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Consumer's Perception towards Electricity Theft: A Path Analysis

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Consumer's Perception towards Electricity Theft: A Path Analysis

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Contents

List of Tables

List of Figures

Abstract

Electricity theft is a chronic issue that weakens the electricity supply system. Energy worth billions of dollars is stolen annually from electricity grids round the world and the extent of theft is higher in the developing countries. The problem is treated as a technical one and generally technical solutions are considered. This study highlights the socio-economic factors that are involved in escalating electricity theft situation in the Islamabad Electric Supply Company (IESCO). The study examines the factors that facilitate the illegal consumption of electricity and the factors are analyzed using the path analysis by employing a measurement model in AMOS. The study uses primary data set comprising of 330 observations collected through a structured questionnaire from the twin cities of Islamabad and Rawalpindi. The results are based on the perception of electricity consumers. The variables examined include bribery payments, load shedding and electricity theft, quality of conduct of the utility officials, probability of detection, electricity tariff rate, rule of law, and household profile. It is found that corruption diluting deterrence, load shedding and age are statistically significant in affecting electricity theft. The role of tariff rate in motivating consumers to steal electricity is insignificant. The study suggests that controlling corruption and improving the reliability of electricity supply can ameliorate the current situation by reducing the extent of electricity theft.

Keywords: Electricity theft; socio-economic indicators; AMOS; Pakistan

1. Introduction

The energy sector acts as a spine for the progression of a country and it requires energy security and cost recovery to ensure sustainable supply and distribution of electricity. Electricity is essential for the production process besides labor, technology and capital, and its supply at a price that is reasonable for an economy. In developing countries, economic growth is deteriorated by an insufficient supply of electricity and the main reasons for this electricity shortfall include electricity theft and lack of adequate generating capacity. From 2006, Pakistan's power sector is facing a serious shortfall of electricity in its history. Previous researches identified that electricity shortfall in Pakistan causes a yearly loss of production, amounting to over a billion-dollar only in the industrial sector (Pasha *et al.,* 1990; Siddiqui *et al.*, 2011; Cardenas *et al.*, 2012). In 2018, Pakistan had lost Rs 196 billion in electricity theft and line losses (Planning Commission, 2018). The heavy losses and theft resulted in an accumulated circular debt of over Rs.860 billion in October 2019.

Pakistan Electric Power Company (PEPCO) reported in April 2011, that the demand for electricity was 14,475 MW and at that time available supply was 9465 MW. The total demand-supply gap across the country was of 5000 MW. This demand-supply gap rises due to T&D losses. These losses include both, technical and non-technical losses. Technical losses comprise of dissipation of power in components of electricity system such as transmission and distribution lines, transformers, and measurement systems whereas, Non-technical losses (NTL) are caused by actions that are exterior to the power system which consists mainly of electricity theft, errors in record-keeping, and non-payment by customers.

Electricity theft is a crime that comprises of sanctions on detection. Becker (1968) says that the offender does a cost-benefit analysis to measure the expected utility of the offense; if the expected gain is higher than the cost then he will commit that offense. According to the Electricity Act, any unlawful extraction from the grid is considered an unlawful activity and will be charged with a sanction. Islamabad Electric Supply Company (IESCO) serves consumers of electricity through a network of 2.4 million electricity of 25 million populations. The industrial sector consumes 26% of electricity whereas household consumers consume 60% of the total electricity provided by IESCO (Jamil, 2018).

In this perspective, the study will focus on investigating the perception/behavior of household consumers towards electricity theft. We will use primary data for this study. We performed an exploratory data analysis in which all the linkages of electricity theft will be studied. For this, survey data is used, based on the respondent's perception of stealing electricity; which is collected from residents of Rawalpindi and Islamabad. The consumer's response plays an important role in the exploration because the consumers comprise of both the offenders and victims of a crime. We conducted a path analysis through AMOS to get the results. The results show that corruption perception of the respondent, load shedding and age contribute positively to electricity theft whereas, education, the probability of detection and the quality of conduct of the utility employees are negatively correlated to electricity theft. Following are the main objectives of the study.

- The research objective is to identify the linkages of socio-economic indicators (Load shedding, rule of law, probability of detection, tariff rate, quality of conduct, electricity consumption pattern, age, and education) with electricity theft and specifically evaluating the contribution of corruption (corruption diluting deterrence) towards the extent of electricity theft.
- Statistical modeling of consumers' perception of electricity theft by using path analysis.

Since corruption and theft are negative aspects of society hence both the utility employees and the consumers are reluctant to give accurate information regarding their involvement in the crime. Therefore the study adopted the alternative method in which the individual choice is assessed to be contingent on its perception about the occurrence of the crime.

The plan of the study is as follows; section 2 examines the literature review in which the methodology and results of the associated studies are discussed. Section 3 explains the conceptual framework used in the study. The research methodology is explained in section 4. The results of data analysis are shown in Section 5. And section 6, concludes the study.

2. Literature Review

For both developed and developing economies, the adequate supply of electricity is important. The shortfall of electricity severely affects all sectors of the economy and hinders development. Kessides (2013) examines the severe electricity crisis in Pakistan and found that there exists a yawning gap between available system generating capacity and demand. The constantly increasing electricity shortfall threatens to damage the credibility and legitimacy of the government. It was examined that the core reasons for the power crisis are reckless energy policies. The bankruptcy of Pakistan's energy is basically due to immense institutional and governance failure. To understand this. supply-demand gap thoroughly, we need to understand the demand and supply difficulties of electricity to the consumers.

Most of the studies in the past, used aggregated country-level data, whereas the underlying theory of consumer demand is based on the behavior of individual agents that reflects individual and household behavior more closely. Filippini and Pachaur, (2004) investigated the electricity demand elasticities in urban India and found that the geographical and the demographical variables of households are important in determining the demand of electricity whereas, electricity demand is income and price inelastic; whereas Carter *et al.*, (2012) found that the change in price or increase in tariff can affect the consumption pattern. He claimed that it not only influences demand but the supply side is also affected. In developing countries with an increase in the population, the investment needs of the electricity sector have also increased. When the price of oil increase it increases the cost of investment thereby making the demand-supply gap wider (Krishnaswamy and Stuggins, 2007).

One of the main causes of this supply-demand gap of electricity is transmission and distribution losses which are categorized into technical and non-technical losses. In Pakistan, approximately 17% of electricity is being wasted every year through T & D losses. Out of this 17%, only 3-4% of electricity is wasted in technical proceedings while the rest of the 13-14% is wasted by means of non-technical losses. Ahmad (2017) analyzed the total energy losses in the power distribution through the consumer energy consumption information from the Rawalpindi region. He examined the non-technical losses(NTL) in terms of the power distribution systems. Also, these losses are majorly financial losses for the utility companies present in the developing countries. He concluded that NTLs is the major cause of damaging infrastructure and network reliability reduction.

The major portion of the non-technical losses comprises of electricity theft. In the previous studies, it was found that in the developing countries the major cause of NTL is electricity theft. Smith, (2004) described that electricity theft can occur in four forms i.e. any form of scam, pilfering, billing irregularities and unpaid bills. Jamil (2018) identified that electricity theft is the persistent problem of Pakistan. This issue creates severe financial crises of utilities and requires to make huge investments to advance the capacity of the electricity grid. His study provides substantial insights to minimize electricity theft by reducing electricity bills and say no to bribe. A study by Nepal and Jamasb (2012) revealed that the main reason for the shortfall of electricity is electricity theft, which is widespread at the household level.

