

STUDY OF INDUSTRIAL BUYING BEHAVIOR TOWARDS LOW VOLTAGE ENERGY-EFFICIENT MOTORS WITH PARTICULAR REFERENCE TO CEMENT INDUSTRIES IN INDIA: THE PILOT STUDY REPORT

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ABSTRACT

Sustainability and energy conservation are one of the most important goals of modern-day organizations. Typically, the cement industry is capital intensive and consumes a lot of energy for its operations. To achieve energy conservation at the plant level, energy-efficient motors are an essential tool. The research tries to understand Low Voltage Energy Efficient Electric Motors' industrial buying behavior by a survey of 300 purchase executives and managers of cement plants all over India. As a part of the main research, a pilot study of 30 respondents was conducted in the initial phase. This paper presents the pilot study report. The findings suggest that pre-purchase buying behavior is significantly different for standard and energy-efficient LV motors. Moreover, the impact of sales promotion of energy-efficient motors is significant. Further, post-purchase behavior has significant unique features. And lastly, the patterns, practices, and strategies of industrial buying in the cement industry are significantly indifferent. Hence, the importance of energy efficiency as a sales promotion factor remains intact.

Keywords: Energy efficiency, low voltage electric motors, industrial buying behavior, Cement plant.

1. Introduction

1.1 Introduction to the study

The research was undertaken to understand Low Voltage Energy Efficient Electric Motors' industrial buying behavior by a survey of 300 purchase executives and managers of cement plants all over India. As a part of the main research, a pilot study of 30 respondents was conducted in the initial phase.

Sustainability and energy conservation are one of the most important goals of modern-day organizations. Given the infrastructure and housing push in the Indian economy, the Cement industry assumes great importance. Typically, the cement industry is capital intensive and consumes a lot of energy for its operations. To achieve energy conservation at the plant level, energy-efficient motors are an essential tool. The paper presents the results of the pilot study of 30 respondents.

Electrical Motors

Electric motors impact every part of modern living. Refrigerators, vacuum cleaners, air conditioners, fans, computer hard drives, automatic car windows, and multitudes of other domestic appliances and devices all utilization electric motors to change over electrical energy

into mechanical energy. Notwithstanding running the typical appliances, electric motors are also responsible for an exceptionally enormous industrial process segment.

Industrial Buying Behavior

Industrial buying behavior is the branch of industrial marketing that focuses on how companies and organizations purchase goods and services. It is defined as the emotional cycle by which formal organizations set up the requirement for items and services and identify, evaluate, and choose among alternative brands and suppliers.

Cement Industry in India

India is the second-largest producer of cement in the world (Ibef.org, 2019). India has a ton of potential for development in the infrastructure and construction sector, and the cement sector is required to benefit from it primarily. For example, a portion of the new initiatives, the development of 98 smart cities, are required to give a significant lift to the sector.

Research Objectives:

1. To study the cement industry buyers' purchase behavior towards LV energy-efficient motors

2. To investigate the impact of sales promotion of energy-efficient motors due to energy savings appeal on buyers in the cement industry
3. To study and analyze the cement industry buyers' post-purchase behavior towards LV energy-efficient motors
4. To study the existing pattern, practices, and strategies of industrial buying in the cement industry about different buying situations

1.2 Introduction to the Pilot study

A pilot study seeks to determine if the research can be done, should the researchers proceed with the same, and if so, in what manner. A pilot study also has unique design features. It is carried on a much smaller scale than the full-scale main or study (In, 2017). As a precursor to the main study, this pilot study was undertaken with the following goals:

1. To understand critical aspects in data collection
2. To put to the test the use of the survey questionnaire
3. To check if the hypotheses get duly tested as per the research methodology
4. To test the validity and reliability of the survey questionnaire

2. Literature review

There are several articles on industrial buying behavior, industrial buying behavior in the cement industry, energy efficiency in the context of electric motors, and using energy efficiency as a sales promotion tool. A few of them are highlighted below. Our study covers all these topics comprehensively and also fills the contextual research gap.

