

# A STUDY ON CONSUMER'S READINESS TOWARDS ADOPTION OF LED LIGHT IN INDIA

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## Abstract

The purpose of this paper is to find out the factors responsible for purchase of LED (light-emitting-diodes) bulbs & tubes among Indian consumers and how much they are ready to replace their existing lighting system with LED fittings. A multiple regression model has been employed to investigate the factors affecting the buying decision of LED lamps in place of CFL and incandescent lamps. Eleven motives for adopting LED lamps has been identified viz. price, quality, energy saving, durability, brand, promotion, CSR, & environmental consciousness.

In addition the effect of demographic variables like gender, age, household income on the purchasing decision of LED has also been examined. A total 150 respondents were contacted visiting different outlet of electrical shops of Northern Delhi.

The study may helpful for the companies to decide their marketing strategies to promote LED Lamps among the consumers with an aim to save energy and save environment.

**Keywords** Consumer Behavior; CSR; Innovation; LED Lamps; New Products

## 1. Introduction

### 1.1 Importance of energy conservation-

Energy is the central of achieving the interrelated economic, social, and environmental aims of sustainable development. The relationship between use of energy and economic growth has been a subject of great interest as energy is considered as one of the strong driving forces for economic growth in all form of economy (Pokharel, 2006).

According to Energy Information Administration (EIA, 2010); there is a strong two way relationship between economic development and energy consumption. In one hand growth of an economy with its global competitiveness, hinges on availability of cost-effective and environmentally

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benevolent energy sources, and on the other hand, the level of economic development has been observed to be dependent on the energy demand.

Energy is an essential input of all industrial production and many consumption activities. With existing technology, increased per capita productivity needed to increase per capita income, requires increasing amount of energy. In fact, without an assured supply of energy, rapid economic development is not likely.

## 1.2 The Trend-

In rapidly industrializing economies, middle income countries like India, Thailand, Malaysia, energy use has grown faster than the GDP of these nations. According to TechSci Research report, India's LED lighting market; by type, by application, by end use sector, by competition, by opportunities; forecasted a Gross Annual Growth Rate (GAGR) of over 30% during 2016-2021, on account of rising personal disposable income, growing Government initiatives for encouraging use of LED light and increasing focus on smart city projects.

For instance Delhi Mumbai Industrial Corridor Development Corporation (DMICDC) announced to develop seven smart cities in Gujarat, Haryana, Maharashtra, Rajasthan, Uttar Pradesh and Madhya Pradesh in near future. These projects are expected to increase the Government emphasis on energy efficient lighting products such as LED in coming years. Favourable Government policies and initiatives such as state and national programs that offer LED lighting products at subsidized rates is contributing a huge way towards boosting LED adoptions in the country.

Additionally, with increasing public awareness, demand for LED lighting in residential and office places are growing in faster rate. More and more adoption of LED in residential may help to solve the acquit power shortage in several states like Uttar Pradesh, Bihar.

Outdoor lighting applications generate a revenue share of over 60% in India's LED lighting market in 2015 and the trend is expected to continue through 2021.

Philips, Surya, Havells, Syska, Eveready are few of the leading players operating in India's LED lighting market. The adoption of LED is recorded highest in Northern and Southern India due to higher literacy rate, rising disposable income and rising awareness about the benefits of LED lighting. With increase urbanization and industrialization, demand for energy increases day by day and meeting this demand efficiently is a great challenge for the Government. For this reason increasing energy efficiency through the use of most advance technology like LED lamps is warranted.

The residential LED lighting market in Asia Pacific market is only 8% compare to Japan 27%,

Europe, 22%, America 20% and China 19%.

## **2. Literature Review**

### **2.1 Cost/ Price**

According to Menanteau and Lefebvre (2000), there has been a partial adoption of Compact Fluorescent Light (CFL) for a number of reasons, e.g. both CFL & LED lamps are characterized by high initial cost for customers, and this serves as a barrier to their adoption.

It is therefore likely that the higher initial purchase cost of LED will be an obstacle to their adoption; or we may say that price of the LED do have a negative influence to intention to buy.