Illegal use of electricity is a crime. This crime is more prevalent in developing countries. Depuru *et al.* (2011) studied that electricity theft is a relatively unknown crime that has significant economic costs. He found that in developing countries there exists a strong correlation of political governance indicators and electricity theft. In developing countries, the major problem is (NTL) that occurs during electrical energy transmission and is creating problems for utility companies to detect and punish the people responsible for the theft.

The existing literature provides strong evidence that there are basically three main sources that prove to be the cause of electricity theft i.e. technological incompetence, socio-economic factors, and institutional irregularities. The researchers claim that socioeconomic indicators have a strong impact on electricity theft. The economy also suffers due to the prevalence of corruption. Electricity theft and corruption are deteriorating for an economy. Both of these illegal activities need to be controlled but due to the inefficiency of the institutions, it is difficult to combat. Some existing literature highlights the various factors which captivate a person to indulge in criminal activities.

Electricity theft is influenced by socio-economic indicators. In developing countries like Pakistan, the problem is that we treat electricity theft as a technical problem and ignore the socio-economic indicators. Various researchers have worked on the socio-economic side of this problem. Razavi and Fleury (2019) claim that in developing countries like India, a major portion of the total amount of electricity produced is being wasted by electricity theft; and the socio-economic factors majorly escalate the extent of electricity theft. They suggested that only technical solutions are not enough to mitigate the problem; both social and economic factors must also be incorporated in combating electricity theft. The average electricity consumption per capita, income, crime rate, literacy rate, and urbanization are found to be statistically significant in their findings.

Similarly, a study was conducted in Ghana by Yakubu *et al.* (2018). They claimed that the main causes of electricity theft are corruption, poor enforcement of the law against electricity theft, higher electricity prices and poor quality of power supplied. In this study, unemployment, illiteracy, and poverty also add to electricity theft. In numerous studies, it was examined that the socioeconomic indicators that facilitate electricity theft include income, social capital, rural population rate and temperature index (Yurtseven, 2015; Siani, 2017).

There are a lot of studies available that provide evidence for the impact of socio-economic indicators on electricity theft. Some studies conclude that socio-economic and governance indicators have a significant role in the extent of electricity theft. Tax rate and corruption boost electricity theft. Some researchers studied the long-run determinants of electricity theft in Pakistan. They identified that there exists a strong relationship between electricity theft, electricity price, per capita income, number of consumers and economic openness. It was found that per capita income has a negative and significant correlation with electricity theft; and electricity prices are positively related to electricity theft (Mirza and Hashmi, 2015; Gaur and Gupta, 2016).

To curb this problem, we have to identify the factors that facilitate electricity theft. Various studies claim that an important role is played by corruption in enhancing electricity theft. It was argued that corruption possesses multidimensional facets that create different distortions in the system. Corruption hinders the path for economic development; it creates inefficiency in the system and leads to political instability in the country. Mauro says that corruption has a strong impact on the system. Normally corruption takes place in those areas where it is difficult to measure e.g. health and education. But the effects on corruption influence all the sectors (Bo and Rossi, 2007; Shleifer and Vishny, 1993; Mauro, 1998; Jamil and Ahmad, 2019)

Bribe culture is also very deteriorating for the economy. People usually get attracted to the crime when the benefit is greater than the cost. Criminals do cost-benefit analysis through expected utility theory. But in some cases, it was also found that ethics plays an important role in decision making (Becker, 1968; Shah, 2007; Colyvan *et al*., 2010; Winther, 2012).

The literature reveals that electricity theft is influenced by socio-economic indicators. In developing countries like Pakistan, the problem is that we treat electricity theft as a technical problem and ignore the socio-economic indicators. Social and economic factors play a significant role in combating electricity theft. The prior literature explained electricity theft by identifying the predictive power of socio-economic indicators. It was claimed in different studies that the main causes of electricity theft are corruption, poor enforcement of the law against electricity theft, electricity consumption patterns, higher electricity prices and poor quality of power supplied. On the basis of prior literature, this study focuses on highlighting the factors that facilitate electricity theft.

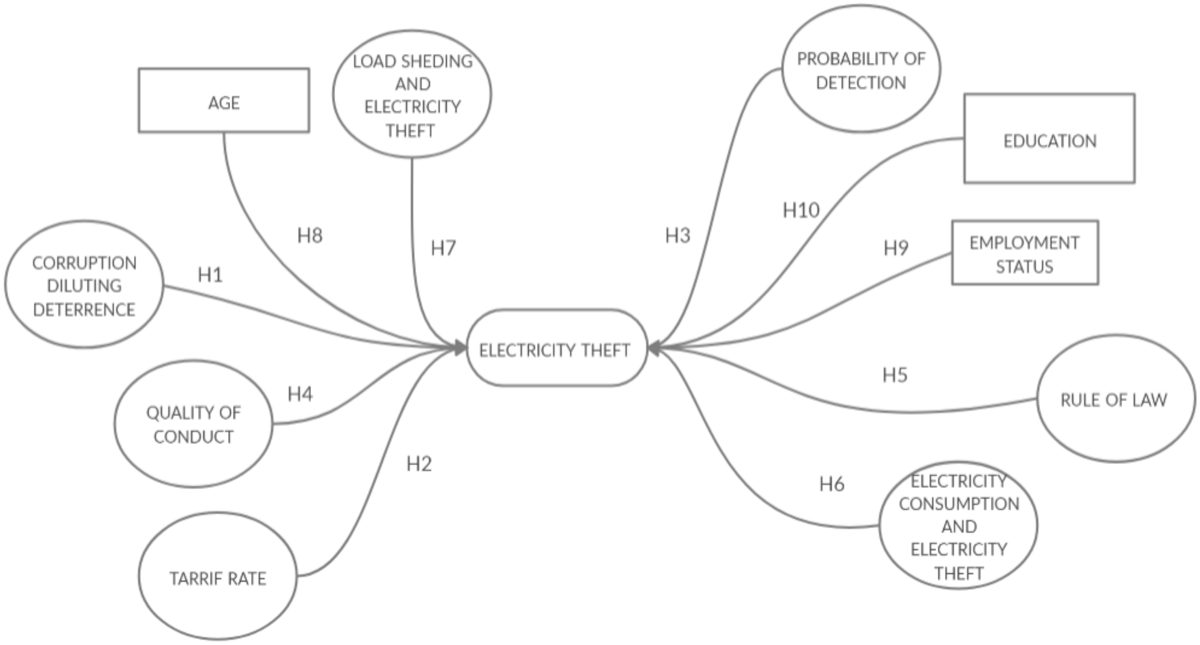
3. Conceptual Framework

On the basis of the literature review presented in Section 2, the linkages between variables were developed and the expected utility theory by Von-Neumann Morgenstern provides a theoretical basis for this research. The model will incorporate factors covering uncertainty such as probability and risk factor. In this chapter, the conceptual framework is presented.

3.1 Model Development and Research Hypothesis

On the basis of literature review, this section explains the linkages between the socio-economic variables and electricity theft in detail. The model is developed and presented on basis of number of factors based on theories which can perhaps influence consumer's perception towards electricity theft. The research model proposed in this study is presented in Figure 1.

