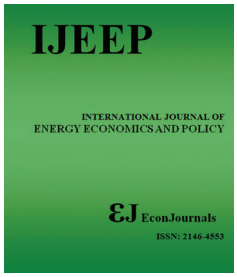

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Renewable Energy Products and Customer's Purchase Intentions having Environmental Concern

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ABSTRACT

The wind or solar, a renewable energy source, is not depleted when used. The current study examined the relationship of renewable energy products (solar panels and related equipment) and customer purchase intentions with a mediating role of customer's concern for the environment and perceived risk involved in buying such products. A cross-sectional, quantitative, and explanatory design is used by sampling 354 male and female customers on convenience basis. Structural equation modeling is applied through AMOS software for hypotheses testing. The results revealed that customers product related knowledge, environmental concern and even risk involved helped customers develop their purchase intentions regarding purchase of renewable energy products. This study used a cross-sectional design and used a single segment of products that are solar panels (renewable energy technology/product). It is recommended that future studies must use other research designs with diverse samples and products. Single aspect of risk is used in the study that was physical risk related to product other types of risk may bring interesting insights. The effort is made to know the customer intentions for purchasing renewable energy products for environmental protection. Greater the knowledge higher will be the propensity of developing purchase intentions. Marketers must focus on reducing risks and enhance confidence by educating them for increased purchase intentions, particularly when it is about renewable energy products. The study examined the linkages between knowledge, risk and environmental concern shaping the purchase intentions that have not been examined earlier in the context of energy deficient country – Pakistan and highlighted the need for renewable energy use.

Keywords: Customer, Knowledge, Renewable Energy Products, Physical Risk, Environmental Concern, Purchase Intentions
JEL Classifications: M31, M37

1. INTRODUCTION

Efficient use of energy for environmental protection has its weight in the turbulent times of energy shortage. In Pakistan, the electricity breakdown is on the rise, especially in the summer season. The electricity crisis is due to the gap persistent between the supply and demand of the generating capacity. This gap has not emerged abruptly but the reckless energy policies have contributed to it over the past three decades (Kessides, 2013). To keep them comfortable people try to find out ways that satisfy their summer needs. For this reason, they look for energy alternatives and try to go for the products that are not consumed totally with the passage of time. The electricity shortage ranges from 8 to 12 h/day in cities and up to 18 h in backward areas of the country, this is because of

the ever increasing gap between supply and demand of electricity and financial constraints (DasValasai et al., 2017).

Moreover, the marketing literature is found curious about the factors having direct and indirect contributions in shaping customers' purchase intentions (Sarmad et al., 2020: Oliver, 1997). Sales forecast depends up on the purchase tendencies of customer' for the technological new products/ services and it also aids decisions regarding demand of the products, segmenting the market and advertisement strategies (Tsiotsou, 2006) because the purchase intentions are having dynamic nature (Oliver, 2009), especially for the products that are new-to-market such as renewable energy equipment – new technology and products (Johnson et al., 2006) like renewable energy products including solar panels. Regarding such products, knowledge of the products and satisfaction regarding information is seen as having a concrete role in developing purchase intentions (Tuu and Olsen, 2012). Moreover, existing evidence revealed that the knowledge-purchase intention linkage is indirectly affected by other factors/variables (mediators) such as consumer's characteristics and situational characteristics (Walsh et al., 2008) or cultural variations (Kassim and Abdullah, 2010).

Perceived risk explains and provides understanding regarding consumer evaluation, choice and purchase patterns (Campbell and Goldstein, 2001). Evidence also exists regarding increased consumers' knowledge and minimized perceived risk (Goyal, 2004) due to the reason that information or experiences boost learning processes reducing perceived risks (Roselius, 1971). Moreover, the knowledge and certainty reduce risk (Krishnan and Smith, 1998) and the perceived risk of illicit conscious consumer behavior (Mitchell, 1999). Collectively examination of these constructs may gain more weightage in the scenario of developing economy, of Pakistan, wherein the risks related to technological products are common due to the low per-capita income, low developments related to technology (Khan and Bae, 2017), lower educational levels (Khan et al., 2018), and deficiency of quality control mechanisms (Ali et al., 2020).