### **2.2 Quality**

Through economic and marketing literature it has been found that signals serve mostly as heuristics in assessing product quality when there is a need to reduce the perceived risk of purchase (Olson, & Jacoby, 1972; Olson 1977), the consumers lack expertise and thus the ability to assess quality (Rao, & Monroe, 1988). The signals that are more studied include brand names (Olson, 1977) or brand advertising, product features or appearance (Nelson, 1970; Olson, 1977), price (Olson, 1972, 1977; Rao, & Monroe, 1989).

It is therefore assumed that the higher the quality of LED lamps, the higher will be their rate of adoption.

### **2.3 Energy savings**

India has made substantial improvement in adopting energy efficient technology which is evident from the reduction achieved in energy intensities of GDP to the tune of 88% during 1980-2007. Similar reduction was observed both with respect to overall Indian economy and the major sectors of the economy (Balachandra et al. 2010).

The European Union appliance energy consumption labeling scheme is a key component of the effort to increase the diffusion of energy efficient house-hold appliances (Mill, & Schleich, 2010)

LED lamps tend to use less than one sixth as much energy as their incandescent or halogen counterparts and two to three times less than the CFLs. LED produces 90-112 lumens/watt; CFL produces 40-70 lumens/watt, and traditional incandescent lamp produces 10-17 lumens/watt. Consequently LED circuit is 80% more efficient than incandescent bulbs. This means that 80% of electrical energy is converted to light energy while the remaining 20% is lost as heat energy; as compare to incandescent bulbs, which operates at about 20% efficiency, 80% of electrical energy is

lost as heat. In terms of environmental effect this reduction in electricity consumption results in reduction of greenhouse gas emission.

Therefore it is hypothesized here that energy saving is positively related to the intention to purchase LED lamps.

## **2.4 Durability**

Consumers purchase durables in response to a recognized specific need (Solomon, 2004). The purchasing behavior is also diverse in style as per the taste/ values of consumer (Dittmer et al., 1996). Cooper's research suggests that there are a number of products which some people wish to keep for more than ten years (Cooper, 2004), and there are also a numbers of products (including small electrical appliances, white goods and some brown goods) which people tends more often to keep until they break beyond repair (Cooper, 2004). Both of these finding may point to a latent desire by some consumers to 'hang on' to some products. This may also suggest that if some products were more durable, consumers may actually keep them in use for longer.

The useful life of LED light is based on the number of operating hours until the LED emits 70% of its initial light output. Top quality LED in well designed fixtures are expected to have a useful life of 30,000 to 50,000 hours, significantly higher than the 1000 hours for a typical incandescent bulb and 8,000 to 10,000 hours for a comparable CFL. The longer the life of a LED the better the return to the consumer over the high initial investment in them.

Therefore, it is hypothesized that the durability of LED lamps is positively related to the intension to buy the product.

## **The Marketing Factors**

### **2.5 Brand**

Brand awareness can affect the choices that people make among brand even if essentially no other associations obtain with those brands. It has shown in the research that consumers sometimes have the tendency to purchase products made by only one familiar, well established brand (Jacoby, Syzabillo, & Busato-Schach, 1977). Thus in context of low involvement decisions (as in case of LED purchase), a minimum level of brand awareness may be sufficient for the consumers in order to make a purchase decision, even when a well formed attitude does not exist (Bellman & Park, 1980).

Thus it may be hypothesized that a well known brand is likely to be positively related to the intention to buy LED lamps.

## 2.6 Promotion

Among the various tools available, it has been found that sales promotion stimulates quick and large purchases during a limited period of time. According to Ailawadi, Gedenk, & Neslin, (1999), a promotion can even yield a long term increase in market share if some individuals try the brand that might not have otherwise done so.

Thus, it is hypothesized that promotion are positively related to the intension to purchase LED lamps.

## 2.7 Corporate Social Responsibility (CSR)

Consumers and company's stakeholders become aware of corporate social responsibility (CSR) through a variety of means, such as sustainability reporting, and this according to Bebbington et al. (2008), can be a way of enhancing a company's reputation. Outstanding corporate reputation, for example, is often related to higher brand value and this may contribute to an increase in a business success (Fombrun, 1996). Ghoshal (2006) discussed about the ethical issue of practicing CSR and suggested to make it mandatory by the Government for big firms to invest a certain percentage of their profit in practicing CSR.

