement the new and improved technologies which reduce carbon footprints. Raising awareness and developing positive attitude towards the environment and green management practices are critical for driving the growth of clean technology and sustainability. In this context, an attempt has been made in the present study to analyse the awareness and attitudes of the owners of granite quarries and processing units towards environment, green management practices and the benefits of clean technology. Structured questionnaire was administered to the respondents to collect primary data. The data has been compiled and analyzed by Logistic Regression method. Confirmatory Factor Analysis has been done to extract four factors and confirmed the pre-specified structure underlying the constraints in the adoption of green management practices and clean technology by the owners of granite quarries in Tamil Nadu. Reliability, Validity and Internal Consistency Reliability of Scale Items for Attitude and awareness study have been presented in this paper. The first section of the chapter provides the results of analysis of awareness among the owners of granite quarries and processing units about green management practices and clean technology. The second section outlines the findings of the analysis of attitudes of owners of granite quarries and processing units towards environment and the benefits of clean technology for the organization and the society. This study forms a part of the RUSA project undertaken by the author.

Keywords: *Green management , clean technology, environmental sustainability, Granite sector*

1. Introduction

The Earth Summit in 1992 guided the United Nations Environment Programme (UNEP) to adopt the major groups approach for achieving sustainable development. The Rio+20 also reaffirms that the commitment and genuine involvement of major groups is critical to the effective implementation of green management practices for environmental preservation and sustainable development. The major groups and stakeholders of environment include government representatives, businessmen, industrialists, scientists, land owners and local users of natural resources. Among them, businessmen and industrialists play a key role in implementing green management practices for protecting the environment.

The clean technology followed by an organization enables the nations to mitigate the risk associated with climate change and contribute to a sustainable future. It enhances reputation of the organization, increases the operational efficiency and reduces cost. It avoids environmental damage at the source through the use of materials, processes and practices with objective of reducing pollutants and wastes. It

is classified into three broad categories namely i) low and non-waste technologies ii) recycle technologies and iii) waste utilization technologies. It requires an interdisciplinary approach to create a clean environment. It is a major component of green management practices which aim at i) raw material conservation ii) optimal use of raw materials, iii) safe disposal and recycling of waste and iv) optimum use of energy and water.

2. Literature Review

Sharma et al. (2022) investigated the importance of inclusion of granite slurry waste in green concrete. They conducted an experimental study using fine aggregates, granite slutty waste and coarse aggregates to manufacture green cement. The study has found that the inclusion of granite slurry waste in the manufacturing of green cement is cheap and more sustainable.

Surra et al. (2023) in their study analysed the technical, environmental an cost aspects of Valorisation of the granite sludge to use as a substitute for ceramic paste and structural concrete mixtures. They found that the valorisation pathway is technically feasible and environmentally advantageous compared to GS landfill. Mani Rathinam et al. (2023) investigated the potential use of granite waste as a filler in geopolymer paver blocks. The experimental study conducted by them concludes that 15 per cent granite waste could be used in the production of geopolymer paver blocks.

Mishra et al. (2023) examined the impact of geo-environmental factors and managerial factors on the operational factors of the mining industry. They conducted the study in the mines of Odisha, Jharkhand and Chattisgarh of India. The study brought out the indirect effect of mangerial factors between geo-environmental factors and operational factors of Indian mining sector. Luo et al. (2023) evaluated the mining industry's level of green development. They employed 16 indicators which included economical and intensive utilization. They administrated Analytic Hierarchy process (AHP) and Entropy Weight Method (EWM) to explore the relationship between indicators at difference levels. The study points out that the overall green mining index exhibits an increasing trend from year to year.

3. Analysis and Interpretation

3.1. Analysis of Awareness about Green Management Practices and Clean Technology

Awareness means the state of knowing something. It enables us to become proactive rather than active. It is related to alertness and being oriented. It enables us to become better decision makers. It makes us realize our responsibilities and accountability for our actions. Its components are attitude, knowledge, automatic behaviour, delivery methodologies and personal involvement. In particular, environmental awareness means understanding the impact of our behaviour on environment and learning the changes to our activities to protect the planet. Being environmentally aware help us mitigate the problems of climate change and biodiversity loss. In the present study, awareness refers to understanding of green management practices and clean technology that prevent environment being polluted. The details of awareness of owners of granite quarries on green management practices and clean technology are furnished in Table 1.