Figure 1. Hypothesized Model



The model posits that consumer's perception towards electricity theft depends on the above variables. All the variables used in the model are based on the perception of the consumer. According to the hypothesized model, we have formulated two research questions and 10 hypotheses given in Table 1.

RQ1: What are the factors that facilitate electricity theft?

RQ2: Is corruption the main facilitating factor for electricity theft?

Table 1. Variables and their Expected Signs (hypotheses)

Variable	Items to construct Varable	Expected sign
Electricity theft (ET)	6	Dependent variable
Corruption diluting deterrence (CDD)	5	Positive
Quality of conduct (QC)	6	Negative 03349880647
Rule of law (ROL)	3	Negative
Probability of detection (PD)	4	Negative
Tariff rate (TR)	2	Positive
Electricity consumption pattern (ECons)	2	Positive
Loadshedding (LST)	3	Positive
Education (Edu)	1	Negative
Age	1	Negative

These hypotheses are made on the basis of existing literature, it was found that electricity theft creates hurdles in the path of economic development of a country. It has now turned into a political issue due to the widening of the demand and supply gap (Kessides, 2013). So, to minimize the gap it is important to understand the underlying factors involved in the widening of this gap. Therefore, to understand the behavior of individuals who steal electricity, we will use expected utility theory under uncertainty; It says that the individuals will be willing to take the risk if the expected benefits are higher than the associated costs. If the risk or the amount of fine is greater than the benefit, than he will not take the risk (Rabin, 2013; Kahneman and Tversky, 2013; Colyvan *et al.*, 2010). Various studies have found that the individual behavior towards electricity theft depends on various socio-economic indicators (Depuru *et al.*, 2011; Yurtseven, 2015; Gaur and Gupta, 2016; Saini, 2017; Razavi and Fluery, 2019; Jamil and Ahmad, 2019)

3.2 Electricity Theft and its Socioeconomic Determinants

The dependent variable used in this research is the perception of electricity theft. The variable is constructed on the questions which were designed in such a way that the respondents were not directly asked about electricity theft because it's socially undesirable rather the questions were asked in a way that they could give an insight of the perception or behavior of consumers towards electricity theft.

The scale used in this research encompasses five categories including strongly disagree, disagree, don't know, agree and strongly agree. For the best depiction of his behavior, the respondent was asked to choose the option that embodies his opinion. Responses of each question are based on 1 to 5 scales which incorporates 1 for strongly disagree and 5 for strongly agree. Cumulative scores of each variable define respondent behavior on a constructed variable (Drost, 2011; Oluwatayo, 2012). There are many socio-economic indicators of electricity theft. We are going to examine the impact of following socioeconomic indicators.

Corruption Diluting Deterrence: Corruption is a multifaceted phenomenon and is impossible to be defined through a precise and comprehensive definition (Aidt, 2003). Jain (2001) defined corruption as an act in which the power of the public office is used for personal gains in such a way that disobeys the rules of law. In our research, we are using the bribery form of corruption. The data for this variable is gathered through an individual's perception of bribery or corruption.

Tariff Rate: A tariff is a form of tax or a duty imposed by the government. This research uses data from consumers of electricity about their perception of the tariff rate.

Probability of Detection: Probability of detection refers to the chances of being fined for some unlawful act.

Quality of Conduct: Quality of conduct includes the services provided by the utility employees to the consumer. It also encompasses communication between utility employees and consumers. In our study, this variable is designed on six questions that are related to the consumer's perception of the services provided by utility employees.

Rule of Law: This variable shows the awareness of consumers about the penalties against unlawful activities.

Electricity Consumption Pattern: This variable shows the effect of consumption patterns on electricity theft.

Load shedding: The relationship between load shedding and electricity theft is examined. This variable in our research is constructed on three questions that are based on the consumer's perception of the relationship between electricity theft and load shedding.

Demographic Profile of Respondent:

Age is an observed variable in our study which gives the absolute value.

Education is also a measured variable.

4. Research Methodology

On the basis of existing literature, a conceptual model and hypotheses concerning the consumer's perception towards electricity theft were constructed. This section outlines the sampling method, questionnaire design, collection of data and the techniques for statistical analysis used in our research. We used Analysis of Moment Structures (AMOS) to evaluate the conceptual framework.

The main reason for using this statistical approach is that; Firstly, it provides a comprehensive analysis of the data, secondly; it not only gives the significance of the relationships but also evaluates the model and equips the researcher to identify the relationships between the variables in the hypothesized manner, and use the demographic variables as a measured variable. Thirdly, it provides a visual representation of the model. Details of the methodology used in this study are explained in the sections below: Section 4.1 presents the design of this study. Section 4.2 describesthe target population. Section 4.3 explains the scheme of the study.

4.1 Research Design and Data

This study employed a quantitative data collection method by using the survey approach to collect data concerning the perception of consumers towards electricity theft. A structured questionnaire approach is used that provides measures which are often more precise and hence preferred (Oluwatayo, 2012). It also allows us to interview a large number of respondents in a short interval of time and is comparatively less costly.

Complete confidentiality was guaranteed to the respondents to get their response of the on committing electricity theft. They were not asked to disclose their names or any other sort of identification in the questionnaire. To avoid threatening the respondent, they were not directly asked about the crime rather they were asked about electricity theft in an indirect manner. Therefore, they were made to feel that they are giving their responses to show how they observe various aspects of electricity supply and theft in the system. This field survey was conducted from February to May 2015.

4.2 Target Population

The target population for our research is electricity users in the twin cities at the household level, who are getting electricity supply from the IESCO grid. The respondents were requested to give their responses along a Likert scale that was segregated between moderate and extreme agreement and disagreement to make sure that the responses recorded are fairly accurate. From different income and occupational groups, educational levels, gender and age groups, a random sample of 330 respondents was selected by applying a simple random sampling technique.