Risks attached to products, especially the technology products/ expensive products/new products and environmental concerns are important predictors of purchase intention/behavior and have indirect effects on the relationship between knowledge about a product and purchase intentions (Evanschitzky and Wunderlich, 2006). Although knowledge is used to minimize risks but still due to having low income people have the tendency to look at the risk at threatening factors that hamper their purchase intentions. It is noted that the prevailing evidence considered examining established brands having recognition in the market and were consumer items for which the cost factor does not matter, services and products, and was having longitudinal approach, experimental designs and so forth. Thus, the current study adopted cross-sectional design with self-administrated questionnaires to record primary data for real responses. Further, the current study examines the mediation effects of the constructs in knowledge about a product and purchase intentions.

The concept highlighted here is noteworthy due to the reason that consumers' knowledge and satisfaction level for the new technology (solar panels) sometimes seen to be uncertain (Berger et al., 1994), the likely risks attached to the renewable energy products (Roe and Teisl, 2007). The effects of such factors regarding renewable energy products experiences are potentially different from that of established products. It is noted that in case of established products consumers may have greater experiences of using the products.

The customer emotions are involved while evaluating a new product, whereas the belief of a person regarding an already existing product evaluation (Westbrook and Reilly, 1983). By using the existing products the customers can decide their new purchases on the basis of experiences but this is not possible in the case of new experiences they have with respect to the recently introduced renewable energy products. Consumer attitudes and satisfaction for the product get strengthened over a period of time (Bolton, 1998), that is why these constructs have interaction with other related constructs like concern for the environment, involvement and may be some other variables (Chandrashekaran et al.,2007).

This study provides insights for purchasing renewable energy equipment when the risk perceptions are surfacing (Martinez-Poveda et al., 2009). The hypotheses are developed in the sub-sequent section.

2. LITERATURE REVIEW/THEORETICAL FRAMEWORK

2.1. Renewable Energy (RE)

Electricity use comprises an increased share of World energy demands that may increase during the upcoming decades. This generated the demand for energy alternatives. At present, in any economy, the renewable energy is desirable even over nuclear power due to less risk of disasters. This also helps in reducing the emission of carbon dioxide (CO_2). Moreover, the renewable electricity technologies will scale up, from a total global supply of 1,454 gigawatts (GW) in 2011 to 2,167 GW in 2017 (Sarver et al., 2013).

The renewable energy (clean technologies) is categorized into energy supply technology, that are the alternative renewable energy sources (like wind and solar power), and energy efficiency technology, that are hired to enhance energy use efficiency, (like combined heat and power [CHP], virtual0power plants [VPP] and smart meters). For the current study only alternative sources of renewable energy, that is solar power is considered for the reason being people having greater tendency towards this technology. It is to bring to light that reviving the energy sector and replacing conventional energy with renewable energy is in evolutionary stages that are associated with technological change and forming markets (Kubiszewski et al., 2010).

2.2. Product Knowledge and Customer Purchase Intentions (PK – CPI)

However, consumer knowledge which is the first point of reference in information search prior to decision making has not received as much attention as is required. Consumer knowledge often termed

"product related knowledge" represents the extent of experiences, expertise, and familiarity consumers have with a product. It refers to internalized information that consumers resort to when making decisions (Kolyesnikova et al., 2010).

Generally, the consumers are expected to possess preliminary information about products they plan to purchase. Consumer knowledge is comprised of "familiarity" and "expertise." Familiarity is the number of product-related experiences accumulated whereas the expertise is the ability to perform successful product-related tasks (Alba and Hutchinson, 1987). Consumers interested to gain more product knowledge conduct efficient information search keeping in mind the attributes of usefulness and are capable of distinguishing between brands and are better brand selectors (Moorthy et al., 1997).

The consumers having strong brand or product knowledge are efficient in making purchase decisions and choose the alternative that is more close to their purchase criteria (Bentler, 1992; Pang and Ji, 2007) than consumers with lower product knowledge. Previously the perceived knowledge and consumption frequency (Rortveit and Olsen, 2007) and development of purchase intention (Soderlund, 2002) are revealed to have positive linkage.