Table 1 indicates that all the owners of granite quarries have been aware that the current global negotiations on climate change have driven India to adopt clean technology. Ninety five per cent of the owners of granite quarries have been aware of the classification of industries as red, orange, green and white based on the range of pollution index. All the sample respondents from granite quarries have been aware that land excavation is essential to avoid haphazard mining. Seventy six per cent of the owners of granite quarries have been aware that the idea of clean technology is based on the principles of Biology, resource efficiency and second generation production concepts in basic industries. Ninety three per cent of the sample respondents know the year of establishment of Tamil Nadu Pollution Control Board.

Table 1: Details of Awareness of Sample Owners of Granite Quarries on Green Management Practices and Clean Technology

Sl. No.	Statements	No. of Sample Respondents
1	Indian Bureau of Mines (IBM) provides technical and consultancy services to minimize the environmental problems arising out of mining activities	124 (58.49)
2	Tamil Nadu pollution control board was set up in 1982	197 (92.92)
3	Mines and Minerals Development and Regulation Act of 1957 was amended in 2021 to mitigate the environmental problems arising out of mining activities	126 (59.43)
4	Ministry of Environment, Forest and Climate Change classifies industries as Red, Orange, Green and White based on the range of pollution index	201 (94.81)
5	The idea of clean technology is based on the principles of Biology, resource efficiency and second generation production concepts in basic industries.	162 (76.42)
6	Environmental management plan for mining of Black granite differs from that of colour granite.	208 (98.11)
7	Granite Mining generates tailings which account for more than 50 per cent of the extracted material, causing many environmental impacts.	94 (44.34)
8	Clean technology includes recycling, green transportation, green chemistry, renewable energy and solid waste management.	149 (70.28)
9	Clean technology differs from green technology	105 (49.53)
10	Green management is a proactive approach	73 (34.43)
11	Granite is more sustainable when compared to other materials.	65 (30.66)
12	Clean technology is capital intensive	118 (55.66)
13	Green management excessively depends on clean technology	132 (62.26)
14	Drilling and blasting in the granite mines release lots of dust particles in the air that leads to pneumoconiosis disease	79 (37.26)
15	Noise due to unscientific quarrying activities pose hazardous problems to local people and wild life	173 (81.60)
16	Granite is recyclable and reusable material	153 (72.11)
17	Planned excavation is essential to avoid haphazard mining	212 (100.00)
18	Clean Technology Fund (CTF) has been created to support the promising low carbon technologies in developing countries	113 (53.30)
19	Granite conservation and development rules were framed in 1999 for systematic and scientific quarrying / processing of granite.	91 (42.92)
20	The current global negotiations on climate change drive India to adopt clean technology	212 (100.00)

Source: Primary Data

Note: Figures in the brackets are percentages to the respective sample size.

Fifty per cent of the owners of granite quarries have been aware that the clean technology differs from clean technology and sixty two per cent of them have understood that green management excessively depends on clean technology. It is essential to note that only thirty four per cent of the owners of granite quarries in Tamil Nadu have learnt that the green management is a proactive approach. Fifty three per cent of the sample respondents have understood that Clean Technology Fund (CTF) has been created to support the promising low carbon technologies in developing countries. Most of the owners of granite quarries have been unaware that granite is more sustainable when compared to other materials. However, seventy two per cent of the sample owners of granite quarries have learnt that granite is recyclable and reusable material. The details of awareness of owners of granite processing units on green management practices and clean technology are given in Table 2.

Table 2: Details of Awareness of Sample Owners of Granite Processing Units on Green Management Practices and Clean Technology