4.3 Scheme of the Study

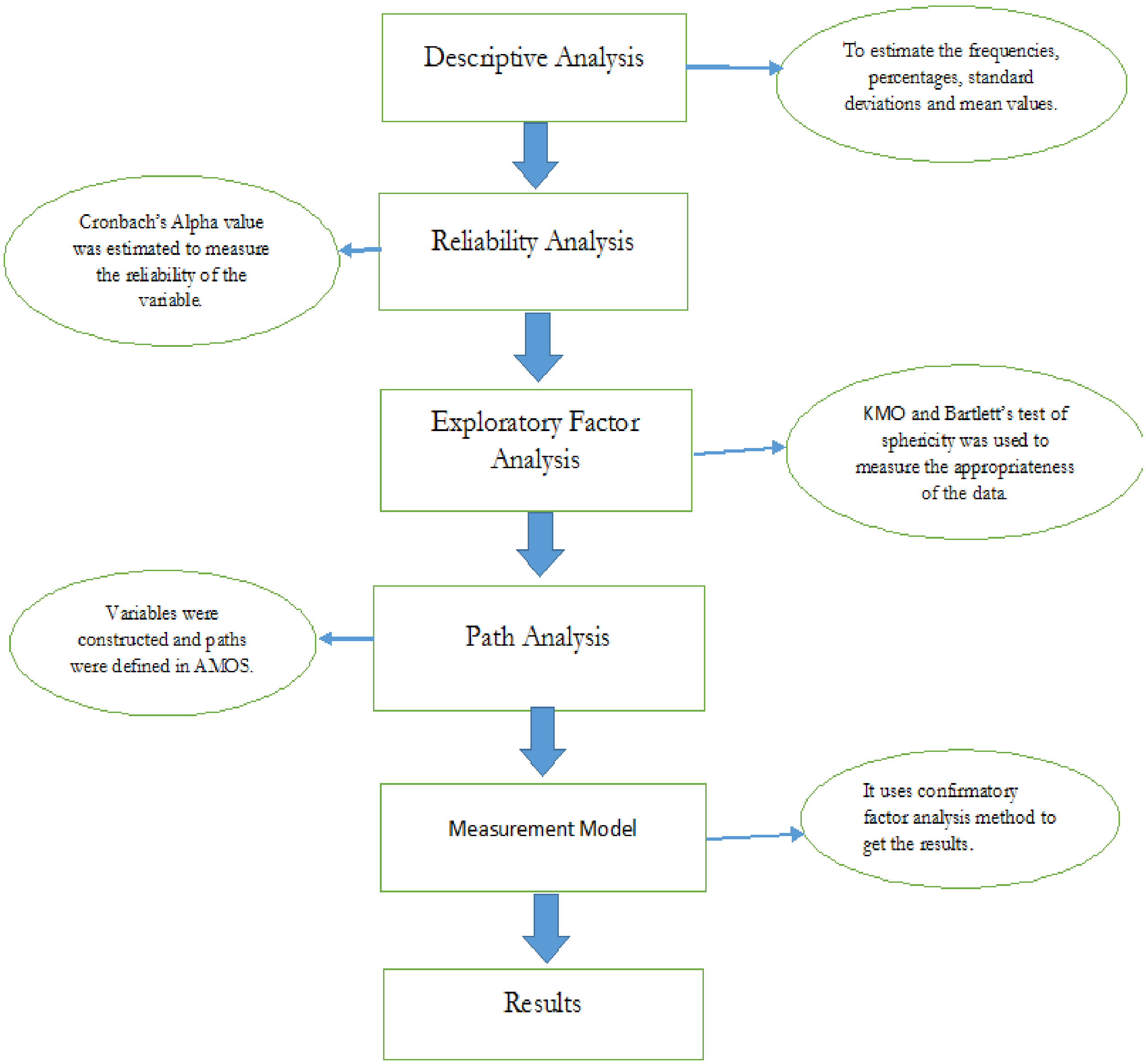
The methodology and plan of the study is presented in Figure 2. Firstly, we did descriptive analysis to measure the frequency, percentage, standard deviation and mean values. Secondly, Cronbach's alpha value was estimated for each variable; the acceptable value for Cronbach alpha is 0.6 or greater than 0.6. Thirdly, exploratory factor analysis was done to check the appropriateness of the data for path analysis. After estimating the appropriateness the of the data, path analysis was conducted through AMOS; then measurement model was applied through confirmatory factor analysis which estimated the results.

5. Data Analysis

5.1 Demographis Characteristics of the Respondents

Data analysis is explained in this section. It gives a description of data used in the analysis and shows the demographic characteristics of the respondents. Furthermore, it provides descriptive statistics of constructs items.

Figure 2. Methodological Scheme of the Study



Data analysis of the respondent's gender, age, education, employment status, and average monthly income is shown in Table 2.

Table 2. Frequencies and Percentages of Demographic Variables

Variable	Category	Frequency	Percentage
Gender	Male=0	251	77
	Female=1	79	23
Age	1= ≤ 30	112	34
	2= 31-40	121	37
	3= 41-50	69	20
	4= 51-60	23	7
	5 >60	5	1.5
Education	1= ≤ matric	83	25
	2= intermediate	65	20
	3= graduate	67	20.1
	4= masters	71	21.5
	5= mphill+phd	44	13.5
Employment status	1=self-employed/business man	104	31.5
	2= private sector employee	76	23
	3= govt. sector employee	69	21
	4= informal sector employee	44	13
	5= unemployed	37	11.5
Estimated monthly expenditure	1= 5000-15000	92	18.5
	2= 15100-29000	89	17.5
	3= 29100-42000	133	26.5
	4= 42100-60000	105	21
	5= >60000	67	14

The descriptive statistics of the selected items of the variables has been done in order to get a fundamental analysis of the study and to provide a summary of variables. The table is given in the appendix, which shows different variables and their frequencies with percentages.

5.2 Reliability Analysis

Reliability analysis is done through Cronbach's Alpha test. Cronbach's alpha coefficient is used to measure the internal consistency reliability for any scales or subscales one may be using. Its coefficient lies between 0 to 1. Results are given in Table 3. George and Mallery (2003) provide the following rules of thumb:"_ > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, _ > .5 – Poor, and_ < .5 – Unacceptable". Nunnally and Bernstein (1994) suggested that the value should be more than 0.60.

Table 3. Reliability Test Results

Variable	No. of items	Cronbach's alpha
Electricity theft	6	0.684
Corruption diluting deterrence	5	0.689
Quality of conduct	6	0.691
Load shedding & electricity theft	3	0.649
Tariff rate	2	0.623
Electricity consumption pattern	2	0.613
Probability of detection	4	0.695
Rule of law	3	0.620

5.3 Factor Analysis

Factor analysis was done through KMO and Bartlett's test of sphericity by using SPSS version 23. In Table 4 the results of KMO and Bartlett's test of sphericity are presented, which tells us that the value of Kaiser-Meyer-Olkin measure of sampling adequacy value was 0.680 and Bartlett's test of sphericity was ($p < 0.000$), as given in the table, indicating the appropriateness of the sample data for conducting confirmatory factor analysis.

Table 4. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.680
Bartlett's Test of Sphericity	Approx. Chi-Square	1957.071
	Degee of Freedom	561
	Significance	.000

5.4 Confirmatory Factor Analysis/ Measurement Model

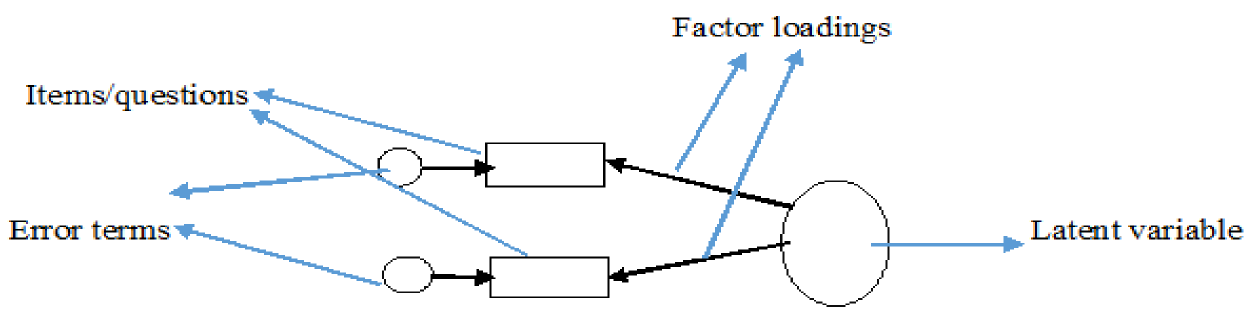
Confirmatory Factor Analysis was conducted for validation of the relationships among constructs and indicators (measurement items), also called as the measurement model, and the relationships between variables are tested by using the structural model. In this study, we will only estimate the measurement model. To confirm the hypothesized relationships between the measurement items and their respective latent variables, we conducted CFA. The main reason for selecting SEM (Path Analysis) for data analysis was that; SEM has the ability to validate underlying relationships between constructs with multiple measurement items (Tabachnick and Fidell, 2001).