According to Diekmann, & Franzen (1999), a large number of respondent throughout the world have stated that they are very concerned about environmental problems. Today's customers are more aware off the seriousness of environmental degradation, and business that support environmental practices are in the list of desire to purchase eco-friendly product (Laroche et al., 2001). Ghoshal (2011) discussed about the problem of green washing, a practice of false claiming about green product. Predictably, the level of people's environmental concern is linked to their interest in and willingness to purchase green products (Biswas et al., 2000).

**Prakash (2000)** believes that it is important to know whether the consumers view the tag "green" as a motivation to buy the product. If this becomes possible, green revolution can receive an automatic boost and lead to great profits. There are a few exceptions even if the public prefer firms like the ISO 14001 certification which approve green revolution.

Thus it is hypothesized that, the higher the corporate social responsibility is perceived, the more likely it is the consumers will buy LED lamps from that company.

## 2.8 Perceived Effectiveness of Environmental Behaviour

According to Allen et al., (1991), "perceived consumer effectiveness" refers to the extent to which individual believe that their actions make a difference in solving a problem. Later, Kim, & Choi (2005) argued that individuals acting in consonance of a strong belief that their

environmentally conscious behavior will result in a positive outcome and are more likely to support their concern for the environment.

Thus it is hypothesized that perceived consumers effectiveness or perceived effectiveness of environmental behavior is positively related to the intention to purchase LED lamps.

## **Demographic Characteristics**

### **2.9 Gender**

Empirical studies have revealed that there are possible differences in relation to ecological value orientations. Stern et al., (1993) showed that women possessed a stronger inclination towards all types of value orientation compare to men. Schultz (2001) found that women showed higher level of ecological value orientation compare to its counterpart.

From the above studies, it can be hypothesized that gender does have an influencing role in induction of LED lamps.

### **2.10 Age**

Like gender, age does have a role in decision making of LED purchase. The survey research of Linden et al. (2006) for Sweden, indicate that younger people have better knowledge about energy saving measures than older people. Studies by Whitehead (1991) and those of Carlsson, & Johansson- Stenman (2000)- cited by Torgler, & Garcia (2007)-founded that people are less willing to pay environmental protection as they grew older. This may be because these individuals expect fewer benefits from environmental preservation since they perceived that their remaining lifetime is not longer.

Torgler, & Garcia (2007) in a study in Spain, & Torgler et al. (2008) in a study on western European countries, also observed a negative correlation between age and environmental attitudes and preferences. Similarly according to Howell, & Laska (1992), younger people in USA are more concerned about the environment than older people.

*Given the results of these studies, it is assumed that age is negatively related to the intention to purchase LED lamps.*

### **2.11 Household Income**

Household income, according to Held (1983), can be seen as a dominant predictor of behavior regarding the use of energy. In an econometric estimation of the determinant of energy conservation expenditures, Long (1993) provided that the, "income level of household was

positively and statistically related to larger conservation investment.” In the same line Kasulis et al.(1981) argued that if a household belongs to low income, individuals in it are likely to be used low amount of energy and for this reason would not be likely to respond to the request to conserve energy to a great extend. Stern, & Gardner (1981), stressed that it is energy efficiency rather than measures that cartels its use that is preferred by high income consumers. In a recent study, Poortinga et al. (2003) urged that higher income group is more open to the idea of technical improvements.

According to Schipper, & Hawk (1991), low income household may feel financial unstability and lack of extra money to invest in residential energy saving improvements. Finally, Walsh, (1989) in econometric analysis proved that, higher income household are better able than lower income one in adoption of energy efficient technology.

Thus it is hypothesized that household income is positively related to the intention to purchase LED lamps.

### **3. Objective of the study**

The main object of the study was to find out the factors which have an influential power in decision making to purchase LED lighting system/ LED light in place of incandescent and CFL bulbs.

## **4. RESEARCH METHODOLOGY**

### **4.1 Sampling**

The questionnaire was first tested with 30 BBA & B.Com students for a preliminary understanding about the reaction of respondents. Based on the suggestions the questionnaire was pretested amongst 10 adult shoppers who were the target respondents. The questionnaire was revised based on feedback of the interviewees for its suitability and clarity.

The main study was conducted in the month of May and June 2017 in Delhi. One hundred and fifty eligible shoppers were interviewed from 20 randomly selected electrical shops in Rohini district of Delhi.