Sl. No.	Statements	No. of Sample Respondents
1	ISO 14001 is an internationally recognized framework for Environmental Management System	86 (50.29)
2	Tamil Nadu Minor Mineral Concession Rules, 1959 have been amended to allow granite waste as a raw material in M-sand production	153 (89.47)
3	Ministry of Environment, Forest and Climate Change classifies industries as red, orange, green and white based on the range of pollution index.	161 (94.15)
4	The Government has fixed seigniorage fee for granite waste as Rs.100 per tonne	166 (97.07)
5	Tamil Nadu pollution control board was set up in 1982	115 (67.15)
6	Mines and Minerals Development and Regulation Act of 1957 was amended in 2021 to mitigate the environmental problems arising out of granite processing	132 (77.19)
7	Granite is a recyclable and reusable material	157 (91.81)
8	Clean technology includes recycling, green transportation green chemistry, renewable energy and electric motors	160 (93.57)
9	Clean technology differs from green technology	68 (39.77)
10	Diamond Multi Wire Saw (DMWS) technology saves 30 per cent of water and 40 per cent of energy.	163 (95.32)
11	Green management is a proactive approach	139 (81.29)
12	Granite is more sustainable when compared to other materials.	124 (72.51)
13	Clean technology is capital intensive	76 (44.44)
14	Green management excessively depends on clean technology	101 (59.06)
15	Granite processing is water intensive	169 (98.83)
16	The waste generated during processing is 30-35 per cent of the granite mass transported to processing units	32 (18.71)
17	The current global negotiations on climate change drive India to adopt clean technology	69 (40.35)
18	Granite conservation and development rules were framed in 1999 for systematic and scientific quarrying / processing of granite.	53 (30.99)
19	The idea of clean technology is based on the principles of Biology, resource efficiency and second generation production concepts in basic industries.	136 (79.53)
20	Coagulation helps to remove pollutants that make water toxic.	49 (28.65)

Source: Primary Data

Note: Figures in the brackets are percentages to the respective sample size.

The awareness on green management practices and clean technology has been classified as Low and High levels based on median values for granite quarries and processing units separately. The findings are outlined in Table 3. It is apparent from Table 3 that seventy per cent and seventy four per cent of the owners of granite quarries and processing units respectively in Tamil Nadu have higher level of awareness on green management practices and clean technology.

Table 3: Distribution of Sample Respondents Based on Their Levels of Awareness on Green Management Practices and Clean Technology

Sl. No.	Awareness Level	Number of Respondents		
		Granite Quarries	Granite Processing Units	Total
1	Low Level	64 (30.19)	45 (26.32)	109 (28.46)

2	High Level	148 (69.81)	126 (73.68)	274 (71.54)
	Total	212 (100.00)	171 (100.00)	383 (100.00)

Source: Primary Data

Figures in the brackets are percentages to the respective sample size.

The available literature points out that awareness can be influenced by age, education, previous experience in the related field, social and family support and extension contact. The present research work has made an attempt to analyse these factors influencing the awareness levels. The binary logistic regression line has been estimated to study the factors determining the awareness levels on green management practices and clean technology in granite industry of Tamil Nadu. The results are given in Table 4.

Table 4: Estimated Values of the Logistic Regression Coefficients of Factors Determining the Levels of Awareness of Owners of Granite Quarries on Green Management Practices and Clean Technology

Sl. No.	Factors	Coefficients	Wald Statistics	Odds Ratios
1	Owner's age	0.1054 (-1.137)	0.009	0.890
2	Owner's education	0.716 (0.574)	1.556	2.046
3	Owner's experience	0.413* (0.179)	5.323	1.511
4	Ancestry	0.637* (0.352)	3.274	1.891
5	Social and Family support	0.509 (0.457)	1.240	1.663
6	Extension contact	0.379* (0.094)	16.257	1.461
	Constant	3.611* (1.537)	5.519	---

Source: Primary Data

Notes:

N = 212

Figures in the brackets are standard errors Chi-square value = 18.739*

* indicates one per cent level of significance

** indicates five per cent level of significance

The results of the Logistic Regression Analysis bring out the following factors determining the levels of awareness of owners of granite quarries on green management practices and clean technology in Tamil Nadu. The variables owner's previous experience, ancestry and extension contact have been statistically significant. The meaning is that the possibility of owners of granite quarries with more experience in the related business field being aware of green management practices and clean technology has been 1.51 times higher than that of those owners who are first generation entrepreneurs. Further, the Odds Ratio for the variable 'Extension Contact' has 1.461. It implies that awareness level increases with the increase in owners' extension contact with government institutes and NGOs. The Hosmer – Lemeshow test (Chi-square value) points out that the Logistic regression model fitted for analysing the factors determining the awareness levels of owners of granite quarries on green management practices and clean technology. The predictive accuracy of the model could be understood from the Table 5.