The paper by Singh and Modgil (2020) planned to assess and organize the critical supplier selection indicators and to set up the relationship between available alternatives and chose indicators by utilizing stepwise weight assessment ratio analysis (SWARA) and weighted aggregated sum product assessment (WASPS). Authors have separated the supplier selection criteria from literature and utilized a joined SWARA-WASPS strategy to assess and rank the criteria. SWARA is applied to evaluate and weigh selection criteria, while WASPS helped evaluate different available

alternatives based on supplier selection indicators. Finding from SWARA proposes that supplier management is the high weighted criteria, followed by information sharing and joint actions. WASPS were utilized to assess the available alternatives. Additionally, sensitivity analysis shows the different situations for the best supplier selection.

Hossain et al.'s (2020) investigation was to exhibit and examine the energy management practices in the cement industries of Bangladesh. The result of this investigation shows that there are a few hindrances in energy management and energy efficiency practices; Lack of staff consciousness, insufficient attention from government, and bureaucratic intricacy are most significant among them. Unexpectedly, the most dominant energy management drivers are the risk of high energy prices in the future, highly motivated employees, and high demand from consumer and Non-Government Organizations. According to the examination, around 4–5% of energy efficiency can be improved with energy management practices in cement industries. Notwithstanding, numerous industries are unaware of energy service companies' possibility as there is an absence of information about such organizations and a deficit of competent human resources in the energy management sector.

The article by Homburg and Kuester (2001) researches the number of suppliers that a firm has for a given product in its purchasing portfolio. Given economic arguments, we hypothesize that this number is negatively influenced by the degree of complexity of the purchasing situation and positively influenced by the product's economic importance. The hypotheses got from the theoretical model are tried observationally by utilizing cross-sectional information. Results affirm the model. From a theoretical perspective, the investigation uncovers that economic thinking is appropriate for anticipating industrial buying behavior results. Toward the finish of the article, the model is utilized to build up a purchasing portfolio.

This investigation by Gaspar and Antunes (2011) tries to examine the following:

1. Understand the factors/characteristics typically considered when purchasing electrical appliances.
2. Dissect the contrasts between consumer profiles regarding these.
3. Understand the factors driving the consideration of energy efficiency class by purchasers.

Results indicate an inclination for first considering cost, followed by quality and energy consumption considerations. These are correlated positively with the consideration of the energy efficiency class in consumer choices. Additionally, regression examination demonstrates environmental attitudes as negative predictors of energy efficiency class consideration, while explicit environmental practices were positive predictors. Finally, consumer profiles were distinguished, dependent on gender and age.

A comprehensive study with special impetus on energy-efficient motors in the Indian context is not so easily seen. Therefore, this study investigates industrial buying behavior towards low voltage energy-efficient motors with particular reference to India's cement industries.

3. Methodology

3.1 Population and sample for the main study

According to the Cement Manufacturers Association, there are 45 Cement Companies (Cmaindia, 2020). Assuming 25 executives/managers each in the equipment and consumable section, the target population becomes 1125.

The sample size for a population of 1125, at a 95% Confidence Level with a 5% Confidence Interval, is 287 (Survey Systems, 2019). It was rounded off to 300.

3.2 The sample size for a pilot study

Statistic solutions (2020) have stated that 30 can be taken as the minimum sample size as a

rule of thumb. Hence 30 purchase executives/managers were selected for the pilot study.

3.3 Questionnaire for a survey

The survey questionnaire was designed with four sections other than the profile information. Each of the sections had ten questions. Responses were taken on a 3-point Likert scale for the first section, while the other 5-point Likert scale was used. The first section had significance ratings, and the other three sections had impact/agreement and indifference ratings.

The questionnaires were tested for validity and reliability as under:

3.4 Test of validity

The hypotheses, hypotheses testing method, questionnaire, etc., were validated by the Guide and other experts in the field to ensure that the measurement was adequate and accurate in terms of the desired direction. Responses sought were duly controlled to ensure that only valid input data is collected.

3.5 Test of reliability

Cronbach's Alpha tests were applied on the questionnaire using "Siegle Reliability Calculator" an excel program, and the results are summarized as under:

Table 1: Reliability scores of the questionnaire

Section No.	Section Title	Cronbach's Alpha
1	Entire questionnaire	0.86
2	Section I	0.72
3	Section II	0.89
4	Section III	0.72
5	Section IV	0.79

As all the Cronbach's alpha score were more than 0.70, the questionnaire was considered as reliable.

3.6 Hypotheses formulation:

The hypotheses formulation is presented below.