In structural equation modeling, path analysis is done through the measurement model which explains the relationship among the constructs that are validated through confirmatory factor analysis. The main reason for selecting this technique was that it offers a comprehensive analysis of the data, it not only provides significance of the impact of variables but also evaluate the model, it uses a systematic mechanism to validate the relationships between the constructs and indicators and to identify the relationships in a single model. Furthermore, this is a new technique that is not used by previous researchers to measure electricity theft in Pakistan.

In the first step, the measurement model was constructed by using the linkages between measurement items and latent (unobserved) factors. Then we defined the direction of all independent variables (on the basis of existing literature) to capture the effect of these variables on the dependent variable.

5.4.1 Variable Construction and Path Analysis

In our research, each variable is constructed on a number of items so the first step is to construct all the variables in AMOS. The rectangular box represents each question on which the variable is constructed. An error term is attached to each item of the variable.



5.4.2 Measurement Model Specification and CFA Results

In this research, confirmatory factor analysis (CFA) was performed through the maximum likelihood method to estimate the measurement model to calculate the unidimensionality and reliability and for validation of measures. In CFA, the goodness of fit (GOF) criteria indices was used to assess the measurement model. Below is the diagrammatic representation of a pooled confirmatory factor analysis.

Table 5. Construction of the Variables through AMOS

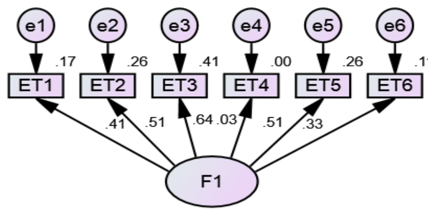
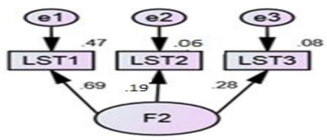
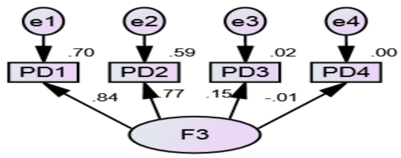
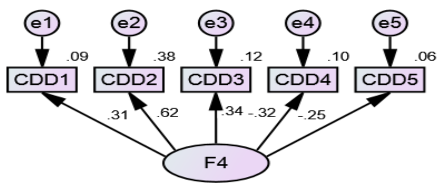
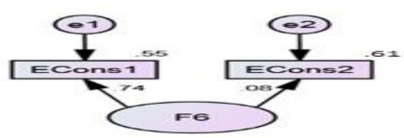
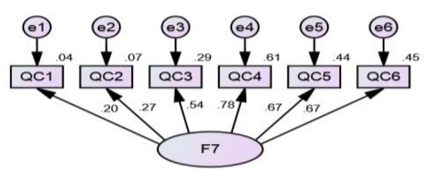
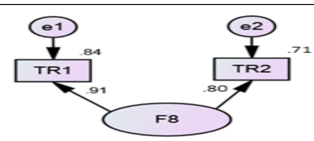
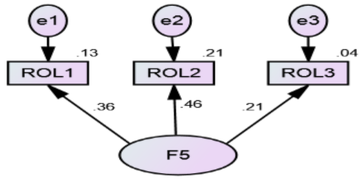
Variable	Figure	Items of the variable
Electricity theft		This variable is constructed on six items of the questionnaire. This variable will not tell the actual amount of electricity theft but will show the perception of electricity theft. We can see from the figure that the factor loadings for question 4 fall below the acceptable range. So we will exclude this question. After excluding item 4, all the values of factor loadings falls in the acceptable range(≥0.6).
Load shedding		This variable is constructed on three items of the questionnaire. It shows the perception of consumers on the impact of load-shedding on electricity theft.
Probability of detection		This variable is constructed on four items of the questionnaire. From the figure, it's clearly shown that the factor loadings for question 4 fall below the acceptable range. Now we will exclude this question. After excluding question 4, all the values of factor loadings falls in the acceptable range.
Corruption diluting deterrence		This variable is constructed on five items of the questionnaire. It shows the consumer's perception of corruption. Item 4 and 5 are showing negative values which shows that there is no need to incorporate these questions in the variable so we will exclude them. After excluding questions 4 and 5, all values fall in the acceptable range.
Electricity consumption pattern		This variable is constructed on two items of the questionnaire. This variable shows the variation in electricity consumption due to an increase or decrease in income. The factor loadings of both items are above 0.6, which means they are acceptable.
Quality of conduct		This variable is constructed on six items of the questionnaire. It shows the quality of services and the communication level between the IESCO workers and consumers. All of the 6 items are needed for the construction of this variable because all are showing acceptable values of factor loadings.
Tariff rate		This variable is constructed on two items of the questionnaire. It shows the amount of tax on electricity.
Rule of law		This variable is constructed on three items of the questionnaire. It shows the implementation and awareness of the law regarding electricity theft. All the factor loadings of items fall in the acceptable range i.e. >0.6.