2.3. Product Knowledge and Perceived Product Risk (PK – PR)

The familiarity and expertise, the two components of knowledge (Alba and Hutchinson, 1987) are healthy contributors toward reducing risks. The psychologists have further distinguished knowledge as "declarative" and "procedural" (Worsley, 2002) where in the declarative s about drawing conclusions on the basis of information accumulated whereas the procedural pertains to the process of gathering information. Moreover, the knowledge is classified with regard to content, the nature, complexity, valence and information quantity stored in one's memory (Fabrigar et al., 2006). Relevant to this study, the knowledge is classified as a facet of attitude strength providing a sense of certainty or confidence (Petty and Krosnick, 1995). The accumulated knowledge helps to evaluate and consuming the selected product (Alba and Hutchinson, 1987; Smith et al., 2008), providing better satisfaction and building re-purchase intentions.

The consumers' knowledge increases when they get the actual product and re-think carefully (Smith et al., 2008). This information reduces the high levels of risk associated with product quality and functioning. They often rely on the knowledge acquired through various sources to perform evaluations (Chen and Li, 2007) for best purchase decisions. In addition, consumers with high levels of relevant information often evaluate more exactly and confidently (Smith et al., 2008). Therefore, except for the consumers perceiving higher risks and less tolerance may prevent from making positive decisions (Yuksel and Yuksel, 2007). Consumers having higher level of knowledge have the ability to limit the negative consequences of risks. The negative repercussions of perceived risk on its consequences (e.g. the satisfaction-purchase intention relationship) are weaker for higher knowledge consumers than for lower knowledge consumers.

2.4. Product Knowledge and Environmental Concern (PK – EC)

The humanity with weaker environmental concern is upsetting the nature's balance (Dunlap et al., 2000; Khan et al., 2019) with a motive to rule over nature whereas customer's knowledge is one's clarity about a certain product and its uses. The greater the knowledge leads to greater environmental concern (Schiffman and Kanuk, 2009).

The environmental altruism is a social behavior produced from a desire to protect the health of other people, especially family members and future generations from being polluted. Environmental concern is described as a "uni-dimensional construct ranging from unconcerned about the environment at the low end to concerned at the high end, as measured by the new environmental paradigm" (Mostafa, 2009, p. 31). Alternatively, it describes an attitudinal disposition one has about the environment (Mostafa, 2009) and its protection.

The customer knowledge about the product and its pros and cons with respect to environment and its effect on the health of the people helps to develop environmental concern (McFarlane and Ogazon, 2011: Iqbal et al., 2020). Greater the amount of knowledge greater the environmental concern (Kaufmann et al., 2012) and vice versa.

The knowledge plays an important role in sustainable purchasing and building consumer motivation for sustainable energy goods encouraged by media and educational alternatives available (Thompson et al., 2012) whereas the people with lack of knowledge are seen as disadvantaged.

2.5. Perceived Product Risk and Customer Purchase Intentions (PR – CPI)

It is the uncertainty of achieving goals set in product purchase (Cox, 1967). The customers having risk averse tendencies have weaker tendency to develop the purchase intentions and vice versa. There exist different types of risks attached to a product purchase such as perceived functional, financial, physical and psychological risk have the direct negative effects on intention to purchase (Bhukya and Singh, 2015). Risk is a subjective expectation of a loss (Sweeney et al., 1999). Consumers perceive high risks during purchase decisions about unknown brands, thus compelling consumer to select best suited (Bhukya and Singh, 2015). Beneke et al. (2012) revealed that functional and time risks negatively influenced the purchase intentions for certain privately labeled goods, while financial, physical, psychological and social risks do not have any significant influence.

Perceived risks drastically affect consumer's decision of purchasing premium Private Labeled Brands (Glynn and Chen, 2009; Erdem and Swait, 2004). Moreover, the product complexity is found correlated with functional risk. Semeijn et al. (2004) discovered producing Private Labeled Brands more challenging than the well-renowned brands, which can be seen in the case of re-knowable energy products in Pakistan.

Physical risk has three variations such as the possibility of getting physical harm by the use of product, the hurting of a shopper's

expectations by the people at shopping outlet and the loss of physical efforts spent on one's shopping expedition (Schiffman and Kanuk, 2009; Chen and He, 2003). But the most probable risk is a consumer's fear of product damaging their health or bringing physical injures (Mieres et al., 2005 and Ahmad et al., 2014).