Table 5: Classification Matrix for Awareness Levels of Owners of Granite Quarries

Sl. No.	Awareness Level	Predicted Membership		Total
		Group-I	Group-II	
1	Low Level	60 (93.75)	4 (6.25)	64 (100.00)
2	High Level	11 (7.43)	137 (92.57)	148 (100.00)

Source: Primary Data

Overall Efficiency = 92.92 per cent.

The fitted Logistic regression correctly classifies 60 out of 64 respondents having low level of awareness on green management practices and clean technology under group I and 137 out of 148 granite quarry owners having awareness at high level under Group II. That is, 197 out of 212 granite quarry owners having awareness on green management practices and clean technology are correctly grouped by the Logistic regression showing that the overall efficiency is 92.92 per cent. The same analysis has been done for studying the factors determining the levels of awareness of owners of granite processing units on green management practices and clean technology in Tamil Nadu. The findings are furnished in Table 6.

The results of the Logistic Regression Analysis reject the hypothesis that owner's education, ancestry and extension contact do not determine the owners level significantly. The meaning is that the possibility of technically or professionally qualified owners of granite processing units being aware of green management practices and clean technology has been 2.09 times higher than that of the owners who are not technically or professionally qualified.

Table 6: Estimated Values of the Logistic Regression Coefficients of Factors Determining the Levels of Awareness of Owners of Granite Processing Units on Green Management Practices and Clean Technology

Sl. No.	Factors	Coefficients	Wald Statistics	Odds Ratios
1	Owner's age	-0.097 (-0.109)	0.792	0.908
2	Owner's education	0.737* (0.318)	5.371	2.090
3	Owner's experience	0.222 (0.349)	0.405	1.249
4	Ancestry	0.436* (0.114)	14.627	1.547
5	Social and Family support	-0.041 (-0.233)	0.031	0.960
6	Extension contact	0.193* (0.095)	4.127	1.213
	Constant	1.749* (0.603)	6.411	---

Source: Primary Data

Notes:

N = 171.

Figures in the brackets are standard errors Chi-square value = 19.952*

* indicates one per cent level of significance

** indicates five per cent level of significance

Further, the Odds Ratio for the variable 'Extension Contact' has been 1.283. It implies that the awareness level increase with the increase in owners' extension contact with government institutes and NGOs. To sum up, the awareness levels of owners of granite processing units have been influenced significantly by owner's education, ancestry and extension contact. The Hosmer – Lemeshow test (Chi-square value) points out that the Logistic regression model fitted for analysing the factors determining the awareness levels of owners of granite processing units on green management practices and clean technology is good. The predictive accuracy of the model could be understood from the Table 7.

Table 7: Classification Matrix for Awareness Levels of Owners of Granite Processing Units

Sl. No.	Awareness Level	Predicted Membership		Total
		Group-I	Group-II	
1	Low Level	42 (93.33)	3 (6.67)	45 (100.00)
2	High Level	12 (9.52)	114 (90.48)	126 (100.00)

Source: Primary Data

Overall Efficiency = 91.23 per cent.

The fitted Logistic regression correctly classifies 42 out of 45 respondents having low level of awareness

on green management practices and clean technology under group I and 114 out of 126 owners of granite processing units having awareness at high level under Group II. That is, 156 out of 171 owners of granite processing units having awareness on green management practices and clean technology are correctly grouped by the Logistic regression showing that the overall efficiency is 91.23 per cent.