The MAN (Money, Authority, and Need) theory was applied to identify the eligible shoppers.

To test the hypothesis, a multiple regression analysis was applied using SPSS 20 software.

## 4.2 Hypothesis:

H01: There is no relationship of intention to buy LED bulbs with the product's characteristics, marketing efforts and demographic factors of consumers.

Ha1: There is a strong relationship of intention to buy LED bulbs with the product's characteristics, marketing efforts and demographic factors of consumers.

## 5. Data Analysis

### 5.1 Reliability Analysis

Reliability means the extent to which a scale produces consistent results if repeated measurements are made on the characteristics (Malhotra, and Dash, 2011). In this study, the internal reliability has been measured with the help of Cronbach's alpha statistic as well as composite reliability (CR). For a measure to be acceptable, coefficient alpha and composite reliability should be more than 0.7 (Malhotra, and Dash, 2011). Owing to multidimensionality of the construct, coefficient alpha and composite reliability have been computed separately for all the dimensions identified.

In the present study, values of Cronbach's alpha and composite reliability are more than 0.958, indicating good consistency among the items within each dimension.

**Table 5.1** Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Price	17.7400	35.549	.867	.915	.952
Quality	18.1400	39.061	.713	.805	.957
Energy saving	18.2533	40.593	.662	.936	.958
Durability	17.8533	37.227	.931	.920	.949
Brand	17.7933	36.004	.924	.933	.949
Promotion	17.5000	36.252	.898	.921	.951
CSR_decisive_factor	17.0933	38.944	.788	.904	.954
Environment_effectiveness	17.0733	38.834	.752	.923	.956
Age	17.5800	38.688	.857	.831	.952
Gender	18.4133	43.909	.548	.871	.962
Household_income	17.6933	36.563	.947	.938	.949



In table-I, column six, we can see that the Cronbach's alpha values (if deleted) of all the items are either equal or less than the Cronbach's alpha,0.958, this implies that no item is required to be eliminated from the test.

## 5.2 Demographic Profile of the Respondents

Table 5.2 Demographic characteristics of respondents.

Demographic characteristic	Frequency	Percentage
<b>GENDER</b>		
Male	135	90.00%
Female	15	10.00%
<b>AGE</b>		
18-35 yrs	40(young)	26.67%
35-55Yrs	90(middle age)	60.00%
55-75 Yrs	20(old age)	13.33%
<b>MONTHLY FAMILY INCOME(Rs.)</b>		
Less than 20,000	35( low income)	23.33%
20,000-40,000	53(middle income)	35.33%
40,000+	62(higher income)	41.33%

According to Table-II, most of the respondents are male (90%), implies males are most actively engaged in purchasing household lighting products. About 86.67% of the respondents are within the 18-55years age group; implies that the young and middle aged people are in favour of purchasing LED light for their household. 76.66% respondents have a monthly income of above Rs. 20.000/ month implies middle and higher income households mostly prefer to purchase LED rather than conventional incandescent bulbs.

*Product characteristics*, i.e. price, quality, energy savings, and durability; *the marketing efforts* of LED light say, brand, promotion, CSR, and effectiveness of environmental behavior, as well as *demographic characteristics*, including gender, age, and household income, are likely to be positively related to the intention to buy LED lamps/ lighting system. In order to find out whether this hypothesis is true, a linear regression analysis was conducted. The earlier-mentioned independent variables were regressed on 'the intention to buy LED light' that was taken as the dependent variable. The results of the multiple regression analysis are shown in following table.

## Regression Analysis

In regression analysis, 'intention to buy LED' is taken as dependent variable and attributes of product's features, marketing efforts and demographic factors are taken as independent variables.

We assume that there is no relationship of intention to buy LED bulbs with the product's characteristics, marketing efforts and demographic factors of consumers (Ho1).

Now we will regress 'intention to buy with the product features (price, quality, energy saving, durability), marketing effort (brand, promotion, CSR, environment effectiveness) and demographic factors (age, gender, and household income) one by one, we obtained:

Table 5.3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.906a	.820	.815	.34355

In table-III, the R value represents the simple correlation and the value is 0.906, indicates a very high degree of correlation between dependent variable and predictors. The adjusted R<sup>2</sup> value indicates how much of the total variation in the dependent variable can be explained by the independent variables. In this case it is 81.5%, indicating a fair level of correlation between the dependent variable and the independent variables.