2.6. Environmental Concern and Customer Purchase Intentions (EC – CPI)

The environment has changed considerably worldwide because of global warming and natural disasters affecting not only the living organisms but also the economic and social conditions (Maichum et al., 2017 and ahmad et al).

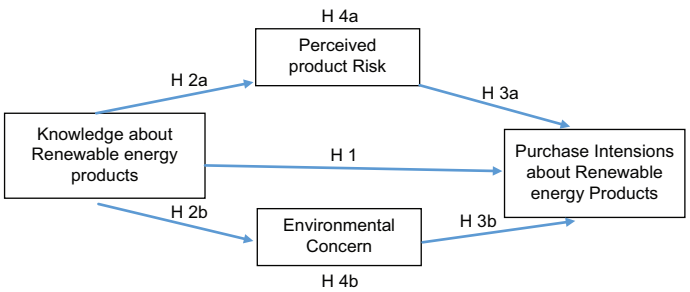
People having tendency to see their environment clean and healthy provide basis for environmental research (Kim and Choi, 2005). Dagher and Itani (2014) examined the linkage of environmental concern and green purchase behavior and found a positive linkage and have recommended investigating the same with product specific context.

On the other hand, the people having meager concern about their surroundings (Junior et al.,) tend to purchase any product regardless of looking at its environmental aspects. People with higher environmental concerns have higher tendency of buying pro-environmental products (Braga Junior et al., 2014). The motivators behind buying the renewable energy products that are environment friendly in nature can be several (Soni and Wehr, 2004).

2.7. Technology Adoption Model (TAM) in Action

It is an intention-based theory and is considered as a valuable tool to explain the adoption and use of newly introduced renewable energy technology and energy efficiency technologies. Various researchers (Pang and Ji, 2007; Shang et al., 2005), used TAM to explain consumers' shopping behavior related to technological equipment. This model is based on the Theory of Reasoned Action (TRA) specifying the causal linkages between consumers' perceived usefulness, perceived ease of use and user acceptance, and actual usage of the technology (Davis et al., 1989) under consideration. Perceived usefulness is a person's belief that using a particular product would enhance performance, and ease of use is about a person belief that using a particular product would be free of effort. Davis argued that perceived ease of use had a positive effect on product usage.

2.8. Research Framework and Hypotheses



Hypotheses

H_1: Product knowledge has a positive relationship with customer purchase intentions.

H_{2a}: Product knowledge has a negative relationship with perceived risk.

H_{2b}: Product knowledge has a positive relationship with environmental concerns.

H_{3a}: Perceived risk has a negative relationship with customer purchase intentions.

H_{3b}: Environmental concern has a positive relationship with customer purchase intentions.

H_{4a}: Perceived risk mediates the linkage between knowledge and purchase intentions

H_{4b}: Environmental concern mediates the linkage between knowledge and purchase intentions

3. METHODOLOGY

3.1. Sample

The sample of 354 university students as customers (male and female) was considered for the study. The students were considered for the reason that they tend to have more knowledge about the newly introduced technological products and they might have a better concern for protecting the environment thus having greater tendency to have stronger purchase intentions towards renewable energy products.

3.2. Measures

There were four constructs selected for the current examination. The knowledge about renewable energy products was first adopted and later adapted from the study conducted by (Tuu and Olsen, 2012), environmental concern (Maichum et al., 2017), perceived risk (Chen and He, 2003) and purchase intentions (Tuu and Olsen, 2012). The customers were requested to rate the items on five points Likert scale.

3.3. Context and Statistical Tests Used

The study was conducted in the summer season when the electricity shortage in Pakistan is at the peak and people have the strongest tendency to look for energy alternatives for satisfying their summer needs. AMOS was used for running SEM (Byrne, 2013) for direct bootstrapped bias-corrected results with confidence intervals for indirect effects, with the help of maximum likelihood estimation method. Further, the Preacher and Hayes (2008) recommendation to use a minimum of 5000 resamples for the bootstrap analysis is also considered for this study.

4. RESULTS

4.1. Measurement Model

Firstly the confirmatory factor analysis (CFA) was conducted for integrity of measurement models, Table 1 the scales presented a better fit as per the criterion presented by Hooper et al. (2008).