3.2. Analysis of Attitude towards Environment and the Benefits of Clean Technology

Attitude refers to a set of beliefs, opinions and behaviour towards environment and benefits of clean technology for the organization and the society. It may vary depending on situations and context. It is an internal state of preparedness for action. It might not always be simply positive or negative, but it may include both positivity and negativity. In addition, strong and weak attitudes are associated with many different outcomes. Environmental attitudes and behaviours are essential for environmental conservation. Promoting positive development among the owners of granite quarries and processing units may empower them to contribute actively to the environment through positive attitudes. However, the past research works reflect that owners' attitudes have been increasingly viewed as a hindrance to the adoption of green management practices and clean technology in granite industry. Despite the general support for environmental preservation and clean technology, owners' attitudes can be negative towards certain aspects of environment and benefits of clean technology and conflicts are created. Though there is abundant research work on attitudes towards environment and benefits of clean technology, understanding these attitudes is still challenging due to different contexts and dissimilar research methodologies. Thus, it is essential to analyze the owners' attitudes towards environment and benefits of clean technology. In this context, the researcher constructed the scales to study the pre-specified factor structure underlying the attitudes. The sixteen items revealing the owners' attitude towards environment and the perceived benefits of clean technology for the organization and the society have been taken for Confirmatory Factor Analysis (C.F.A) to examine the reliability and validity of the scales. The CFA using AMOS 21 was done to determine the fit between the hypothesized model with sixteen items and the data. The standardised factor loadings of the items and their standard errors have been computed. Normed Fit Index (NFI), Comparative Fit Index (CFI) and Root Mean Square Error Approximation (RMSEA) have been computed to test the goodness of fit of CFA. The internal consistency reliability of scales has been examined by Composite Reliability and Average Variance. The results are furnished in Table 8.

Table 8: Reliability and Validity of Scale Items Showing Attitudes of Owners of Granite Quarries towards Environment and Benefits of Clean Technology

Sl. No.	Scale Items	Standardised Factor Loadings
	A) Attitude towards environment (F_1)	
1	Plants and Animals have as much right as humans to exist.	0.81
2	Failure to protect the environment means that we do not care about future generations.	0.79
3	The balance of nature is very delicate and easily upset by human activities.	0.72
4	The so called "Ecological Crisis" facing mankind is greatly exaggerated.	0.84
5	Humans are meant to rule over nature.	0.73
	B) Attitude towards benefits of clean technology for the organization (F_2)	
6	Clean technology results in long term cost benefits	0.86
7	Clean technology enhances the reputation of quarry	0.77
8	Clean technology ensures greater employees retention.	0.69
9	Clean technology improves productivity.	0.95
	C) Attitude towards benefits of clean technology for the society (F_3)	
10	Clean technology minimizes water consumption.	0.74
11	Clean technology minimizes energy consumption.	0.82

12	Clean technology promotes sustainable development	0.78
13	Clean technology promotes economic growth.	0.69
14	Clean technology facilitates human well-being.	0.80
15	Clean technology ensures the survival of ecosystem	0.75
16	Clean technology is pollution free	0.71
	D) Correlation between factors	
	F_1 x F_2	0.53
	F_1 x F_3	0.64
	F_2 x F_3	0.49
	Chi-square value	27.59
	NFI	0.87
	CFI	0.90
	RMSEA	0.062

Source: Primary Data
Figures in the brackets are standard errors

The CFA has extracted four factors and confirmed the pre-specified structure underlying the constraints in the adoption of green management practices and clean technology by the owners of granite quarries in Tamil Nadu. All the coefficients have been statistically significant either at one per cent Level or five per cent level showing a significant contribution of each item to the related factor. The value has been 6.87 of NFI and that of CFI has been 0.9 showing a good fit to the data. The value of RMSEA is 0.062 indicating that the CFA model fit to good. Thus, these four factors have been allowed to correlate each other. The internal consistency reliability has been tested with the help of Composite Reliability (CR) and Average Variance (AV) extracted. The results are provided in Table 9.

Table 9: Internal Consistency Reliability of Items in the Attitudes Scales for the Owners of Granite Quarries

Sl. No.	Attitudes	Number of Items	Composite Reliability (CR)	Average Variance (AV)
1	Attitudes towards environment	5	0.81	0.26
2	Attitudes towards benefits of clean technology for the organisation	4	0.92	0.09
3	Attitudes towards benefits of clean technology for the society	7	0..88	0.12

Source: Primary Data

The values of Composite Reliability show that the items are consistent in measuring the underlying construct. The values of Average Variance indicate low variability in the items of attitudes towards the benefits of clean technology for the organization and moderate variability in the items of attitudes towards environment and perceived benefits of clean technology for the society. The levels of agreement over the attitude towards environment and perceived benefits of clean technology for the organization and the society have been computed. The findings are furnished in Table 10.