Table 5.4 Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			tolerance	VIF
1(constant)	-.540	0.110		-4.921	.000		
Price	.871	0.098	0.504	8.894	.000	0.386	2.589
Quality	.255	0.070	0.236	3.659	.000	0.299	3.344
Energy saving	.446	0.173	0.209	2.577	.011	0.189	5.285
Durability	.142	0.158	0.058	0.898	.371	0.299	3.344

R<sup>2</sup>=.820, adj. R<sup>2</sup>=.815, F=165.171, p= 0.000, Sig at 0.05.

According to the standard beta coefficient, as shown in table-IV, predictors like, price, quality, energy saving, durability; have a positive beta value which implies that all these independent variables do have a positive impact on dependent variable. The higher standard beta value of price indicates that it do have a greater impact on decision making compare to other variables. At the same time, the significance level, p-values of price, quality, energy saving are below .05, indicate that these predictors do have a significant impact on dependent variable. On the other hand,

durability has a significant value more than 0.05, implies, it is not so significant for dependent variable i.e. intention to buy LED lamps. This may be due to the fact that LED has recently launched and the guarantee that is claiming by companies is still to be tested. The VIF values far less than ten indicate that no multicollinearity among the variables exists.

**Table 5.5** Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			tolerance	VIF
1(constant)	-.881	0.087		-10.154	.000		
Brand	1.000	0.067	0.502	14.951	.000	0.500	2.000
Promotion	.238	0.056	0.253	4.277	.000	0.161	6.220
CSR	.121	0.049	0.104	2.468	.015	0.319	3.135
Environment effectiveness	.403	0.083	0.239	4.875	.000	0.236	4.245

R<sup>2</sup>=.918, adj. R<sup>2</sup>=.916, F=406.606, p= 0.000, Sig at 0.05.

In table-V, the standard beta coefficients of all the marketing effort predictors are positive with a significant level less than .05, implies that product brand, promotion, image of CSR and environment consciousness are all significant and have positive impact on purchasing decision of LED bulbs. The VIF values far less than ten indicate that no multicollinearity among the variables exists.

**Table 5.6** Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			tolerance	VIF
1(constant)	-.223	.157		-1.424	.157		
Age	.159	.119	.123	1.333	.185	.285	3.506
Gender	.242	.174	.091	1.395	.165	.568	1.760
Household income	.754	.114	.634	6.621	.000	.266	3.758

R<sup>2</sup>=.644, adj. R<sup>2</sup>=.637, F=88.169, p= 0.000, Sig at 0.05.

In table-VI, contrary to previous discussion the standard beta coefficients of demographic predictors say age and gender have significant p-value greater than .05 indicates no correlation with dependent variable, implies that purchase decision of LED lamps do not depend on age and gender of the consumer. A higher standard beta value of household income (.634) with p value 0.000 indicates that higher the household income, higher is the intension to buy LED instead of incandescent bulb.

The VIF values far less than ten indicate that no multicollinearity among the variables exists.

## **Conclusion and managerial implications**

With India, selling 770 million LED bulbs every day, the country will soon become the LED capital of the world. Price of LED bulbs has been come down to Rs.50/- from over Rs. 330/- during the last two years.

But the current research shows that consumers still have the impression about the high price of LED lamps. This implies, somehow there is a communication gap between the market and consumers.

The current NDA Government has take a major steps towards encouraging the consumers to adopt more and more LED bulbs in place of incandescent one as an active participant of UJALA (Unnat Jyoti by Affordable LEDs for All) scheme.

It has been found that 12% of all LED lighting system sold throughout the world is consumed in India according to Managing Director of Energy Efficient Services, the company promoted by state run power utilities, is the nodal agency for implementing the UJALA scheme. More than 10 crore LED bulbs have been distributed so far under the scheme.

Lighting sector accounts for about 20% of the total power consumption in India. Most of the lighting need in domestic and public sectors are met by the inefficient incandescent or CFL bulbs.

As mentioned earlier, price and household income have a strong correlation with customers intension to buy; marketers need to be more serious about the determinants of LED adaptation and should realized the potential of LED market in India in years to come.

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