Afterwards, the convergent and discriminant validity was examined upon Hair et al. (2012) recommendations, including;

Table 1: Goodness of fit statistics

χ^2/df	p	IFI	TLI	CFI	RMSEA	SRMR
2.237	0.000	0.895	0.885	0.897	0.059	0.077

the Cronbach's $\alpha > 0.70$, composite reliability >0.70, and average variance extracted >0.50. Table 2 shows the results.

Further, the discriminant validity of Hair et al. (2012) was measured through the square root of the average variance extracted (AVE). The AVE for each construct was greater than the bivariate correlations between the constructs (Table 3).

The Table 1 focuses on the model fitness indices and has shown an adequate fil keeping in view of the target range for each index.

4.2. Testing of Hypotheses

The structural model was examined in two stages. In the first Stage (Model 1) the relationships between PK and the product risk were negative and were positive for the remaining two variables such as environmental concern, and customer purchase intentions. All the tested relationships were positive and significant, thus supporting Hypotheses 1, 2a, and 2b. Further, the direct effects of product risk and environmental concern on purchase intentions were examined resulting in positive and significant results (product risk→ purchase intentions, path = 0.45, $P < 0.001$; and concern→ purchase intentions, path = 0.25, $P < 0.01$), therefore H_{3a} and H_{3b} were also supported.

In the second Stage, the multiple mediation effects were examined for risk and concern and a comparison was made between previous Model and Model with mediators. In this stage, it was determined whether the mediators (product risk and environmental concern) affect renewable energy products' purchase intentions when the independent variable (product knowledge) is controlled. If product risk and environmental concern completely mediate the relationship between customer's product knowledge and customer's purchase intentions, the path between them should then become non-significant.

The information presented in Table 3 shows an adequate correlation existing between the variables selected for the study.

Firstly the maximum-likelihood method in AMOS was employed and calculated the significance of a multiple mediation effect in the SEM. Further as recommended by (Efron and Tibshirani, 1993) the bootstrapping was used that provides the most powerful and reasonable confidence limits for mediation effects under various conditions (Preacher and Hayes, 2008). Table 4 for the lower and upper bounds for the indirect (mediated) variables do not include zero, the direct effect from PK to PCI does include zero. Hypotheses 3a and 3b (risk and concern both link to purchase intentions), and 4a and 4b (mediation effects) are supported.

Table 2: Convergent validity tests

Variables	Cronbach's alpha	CR	AVE
Product knowledge	0.89	0.82	0.53
Perceived physical risk	0.83	0.84	0.52
Purchase intentions	0.91	0.84	0.63
Environmental concern	0.82	0.87	0.54

5. DISCUSSION

The study was aimed at examining the mediating role of product risk and environmental concern in the relationship between customer's product knowledge and customer's purchase intentions. The results of the study found a positive effect of all the variables on the customer's purchase intentions regarding renewable energy products available in the market.

Knowledge was found to have a positive impact on the customer's purchase intentions. The results are consistent with the earlier research studies (Kolyesnikova et al., 2010). The more knowledge people have regarding any specific technology or product, better they are in a state of making purchases. The higher the degree of awareness the higher they evaluate the pros and cons of the technology or products (Tuu and Olsen, 2012). The awareness equips the customers to look at the usefulness of the technology and products.

The results are somewhat contradictory to earlier studies with respect to the risk factor involved (Bhukya and Singh, 2015). The earlier studies have reported that risks involved generally hampered customers' purchase intentions (Beneke et al., 2012) but the current study revealed the positive effect of risk on purchase intentions. It shows the dire need for customers to buy renewable energy products. Even in the presence of risk factors, they were willing to buy the renewable energy products as an alternative to the energy options available/not available (electricity).

Environmental concern (Kim and Choi, 2005; Soni and Wehr, 2004; Maichum et al., 2017) a pushing factor to save the environment and the people around also push the customers to buy environmentally friendly products and look for such alternatives that are not easily consumed with the passage of time. The results of the current study revealed a positive result regarding environmental concern having reinforcement factors for developing purchase intentions (Thompson et al., 2012). Protection of environment not only benefit the current generations but also the generations to come. It is necessary to focus on developing higher environmental concerns for better environmental conditions, which is only possible through adopting renewable energy purchases.