Table 10: Level of Agreement among the Owners of Granite Quarries over Environment and Benefits of Clean Technology

Sl. No.	Scale Items	Level of Agreement
	A) Attitude towards environment (F_1)	**0.70**
1	Plants and Animals have as much right as humans to exist.	0.96

2	Failure to protect the environment means that we do not care about future generations.	0.84
3	The balance of nature is very delicate and easily upset by human activities.	0.56
4	The so called "Ecological Crisis" facing mankind is greatly exaggerated.	0.68
5	Humans are meant to rule over nature.	0.48
	B) Attitude towards benefits of clean technology for the organization (F_2)	**0.73**
6	Clean technology results in long term cost benefits	0.88
7	Clean technology enhances the reputation of quarry	0.92
8	Clean technology ensures greater employees retention.	0.36
9	Clean technology improves productivity.	0.76
	C) Attitude towards benefits of clean technology for the society (F_3)	**0.65**
10	Clean technology minimizes water consumption.	0.80
11	Clean technology minimizes energy consumption.	0.92
12	Clean technology promotes sustainable development	0.64
13	Clean technology promotes economic growth.	0.36
14	Clean technology facilitates human well-being.	0.72
15	Clean technology ensures the survival of ecosystem	0.60
16	Clean technology is pollution free	0.52

Source: Primary Data

It is obvious from Table 10 that owners' attitude towards the benefits of clean technology for the organization has been stronger followed by attitude towards environment. The owners of granite quarries have strong belief that plants and animals have as much right as humans to exist. They also strongly believe that clean technology enhances the quarry reputation and results in long term cost benefits. They hold the opinion that clean technology minimizes energy consumption. Here, it should be noted that the attitude of owners of granite processing units towards the benefits of clean technology for the society has been weak.

Environmental factors play a key role in the formation of attitudes. Among them, most pervasive is the influence of the personal and the social environments which include family, relatives, friends, experience, age, education and extension contact. The researcher has made an attempt to study the factors which determine the formation of attitudes. The correlation analysis has been carried out to analyze study the relationship between attitude towards environment(X_1) and the personal and social characteristics of owners of granite quarries, attitude towards benefits of clean technology for the organization (X_2) and the personal and social characteristics of owners of granite quarries and attitude towards benefits of clean technology for the society (X_3) and the personal and social characteristics of owners of granite quarries, The results are given in Table 11.

Table 11: Estimated Values of the Correlation Coefficients for the relationship between Attitude of Owners of Granite Quarries and Personal and Social Factors (N = 212)

Sl. No.	Personal and Social Factors	Correlation Coefficients		
		X_1	X_2	X_3
1	Owner's age	0.239* (3.192)	0.713 (1.146)	0.327** (2.391)
2	Owner's education	0.616* (2.931)	0.813* (2.614)	0.614* (3.193)
3	Owner's experience	0.541 (0.977)	0.492** (2.331)	0.136 (1.517)
4	Ancestry	-0.626 (-0.459)	0.206 (0.925)	0.225 (1.173)
5	Social and Family support	0.411 (0.519)	0.514 (1.239)	0.199 (0.974)
6	Extension contact	0.739* (2.825)	0.773** (2.413)	0.431** (2.016)

Source: Primary Data

Figures in the brackets are 't' values

* indicates one per cent level of significance ** indicates five per cent level of significance

It could be inferred from Table 11 that there has been positive and significant correlation between owner's age and attitude towards environment. The correlation analysis also brings out positive and significant relationship between owner's education and attitude towards environment. The owner's extension contact and attitude towards environment have also been positively and significantly correlated. The Confirmatory Factor Analysis has also been done for the attitudes of owners of granite processing units towards environment and perceived benefits of clean technology for the organization and society. The findings are provided in Table 12.

Table 12: Reliability and Validity of Scale Items Showing Attitudes of Owners of Granite Processing Units towards Environment and Benefits of Clean Technology

Sl. No.	Scale Items	Standardised Factor Loadings
	A) Attitude towards environment (F1)	
1	Plants and Animals have as much right as humans to exist.	0.52
2	Failure to protect the environment means that we do not care about future generations.	0.65
3	The balance of nature is very delicate and easily upset by human activities.	0.58
4	The so called "Ecological Crisis" facing mankind is greatly exaggerated.	0.73
5	Humans are meant to rule over nature.	0.86
	B) Attitude towards benefits of clean technology for the organization (F_2)	
6	Clean technology results in long term cost benefits	0.74
7	Clean technology enhances the reputation of processing units	0.82
8	Clean technology ensures greater employees retention.	0.60
9	Clean technology improves productivity.	0.91
	C) Attitude towards benefits of clean technology for the society (F_3)	
10	Clean technology minimizes water consumption.	0.80
11	Clean technology minimizes energy consumption.	0.66
12	Clean technology promotes sustainable development	0.57
13	Clean technology promotes economic growth.	0.53
14	Clean technology facilitates human well-being.	0.72
15	Clean technology ensures the survival of ecosystem	0.78
16	Clean technology is pollution free	0.64
	D) Correlation between factors	
	F_1 x F_2	0.68
	F_1 x F_3	0.70
	F_2 x F_3	0.56
	Chi-square value	32.06
	NFI	0.92
	CFI	0.94
	RMSEA	0.04