Figure 3. Framework of the Model Used in the Study

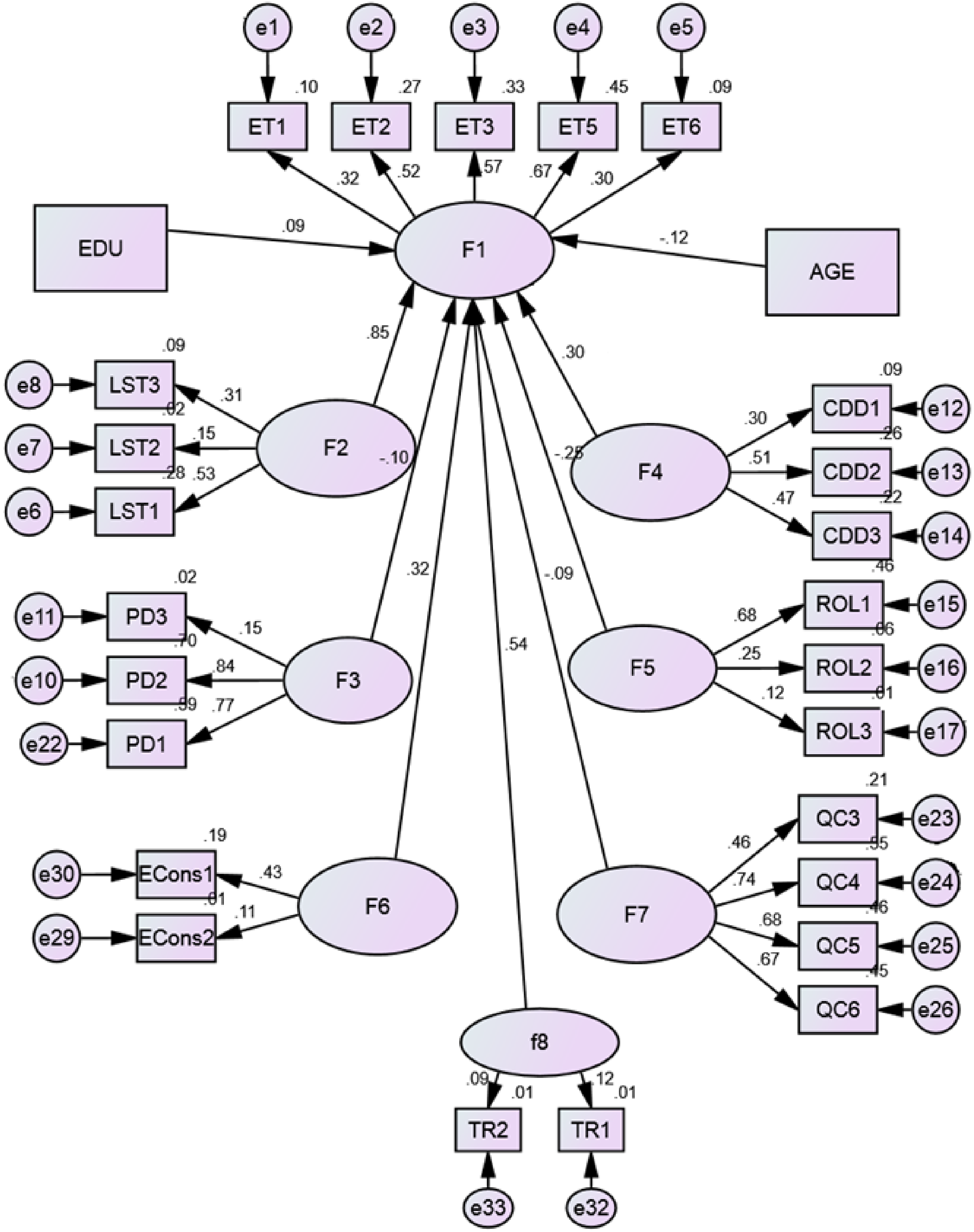


Table 6. Fitness Indices (Good fit criteria of a model)

Goodness of Fit Measures	Index	Categories	Acceptable Level	Results	References
Probability level	p-value		Acceptable ≥ 0	.000	Hair *et al.*(1995) Byrne (2010)
Chi-square	Chisq		-	637.859	
Degree of freedom	Df			314	Hair *et al.* (1995) Cheng(2011) Baumgartner and Homburg (1996)
Chi-Square/ Degree of Freedom	Chisq/df = CMIN		Acceptable <5	2.031	Hair *et al.* (1995) Cheng(2011) Baumgartner and Homburg (1996) and Doll et al. (1994)
Root Mean Square of Error Approximation	RMSEA	Absolute fit	Acceptable < 0.8	.056	Hair *et al.*(1995) Cheng(2011) Baumgartner and Homburg (1996)
Goodness of Fit index	GFI		Acceptable ≥ 0.8	.866	
Adjusted goodness of fit	AGFI	Incremental fit	Acceptable ≥ 0.8	.838	Hair *et al.*(1995) Byrne (2010) Ernest *et al.* (2008)
Tucker-Lewis index	TLI		Acceptable ≥ 0.8	.628	
Comparative fit index	CFI		Acceptable ≥ 0.8	.716	
Parsimony ratio	PRATIO	Parsimonious fit	Acceptable ≥ 0.8	.895	
	PCFI			.640	

In AMOS, there are several fitness indices that are used to reflect that how fit your data is to the model. There is no strong evidence available of using all these indices for a model fit. However, Hair *et al.* (1995) recommended that one should use at least three indices, one from each category. Three model fit categories are Absolute Fit, Incremental Fit, and Parsimonious Fit. In our results, four indices hit the model fit criteria. The significance of each variable is shown in the table below.

Table 7. Estimated Model Results

Variable	Co-efficient	Prob.
Load Shedding	0.401	0.005
Corruption Diluting Deterrence	0.302	0.024
Electricity Consumption Pattern	0.826	0.422
Tariff Rate	1.510	0.545
Probability Detection	- 0.041	0.146
Rule of Law	- 0.112	0.220
Quality of Conduct	- 0.530	0.195
Education	0.023	0.140
Age	- 0.045	0.049

In the proposed model, it was hypothesized that corruption diluting deterrence will have a positive relationship with the perception of electricity theft (H1). The parameter estimate results (H1: CDD → ET; β = 0.302, t-value = 2.225, p = 0.02) for the above hypothesis was found positive and statistically significant. This suggested that corruption is a facilitating factor for electricity theft. So, this hypothesis was accepted. The results of this hypothesis are consistent with the findings of prior researches.

Our second research hypothesis was related to the tariff rate. It was stated that the tariff rate is positively related to electricity theft. The results for this hypothesis are H2: TR → ET; β = 1.510, t-value = 0.195, p = 0.545. The parameter estimate results show that the relationship between tariff rate and electricity theft is positive but it is statistically insignificant. This hypothesis is rejected. Similarly, the third hypothesis states that the probability of detection is negatively correlated to electricity theft. The parameter estimate results (H3: PD → ET; β = -.041, t-value = -1.453, p = .146). Probability of detection and electricity theft are negatively correlated but their relationship is statistically insignificant. This hypothesis is also rejected.

The fourth hypothesis is related to the quality of conduct. It was hypothesized that the quality of conduct is negatively related to electricity theft. The estimates results (H4: QC → ET; β = -.053, t-value = -1.2295, p = .195) for this hypothesis shows that the relationship between quality of conduct and electricity theft is positive but it is statistically insignificant. So this hypothesis is rejected.

It is hypothesized that the rule of law and electricity theft are negatively correlated. The results (H5: ROL → ET; β = -.112, t-value = -1.227, p = .220) shows that the rule of law and electricity theft are negatively correlated but are statistically insignificant, so this hypothesis is rejected.

The sixth hypothesis is based on the relationship between electricity consumption patterns and electricity theft. It is hypothesized that they have a positive relationship. The results (H6:

ECons → ET; β = .826, t-value = 1.030, p = .422) displays that the relationship between electricity consumption pattern and electricity theft is positive but it is statistically insignificant. This hypothesis is rejected.

The seventh hypothesis states that load shedding and electricity theft are positively correlated. Our findings (H7: LST→ ET; β = .401, t-value = 2.838, p = .005) shows that the relationship between load shedding and electricity theft is positive and is statistically significant. So, our hypothesis is accepted.

In the eighth hypothesis, it was claimed that age is negatively correlated to electricity theft. The results for this variable are H8: Age→ ET; β = -.045, t-value = -1.97, p = .041. From the results, it is clear that age and electricity theft are negatively correlated and this relationship is statistically significant. So our hypothesis is accepted.

In the ninth hypothesis, it was mentioned that education and electricity theft has a negative relationship. The results (H9: Edu→ ET; β = .023, t-value = 1.475, p = .140) displays that education and electricity theft are positively correlated, which is against the literature. And is insignificant. So, this hypothesis is rejected.

Table 7 shows that we have three significant variables i.e. corruption diluting deterrence, load shedding, and age. Corruption diluting deterrence shows a positive relationship with the dependent variable which unveils that an increase in corruption will lead towards an increase in electricity theft. Similarly, load shedding is also positively linked to electricity theft which shows that an increase in load shedding will cause an increase in the amount of electricity theft. Our third significant variable is negatively correlated to electricity theft which means that an increase in the age of a consumer will decrease the chances of theft of electricity. The signs of all the variables are in accordance with the literature.