Table 2: Hypotheses formulation

Sr. No.	Area of study	Null hypothesis	Alternate hypothesis
1	Pre-purchase buying behavior	Purchase behavior in the case of LV energy-efficient motors is the same as other standard LV motors.	Purchase behavior in the case of LV energy-efficient motors is significantly different from the other standard LV motors.
2	Impact of Sales Promotion	There is no significant impact of sales promotion of energy-efficient motors due to the energy savings appeal on buyers in the cement industry.	There is a significant impact of sales promotion of energy-efficient motors with energy savings appeal on buyers in the cement industry.
3	Post-purchase behavior	Post-purchase behavior in the case of LV energy-efficient motors has no significant unique features.	Post-purchase behavior in the case of LV energy-efficient motors has significant unique features.
4	Patterns, practices, and strategies of industrial buying	The patterns, practices, and strategies of industrial buying in the cement industry are different in different buying situations.	The patterns, practices, and industrial buying strategies in the cement industry are significantly indifferent in different buying situations.

3.7 Conceptual model

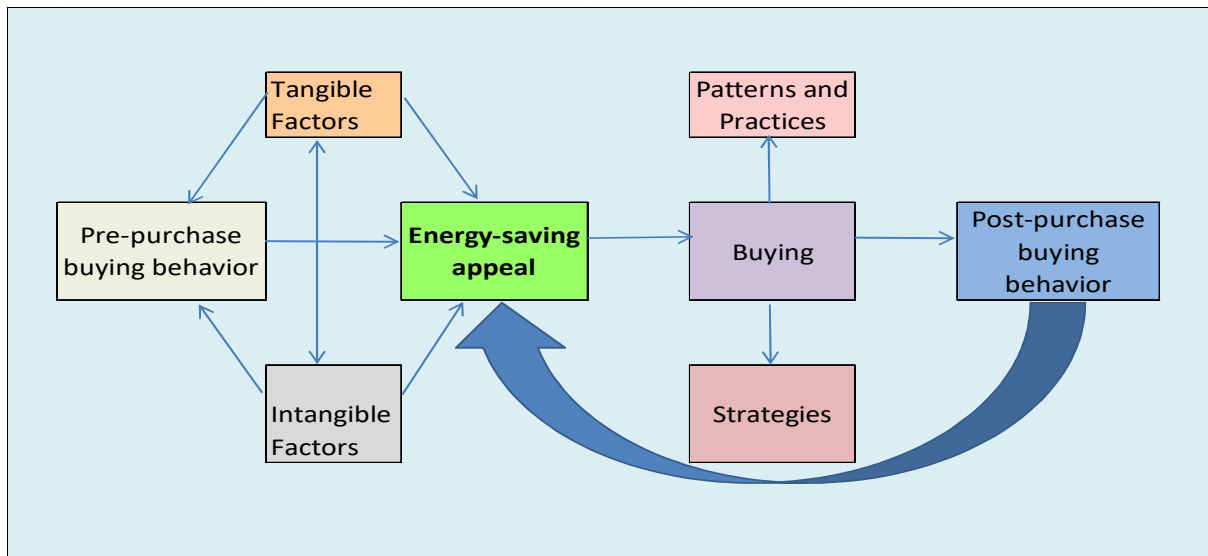


Figure 1: Conceptual model for the research

3.8 Scheme formed for testing of hypotheses

- i. To test the hypotheses, a questionnaire was prepared and administered to 30 Purchase Executives/Managers. It contained profile information and four sections.
- ii. The assessment for section I was done on a 3-point Likert scale. For sections II, III, and IV, a 5-point Likert scale was used.

- iii. The responses for each of the sections were averaged for the ten statements in that section.
- iv. For testing hypotheses 1, two sample means test was applied, and for the rest, p-values were calculated, and the null hypotheses were checked for rejection or non-rejection by way of a t-test. These calculations were done at a 95% confidence level. The sample means were

compared with hypothesized population means taken at mid-point or 50% of the scales connoting an event possible by chance.

- v. While calculating the sample means, for bipolar scales, weights of 2 were used to value extreme responses and distinguish them from moderate (somewhat) responses.
- vi. Ho's rejection would indicate that the sample has statistically significant characteristics and are not by chance.