Source: Primary Data
Figures in the brackets are standard errors

The CFA has extracted four factors and confirmed the pre-specified structure underlying the constraints in the adoption of green management practices and clean technology by the owners of granite quarries in Tamil Nadu. All the coefficients have been statistically significant either at one per cent Level or five per cent level showing a significant contribution of each item to the related factor. The values of NFI and CFI are greater than 0.9 showing a good fit to the data. The value of RMSEA is 0.04 indicating that the CFA model fit to good. Thus, these four factors have been allowed to correlate each other. The internal

consistency reliability has been tested with the help of Composite Reliability (CR) and Average Variance (AV) extracted. The results are provided in Table 13.

Table 13: Internal Consistency Reliability of Items in the Attitudes Scales for the Owners of Granite Processing Units

Sl. No.	Attitudes	Number of Items	Composite Reliability (CR)	Average Variance (AV)
1	Attitudes towards environment	5	0.95	0.08
2	Attitudes towards benefits of clean technology for the organisation	4	0.93	0.06
3	Attitudes towards benefits of clean technology for the society	7	0.85	0.19

Source: Primary Data

The values of Composite Reliability show that the items are consistent in measuring the underlying construct. The values of Average Variance indicate low variability in the items of attitudes towards environment and attitude towards the benefits of clean technology for the organization and moderate variability in the items of attitudes towards the benefits of clean technology for the society. The levels of agreement over the attitude towards environment and perceived benefits of clean technology for the organization and the society have been computed. The findings are outlined in Table 14.

It is obvious from Table 14 that owners' attitude towards the benefits of clean technology for the organization has been stronger than the attitudes towards environment and the benefits of clean technology for the society. The owners of granite processing units have strong belief that plants and animals have as much right as humans to exist. They also strongly believe that failure to protect the environment means that we do not care about future generations. They hold the opinion that clean technology improves productivity and minimizes energy consumption. Here it should be noted that the attitude of owners of granite processing units towards the benefits of clean technology for the society has been weak.

Table 14: Level of Agreement among the Owners of Granite Processing Units over Environment and Benefits of Clean Technology

Sl. No.	Scale Items	Level of Agreement
	A) Attitude towards environment (F_1)	**0.72**
1	Plants and Animals have as much right as humans to exist.	0.96
2	Failure to protect the environment means that we do not care about future generations.	0.88
3	The balance of nature is very delicate and easily upset by human activities.	0.84
4	The so called "Ecological Crisis" facing mankind is greatly exaggerated.	0.72
5	Humans are meant to rule over nature.	0.24
	B) Attitude towards benefits of clean technology for the organization (F_2)	**0.76**
6	Clean technology results in long term cost benefits	0.36
7	Clean technology enhances the reputation of processing units	0.64
8	Clean technology ensures greater employees retention.	0.56
9	Clean technology improves productivity.	0.68
	C) Attitude towards benefits of clean technology for the society (F_3)	**0.57**
10	Clean technology minimizes water consumption.	0.80
11	Clean technology minimizes energy consumption.	0.88
12	Clean technology promotes sustainable development	0.60

13	Clean technology promotes economic growth.	0.52
14	Clean technology facilitates human well-being.	0.44
15	Clean technology ensures the survival of ecosystem	0.76
16	Clean technology is pollution free	0.64

Source: Primary Data

The correlation analysis has been done to study the relationship between attitude towards environment(X_1) and the characteristics of owners of granite processing units, attitude towards benefits of clean technology for the organization (X_2) and the characteristics of owners of granite processing units and attitude towards benefits of clean technology for the society (X_3) and the personal and social characteristics of owners of granite processing units, The results are provided in Table 15.