5.5 Robustness of the Results

To check the robustness of results, we assigned equal weight to each item of the variable and made an index by adding the responses of all the items of each variable. Then we used a tailored software "FACTOR" to check the efficiency of results. Similarly, we used SPSS to measure the contribution of variables towards electricity theft through Principal Component Analysis (PCA). The results of FACTOR and SPSS are the same as we got through AMOS. The results show that Corruption diluting deterrence, Load shedding and Age are significantly contributing towards electricity theft and the direction of all other variables is also the same as we got in AMOS.

Table 8. Comparison of the Estimated Model from AMOS and SPSS

AMOS RESULTS			SPSS RESULTS	
Model	Co-efficient	P-value	Co-efficient	P-value
Load Shedding	0.401	0.005	0.504	0.000
Corruption Diluting Deterrence	0.302	0.024	0.360	0.000
Electricity Consumption Pattern	0.826	0.422	0.131	0.206
Tariff Rate	1.510	0.545	0.164	0.197
Probability of Detection	- 0.041	0.146	- 0.141	0.086
Rule of Law	- 0.112	0.220	- 0.069	0.445
Quality of Conduct	- 0.530	0.195	- 0.018	0.745
Education	0.023	0.140	0.223	0.128
Age	- 0.045	0.049	0.460	0.022

6. Discussion

In this section, we are going to discuss our results in comparison to the literature review findings. Our findings indicate a positive relationship between the perception of corruption and electricity theft. This research is in accordance with the prior literature (Mauro, 1998; Aidt, 2003; Dal Bó and Rossi, 2007; Gaur and Gupta, 2016; Saini, 2017; Yakubu *et al.*, 2018; Jamil and Ahmad, 2019). From this result, we can say that corruption is a major contributing factor in electricity theft. It is usually said that corruption is the mother of all ills. Electricity theft and corruption are two sides of the same coin. It's a crime and unlawful act to commit both of these conducts.

For the tariff rate, our results showed that electricity theft and tariff rates have a positive insignificant relationship. The prior literature suggests that the tariff rate is positively correlated to electricity theft (Jamil and Ahmed, 2019; Mirza and Hashmi, 2015; Gaur and Gupta, 2016). It is illustrated as if the tariff rate will increase, the consumer will have to pay more. In that situation, if he steals electricity, he will have the benefit of saving a large amount of his money. So he indulges himself in electricity theft. But the data we have says that electricity theft and tariff rate have an insignificant relationship.

The probability of detection is also considered vital for controlling electricity theft. In the previous literature, it is found that probability of detection and electricity theft has a negative relationship (Jamil, 2018; Razavi *et al.*, 2019) but our data say that electricity theft and probability of detection have a negative insignificant relationship. Similarly, the researchers suggest that the quality of conduct also has a significant negative relationship with electricity theft. Our findings say that the quality of conduct and electricity theft are in a negative insignificant relationship.

The model is based on the assumption that the rule of law and electricity theft are negatively correlated (Smith, 2004; Kessides, 2013; Saini, 2017; Jamil and Ahmad, 2019). But our data gave the results that show an insignificant relationship between rule of law and electricity theft. It was mentioned in the previous studies that electricity consumption pattern is directly proportional to electricity theft (see, Razavi and Fleury, 2019). The results show that electricity consumption patterns and electricity theft are positively related however, this relationship is statistically insignificant. The study indicates a positive relationship between load shedding and electricity theft. It's basically the perception of consumers which gives an insight that if the load shedding will increase, it will bring an increase in the amount of electricity theft. Previous studies also support our findings (Saini, 2017; Yakubu *et al.*, 2018).

We used two demographic variables i.e. age and education. According to the prior researches, it was suggested that age and electricity theft are negatively correlated which means that an increase in age will lead to a decreasing trend in electricity theft due to increased risk aversion with age of a respondent. Results of this analysis are consistent showing a negative relationship between age and electricity theft. This relationship is statistically significant. In the case of education, it was suggested by the previous studies that education and electricity theft are negatively correlated (Mauro,1998; Marangoz, 2013). Our analysis shows a negative and insignificant relationship between education and electricity theft.

7. Conclusion and Policy Implications

In this research, we identified the facilitating factor for electricity theft developed on the basis of a perception of the consumer of electricity. Our methodology includes a measurement model estimated through maximum likelihood technique and analyzing the goodness of fit model through AMOS. All the results are based on the perception of the consumer. Electricity theft is our dependent variable and corruption diluting deterrence, tariff rate, probability of detection, quality of conduct, rule of law, electricity consumption pattern, age and education are our independent variables. Our results showed a significant relationship of electricity theft with corruption diluting deterrence, load shedding, and age. Corruption diluting deterrence (CDD) and load shedding (LST)are positively correlated whereas age is negatively correlated.

Policy implications are that electricity losses should be treated as a technical as well as socio-economic problem. In order to decrease the extent of electricity theft, man to man interaction should be reduced by using automated meters and heavy penalties to convicted corrupt employees. Increase the monitoring and quality of conduct in those areas where the extent of electricity theft is high to avoid such pilferages. The areas where the chances of detection are greater show a lesser extent of electricity theft hence IESCO should make sure the enforcement of the law.

References

Ahmad T. (2017) Non-technical Loss Analysis and Prevention Using Smart Meters. *Renewable and Sustainable Energy Reviews*, *72*, 573-589.

Aidt T. S. (2003) Economic Analysis of Corruption: A Survey. *The Economic Journal*, *113*(491), F632-F652.

Baumgartner H. and Homburg C. (1996) Applications of Structural Equation Modeling in Marketing and Consumer Research: A Review. *International Journal of Research in Marketing*, *13*(2), 139-161.

Becker G. S. (1968) Crime and Punishment: An Economic Approach; in The Economic Dimensions of Crime.

Byrne, B. M. (2010). Multivariate Applications Series. *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming (2nd ed.). New York, NY, US: Routledge/Taylor & Francis Group.*

Carter A., Craigwell R. and Moore W. (2012) Price Reform and Household Demand for Electricity. *Journal of Policy Modeling*, *34*(2), 242-252.

Colyvan M., Cox D. and Steele K. (2010) Modeling the Moral Dimension of Decisions. *Noûs*, *44*(3), 503-529.

Cheng S. (2011) Comparisons of Competing Models between Attitudinal Loyalty and Behavioral Loyalty. *International Journal of Business and Social Science*, *2*(10), 149-166.

Dal Bó E. and Rossi M. A. (2007) Corruption and Inefficiency: Theory and Evidence from Electric Utilities. *Journal of Public Economics*, *91*(5-6), 939-962.

Depuru S. S. S. R., Wang L., and Devabhaktuni V. (2011) Electricity Theft: Overview, Issues, Prevention and a Smart Meter Based Approach to Control Theft. *Energy Policy*, *39*(2), 1007-1015.

Doll W. J., Xia W. and Torkzadeh G. (1994) A Confirmatory Factor Analysis of the End-user Computing Satisfaction Instrument. *MIS Quarterly*, 453-461.

Drost E. A. (2011) Validity and Reliability in Social Science Research. *Education Research and Perspectives*, *38*(1), 105.

Filippini M. and Pachauri S. (2004) Elasticities of Electricity Demand in Urban Indian Households. *Energy Policy*, *32*(3), 429-436.