4. Data analysis and interpretation

4.1 Descriptive analysis

A total of 30 purchase executives and managers were surveyed. Twenty-three were male, while seven were female. Age for 8

respondents was < 30 years, for 7 respondents was between 30-40 years, and for the balance 15 it was >40 years. In terms of experience, eight respondents had <5 years of experience, 3 had 5-10 years of experience, and 19 had > 10 years of experience. Out of the 30, 21 were in the executive role, while nine worked in a managerial capacity. The plants were evenly distributed all over India, with 9 in the East region, 8 in the West region, 6 in the North Region, and 7 in the South region. 13 respondents were based at Head Office, while 17 were based Plants. In terms of capacity, 11 plants were <1 MTPA, 10 were between 1-3 MTPA, and 9 were > 3 MTPA. In terms of Plant age, two were < 5 years, nine were between 5-10 years, and 19 were > 10 years. The above data has been tabulated as under:

Table 3: Descriptive statistics: Purchase Executives/Managers profile

	Male	Female	Total		
Gender	23	7	30		
	<30 years	30-40 years	>40 years	Total	
Age	8	7	15	30	
	<5 years	5-10 years	>10 years	Total	
Experience	8	3	19	30	
	Manager	Executive	Total		
Role	9	21	30		
	East	West	North	South	Total
Region	9	8	7	6	30
	HO	Plant	Total		
Location	13	17	30		
	<1 MTPA	1-3 MTPA	>3 MTPA	Total	
Capacity	11	10	9	30	
	<5 years	5-10 years	>10 years	Total	
Age of Plant	2	9	19	30	

4.2 Inferential analysis (Testing of hypotheses at 95% confidence level)

Hypothesis 1

Ho1: Purchase behavior in the case of LV energy-efficient motors is the same as other standard LV motors

Ha1: Purchase behavior in the case of LV energy-efficient motors is significantly different from the other standard LV motors
The hypothesis was tested using 2 sample t-test. The results are given below:

Table 4: Summary statistics

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Standard	30	0	30	0.000	1.500	0.823	0.382
EE	30	0	30	0.600	1.700	1.133	0.350

t-test for two independent samples / Two-tailed test:
 95% confidence interval on the difference between the means:
 [-0.499,-0.121]

Difference	-0.310
t (Observed value)	-3.278
t (Critical value)	2.002
DF	58
p-value (Two-tailed)	0.002
Alpha	0.05

Test interpretation:

As the computed p-value is lower than the significance level $\alpha=0.05$, one should reject the null hypothesis H_0 , and accept the alternative hypothesis H_a .

Hypothesis 2, 3 and 4

Ho2: There is no significant impact of sales promotion of energy-efficient motors due to energy savings appeal on buyers in the cement industry

Ha2: There is a significant impact of sales promotion of energy-efficient motors with energy savings appeal on buyers in the cement industry

Methodology: For ten statements related to energy efficiency appeal in sales promotion targeted at buyers from the cement industry (in the context of LV energy-efficient motors) and IMPACT rating on the scale of 0-4 (0-Cannot say, 1-Somewhat significant impact, 2-Strong significant impact, 3-Somewhat insignificant impact, 4-Strong insignificant impact) was obtained from the 30 respondents. Weights of two were applied for the extreme responses and distinguished them from moderate (somewhat) responses.

These ten statements were as under:

- i) Reduced energy consumption
- ii) Reduced costs of energy facilities
- iii) Release of extra capacity
- iv) Reduced emissions

- v) Improved work-life and work conditions
- vi) Decreased dependence on energy suppliers
- vii) Reduced add-ons like electricity duty
- viii) Positive impact on environmental concerns
- ix) Reduction in total per-unit manufacturing cost
- x) Improved productivity per rupee of energy cost

For the 30 respondents, a weighted 89% significant impact rating was found with an SD of 0.77.

Ho3: Post-purchase behavior in the case of LV energy-efficient motors has no significant unique features

Ha3: Post-purchase behavior in the case of LV energy-efficient motors has significant unique features

Methodology: For ten statements related to post-purchase buying behavior (in the context of LV energy-efficient motors), an AGREEMENT rating on the scale of 0-4 (0-Cannot say, 1-Somewhat agree, 2-Completely agree, 3-Somewhat disagree, 4-Completely disagree) was obtained from the 30 respondents. Weights of two were applied for the extreme responses and to distinguish them from moderate (somewhat) responses.