Table 3: Standard deviations, mean, correlations

Variables	Mean	S.D.	Age	Gender	Education	PK	PR	CPI	EC
Age	3.81	1.81							
Gender	1.84	0.37	0.21*						
Education	3.97	1.18	–0.12*	0.06					
Product knowledge	5.05	1.01	–0.05	–0.08	0.08	0.72			
Perceived risk	3.60	1.03	0.05	0.01	0.07	0.42***	0.71		
C-purchase intentions	5.17	1.27	0.03	0.06	0.03	0.41***	–0.51***	0.79	
Environmental concern	5.66	0.98	0.06	0.07	0.02	0.67***	0.35***	0.38***	0.73

Table 4: Bias-corrected bootstrapping results

Links	Confidence limits		P-values
	Lower	Upper	
PK→PR	0.455	0.927	0.000
PK→EC	0.261	0.544	0.000
PK→CPI	–1.200	0.526	0.875
PR→CPI	0.351	0.697	0.000
EC→CPI	0.226	0.812	0.028

Generally environmentally it is noted that the knowledge about the product (technology) reduces the risk and pushes customers to have that product (Beneke et al., 2012). The sources of knowledge can be several including the packaging of the products, the print and electronic media ads, the sales staff of the shops having such products, relatives and friends, family members and the internet (DasValasai et al., 2017). The purchase tendency depends upon the source of knowledge used. The more reliable the source the higher the tendency of buying (Dagher and Itani, 2014). The word of mouth shared by the near and dear ones has greater influence on purchase decisions (Campbell and Goldstein, 2001). It is also noted that environmental concern helps in developing attitudes towards specific products and ultimately helps developing purchase intentions (Fabrigar et al., 2006). Moreover, people having eco-friendly tendencies compel people to get the products that are less wasteful and last long (Kubiszewski et al., 2010)

6. CONCLUSION

Customer purchase intentions are developed regardless of the risks involved in the buying the product. Moreover, the purchase intentions are developed due to the knowledge held regarding renewable products and upon having environmental concerns. This is due to the fact that educated lot of respondents were selected for responses. It is likely that the uneducated respondents may not have much knowledge about these products and may not have the tendency to develop purchase intentions regarding renewable energy products. But it is clear that if the renewable energy product manufacturers want to enhance customer purchase intentions, they have to push their knowledge and have to develop their concern regarding safe and healthy environment by reducing the risks involved. Protection of environment can be ensured through adopting renewable energy products.

6.1. Implications

First of all this study brings to light that knowledge and customer awareness is the necessary component for developing purchase intentions. It is a piece of advice for the producing and marketing companies to take customers on board for equipping them while sharing the information about their products (various segments). This helps reducing risk as in the case of renewable energy products the names are not generally mentioned on the packaging or if at all the names are present people are unaware of those companies. This may reduce the chances of developing purchase intentions.

Marketers can enhance customers' purchase intentions regarding these newly introduced renewable energy products. Awareness is the key to success if the common consumer wants to have alternate energy sources available in the times of electricity shortage in the country. It is clear from the results that people besides having some risks had the tendency to purchase such equipment. It becomes the responsibility of the companies to reduce the risks involved regarding purchasing these products.

It is better to note that people had concern regarding saving the environment that pushed them to have purchase intentions. This brings social implications to light when they are found curious about their fellow beings and family members to be safe and healthy.

6.2. Limitations and Future Directions

The sample for the study was taken form a single segment (students) for the reason that they might have better understanding of the renewable energy products and can better develop purchase intentions for buying such products. It is recommended for the future studies that the difference of purchase intentions should be examined between the literate and illiterate group of people keeping in view the same framework tested.

Further, the current study examined one independent variable and one dependent variable. It is recommended to examine other factors responsible for shaping purchase intentions for in-depth understanding of the relationships. Moreover, the research design used was cross-sectional that could not predict the changing trends over the period of time. It is recommended that the longitudinal design will help to determine the effects over longer period of time. It is to note that the current study was conducted in the summer season that resulted in the current findings. It is recommended to conduct the same study in winter season to compare the results whether customers still preferred to buy the renewable energy products or otherwise. While reviewing the literature it is noted that knowledge and risk have different dimensions so it is recommended for future studies to consider dimension for bringing interesting insights to light.

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