Table 15: Estimated Values of the Correlation Coefficients for the relationship between Attitude of Owners of Granite Processing Units and Personal and Social Factors (N = 171)

Sl. No.	Personal and Social Factors	Correlation Coefficients		
		X_1	X_2	X_3
1	Owner's age	0.352* (2.715)	0.226 (1.830)	0.118 (0.835)
2	Owner's education	0.761** (2.238)	0.615** (2.197)	0.577* (3.901)
3	Owner's experience	0.134 (1.518)	0.219* (2.736)	0.302** (2.007)
4	Ancestry	0.333 (0.527)	0.736* (3.791)	0.431** (2.197)
5	Social and Family support	0.301 (0.574)	0.494 (1.035)	0.383 (1.297)
6	Extension contact	0.729* (3.114)	0.642* (4.206)	0.814** (2.346)

Source: Primary Data

Figures in the brackets are 't' values

* indicates one per cent level of significance

** indicates five per cent level of significance

It is evident from Table 15 that there has been positive and significant correlation between owner's age and attitude towards environment. The correlation analysis also brings out positive and significant relationship between owner's education and attitude towards environment. The owner's extension contact and attitude towards environment have also been positively and significantly correlated.

4. Findings and Discussion

Table 2 shows that forty per cent of the owners of granite processing units have been aware that the current global negotiations on climate change have driven India to adopt clean technology. Ninety four per cent of the owners of granite processing units have been aware of the classification of industries as red, orange, green and white based on the range of pollution index. Ninety nine per cent of the sample respondents from granite processing units have been aware that granite processing is water intensive. Eighty per cent of the owners of granite processing units have been aware that the idea of clean technology is based on the principles of Biology, resource efficiency and second generation production concepts in basic industries. Sixty seven per cent of the sample respondents have come to know the year of establishment of Tamil Nadu Pollution Control Board.

Forty per cent of the owners of granite processing units have been aware that the clean technology differs from clean technology and fifty nine per cent of them have understood that green management excessively depends on clean technology. It is essential to note that eighty one per cent of the owners of granite processing units in Tamil Nadu have learnt that the green management is a proactive approach. Fifty per cent of the sample respondents have understood about the ISO 14001 certification. Most of the owners of granite processing units have been unaware that coagulation helps to remove pollutants that

make water toxic and the waste generated during processing is 30-35 per cent of the granite mass transported to processing units. However, most of the owners of granite processing units (95%) have been aware that Diamond Multi Wire Saw (DMWS) technology saves 30 per cent of water and 40 per cent of energy. Ninety two per cent of the sample owners of granite processing units have learnt that granite is recyclable and reusable material. From Table 6, It is also inferred from the analysis that the likelihood of owners of granite processing units hailing from family business background being aware of green management practices and clean technology has been 1.547 times higher than that of the owners who are first generation entrepreneurs. From table 10, Owners' attitude towards the benefits of clean technology for the organization has been stronger followed by attitude towards environment. From table 11, The implication is that owner's age, owner's education and extension contact are the critical factors underlying the formation of positive attitude towards environment.

The analysis also points out that owner's education, owner's previous experience and extension contact are the factors leading to the formation of positive attitude towards the benefits of clean technology for the organisation. It has also been observed that owner's age, owner's education and extension contact are the crucial factors for the development of positive attitude towards the benefits of clean technology for the society among the owners of granite processing units in Tamil Nadu. From table 15, The implication is that owner's age, owner's education and extension contact are the critical factors underlying the formation of positive attitude towards environment. The analysis also points out that owner's education, owner's previous experience, ancestry and extension contact are the factors leading to the formation of positive attitudes towards the benefits of clean technology for the organisation and the society among the owners of granite processing units in Tamil Nadu.

5. Conclusion

The earth can be saved by following various green practices including energy- efficient process, use of renewable energy, reduction in waste and emissions, proper solid waste management, production of green products, promotion of sustainable supply chains and eco-friendly behaviours. However, the present world suffers from the problems of energy price spikes, resource shortages and environmental damage due to the adoption of traditional practices. Having an awareness of green management practices and clean technology is vital for reducing the risk of environment being damaged. The present study has analyzed the awareness of owners of granite quarries and processing units on green management practices and clean technology.

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