These ten statements were as under:

- i. Expected performance is quantified at the time of purchase
- ii. The performance post-purchase is measured.
- iii. The measurement methods factors both efficiency and effectiveness
- iv. The measurement methods are objective.
- v. Tools like energy audits are used for measuring post-purchase performance.
- vi. Results, positive, neutral, or negative, are duly communicated in the organization.
- vii. Results, positive, neutral, or negative, are communicated to the seller.
- viii. For negative results (dissonance), sellers are given a chance to explain.
- ix. For negative results (dissonance), sellers are given a chance to rectify.
- x. Results, positive, neutral, or negative are communicated to peers.

For the 30 respondents, a weighted 90% agreement rating was found with an SD of 0.75.

Ho4: The patterns, practices, and strategies of industrial buying in the cement industry are different in different buying situations

Ha4: The patterns, practices, and strategies of industrial buying in the cement industry are significantly indifferent in different buying situations

Methodology: For ten factors DIFFERENCE ratings in industrial buying in cement industry

in DIFFERENT BUYING SITUATIONS (examples new purchase, re-purchase, crisis purchase, change in supplier) on the scale of 0-4 (0-Cannot say, 1-Somewhat different, 2-Completely different, 3-Somewhat indifferent, 4-Completely indifferent) were obtained from the 30 respondents. Weights of two were applied for the extreme responses and to distinguish them from moderate (somewhat) responses.

These ten statements were as under:

- i. Standard purchase policies and procedures
- ii. Price considerations
- iii. Energy efficiency
- iv. Quality considerations
- v. Buying center joint decisions
- vi. Contacting multiple sources of supplies
- vii. Considerations for quantity of purchases
- viii. Maintenance and warranties
- ix. Intangibles like company reputation, quality, etc.
- x. Personal variables of the buyer like education, experience, values

For the 30 respondents, a weighted 91% indifferent rating was found with an SD of 0.75.

The hypotheses were tested using t-tests, comparing sample means with a hypothesized population mean of 50%. The results are tabulated below:

Table 5: Testing of hypotheses 2, 3 & 4

Parameter	H2	H3	H4
Sample Mean (\bar{x})	89%	90%	91%
Hypo. population mean (μ)	50%	50%	50%
SD of sample	0.77	0.75	0.88
N	30	30	30
t-value	2.73	2.89	2.54
p-value	0.005	0.003	0.008
Decision	Reject Null	Reject Null	Reject Null

4.3 Summary of inferential analysis

Summary of the testing of all the four hypotheses along with their interpretation is given below:

Table 6: Summary of inferential analysis

Sr. No.	Null Hypotheses	p-value	Decision	Interpretation
1	Purchase behavior in the case of LV energy-efficient motors is the same as other standard LV motors	0.002	Reject Null	There is a significant difference in pre-purchase behavior
2	There is no significant impact of sales promotion of energy-efficient motors due to energy savings appeal on buyers in the cement industry	0.005	Reject Null	There is a significant impact of sales promotion of energy-efficient motors
3	Post-purchase behavior in the case of LV energy-efficient motors has no significant unique features	0.003	Reject Null	Post-purchase behavior has unique significant features.
4	Patterns, practices, and strategies of industrial buying in the cement industry are significantly different.	0.008	Reject Null	Patterns, practices, and strategies of industrial buying in the cement industry are significantly indifferent

5. Key findings and conclusions

Data collection is possible with reasonable comfort if respondents are assured of confidentiality. Processing the data into variables required for inferential data analysis can be done. The hypotheses can be duly tested as per the research methodology—the questionnaire prepared for primary data collection tests well for reliability.

The pre-purchase buying behavior is significantly different for standard and energy-efficient LV motors. While the average significance score for standard motors is 0.823, the same for EE motors is 1.133 and was statistically significant at a 95% confidence level. Moreover, the impact of sales promotion of energy-efficient motors is significant. For the 30 respondents, a weighted 89% significant impact rating was found with an SD of 0.77. Further, post-purchase behavior has significant

unique features. For the 30 respondents, a weighted 90% agreement rating was found with an SD of 0.75. Moreover, the patterns, practices, and strategies of industrial buying in the cement industry are significantly indifferent. For the 30 respondents, a weighted 91% indifferent rating was found with an SD of 0.75.

In conclusion, energy-efficient motors' industrial buying behavior is quite different from that of the energy-efficient motors. The energy-saving appeal has a significant role to play in promoting the sales of energy-efficient motors. Interestingly, buyers have stated that notwithstanding the difference in buying situations, the considerations for purchasing energy-efficient motors are not significantly different. Hence, the importance of energy efficiency remains intact.

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