Gaur V. and Gupta E. (2016) The Determinants of Electricity Theft: An Empirical Analysis of Indian States. *Energy Policy*, *93*, 127-136.

Hair J. F., Anderson R. E., Tatham R. L. and Black W. C. (1995) Multivariate Data Analysis with Readings. *Englewood Cliff, NJ: Prentice.*

Jain A. K, 2001 "Corruption: A Review". *Journal of Economic Surveys*, *15*(1), 71-121.

Jamil F. (2013) On the Electricity Shortage, Price and Electricity Theft Nexus. *Energy Policy*, *54*, 267-272.

Jamil F. (2018) Electricity Theft among Residential Consumers in Rawalpindi and Islamabad. *Energy Policy*, *123*, 147-154.

Jamil F. and Ahmad E. (2019) Policy Considerations for Limiting Electricity Theft in the Developing Countries. *Energy Policy*, *129*, 452-458.

Kahneman D. and Tversky A. (2013) Prospect Theory: An Analysis of Decision Under Risk. *In Handbook of the Fundamentals of Financial Decision Making: Part I (pp. 99-127).*

Kessides I. N. (2013) Chaos in Power: Pakistan's Electricity Crisis. *Energy Policy*, *55*, 271-285.

Krishnaswamy V. and Stuggins G. (2007) *Closing the Electricity Supply-Demand Gap*. World Bank Group, Energy and Mining Sector Board.

George D. and Mallery P. (2003) SPSS for Windows Step by Step: A Simple Guide and Reference. *Allyn, Bacon, Boston,*

Marangoz C. (2013) *Illegal Electricity Use in Turkey: Causes and Policy Implications* (Doctoral Dissertation, Vanderbilt University).

Mauro P. (1998) Corruption and The Composition of Government Expenditure. *Journal of Public Economics*, *69*(2), 263-279.

Mirza F. M. and Hashmi M. S. (2015) Long-Run Determinants of Electricity Theft in Pakistan: An Empirical Analysis. *Pakistan Journal of Social Sciences (PJSS)*, *35*(2).

Nepal R. and Jamasb T. (2012) Reforming Small Electricity Systems Under Political Instability: The case of Nepal. *Energy Policy*, *40*, 242-251.

Nakano M. and Managi S. (2008) Regulatory Reforms and Productivity: An Empirical Analysis of the Japanese Electricity Industry. *Energy Policy*, *36*(1), 201-209.

Rabin M. (2013) Risk Aversion and Expected-Utility Theory: A Calibration Theorem. In *Handbook of the Fundamentals of Financial Decision Making: Part I* (pp. 241-252).

Razavi R. and Fleury M. (2019) Socio-economic Predictors of Electricity Theft In Developing Countries: An Indian Case Study. *Energy for Sustainable Development*, *49*, 1-10.

Razavi R., Gharipour A., Fleury M. and Akpan I. J. (2019) A Practical Feature-Engineering Framework For Electricity Theft Detection In Smart Grids. *Applied Energy*, *238*, 481-494.

Saini S. (2017) Social and Behavioral Aspects of Electricity Theft: An Explorative Review. *International Journal of Research in Economics and Social Sciences*, *7*(6), 26-37.

Shleifer A. and Vishny R. W. (1993) Corruption. *The Quarterly Journal of Economics*, *108*(3), 599-617.

Smith T. B. (2004) Electricity Theft: A Comparative Analysis. *Energy Policy*, *32*(18), 2067-2076.

Winther T. (2012) Electricity Theft as a Relational Issue: A Comparative Look at Zanzibar, Tanzania, and the Sunderban Islands, India. *Energy for Sustainable Development*, *16*(1), 111-119.

Yakubu O., Babu N. and Adjei O. (2018) Electricity Theft: Analysis of the Underlying Contributory Factors in Ghana. *Energy Policy*, *123*, 611-618.

Yurtseven Ç. (2015) The Causes of Electricity Theft: An Econometric Analysis of The Case of Turkey. *Utilities Policy*, *37*, 70-78.

Appendix

Some important responses of primary

Question	Agree	Don't know	Disagree
ELECTRICITY THEFT			
ET1-Electricity theft occurs in my area	53.9	30.6	15.5
ET2-if electricity theft is economically viable, I will commit it	24.0	20.3	55.7
ET3-Given the quality of electricity supply, electricity theft is justifiable	31.2	16.4	52.4
ET4-Being a common phenomenon, one cannot be blamed for electricity theft	41.8	30.9	27.3
ET5-Increasing burden of electricity theft make people steal electricity	20.0	16.1	64
ET6-Electricity theft in Pakistan is ethically and morally justifiable	34.5	19.1	46.4
CORRUPTION DILUTING DETERRENCE			
CDD1-I pay a bribe to an IESCO employee to get lower bills	30.6	27.6	41.8
CDD2- I know people who pay a bribe to IESCO employee to get lower bills	32.7	21.2	46.0
CDD3- One who bribes to IESCO employee cannot be fined for electricity theft	17.8	35.5	46.7
CDD4- One can easily find an IESCO employee willing to accept a bribe for help in electricity theft.	42.1	37.3	20.6
LOAD SHEDDING AND ELECTRICITY THEFT			
LST1- Electricity theft being an individual affair, does not affect load shedding	29.7	16.1	54.2
LST2- Even if electricity bills are honestly paid, load shedding will not decline	39.1	21.2	39.7
LST3-Increased theft in the city will not result in higher load shedding	26.7	19.7	53.9
TARIFF RATE			
TR1- Rising tariffs will lead to proportionately more electricity theft	42.1	23.6	34.2
TR2- the Increasing burden of electricity charges make people steal electricity	44.2	25.5	30.3
PROBABILITY OF DETECTION			
PD1- If I temper the meter without bribing the employee, I will not be detected	52.1	17.0	30.9
PD2- I feel that sufficient monitoring is there to detect theft	70.9	12.7	16.3
PD3- I know people punished for electricity theft in my area in recent past	55.8	23.6	20.6
PD4- The penalty bill is deterring individuals from electricity theft	49.1	23.6	49.1
RULE OF LAW			
ROL1- Generally people are well-aware of penalties for electricity theft	45.1	26.4	28.5
ROL2- Penalties imposed for electricity theft are considered severe	36.3	28.5	35.2
ROL3- IESCO employees are monitored and punished for unlawful activities	21.5	27.6	50.9
QUALITY OF CONDUCT			
QC1-Meter reader arrives regularly to take my meter reading	40.9	21.5	37.6
QC2- Communicated schedule of load shedding is followed by IESCO	22.1	17.9	60.0
QC3- found IESC0 officials cooperative whenever I contact for some issue	42.2	18.8	39.1
QC4- I am satisfied with electricity supply	29.7	10.6	59.7
QC5- I am satisfied with my electricity bills	20.3	15.2	64.6
QC6- IESCO arrangements for customer services are satisfactory	57.9	17.6	24.6
ELECTRICITY CONSUMPTION PATTERN			
ECons1- As my income rises, my electricity consumption increases	37.8	16.7	45.5
EC ons2- Normally, my household electricity bill remains within the range of 1. Less than 50 units; 2. Less than 100 units; 3. Between 101-300 units; 4. Between 301-700 units; and 5. Higher than 700 units	29.1	27.9	43.0

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