

EXPLORING THE UNCERTAINTIES AND AMBIGUITIES IN ACCEPTING WIND POWER PROJECTS: EVIDENCE FROM PAKISTAN



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Abstract

Uncertainties and Ambiguities in Accepting Wind Power Projects considered as a necessary phenomenon in development and the implementation of wind power technologies. It is generally argued that public attitudes need to be changed to change the implementation of possible wind energy technologies. The purpose of this analysis is to explore the perceptual factors pertinent to social acceptance of wind energy technologies with special focus on Sahven Sharif and Sakarand wind farms in interior Sindh province of Pakistan. The respondents were interviewed by using open ended questionnaire and the themes were extracted from the responses followed by the categorization of the factors for the easy conclusion of the study. Results of the study revealed that there were various diverse factors has influential role in societal acceptance of wind power projects includes financial and non-financial determinants. The study also revealed some potential implications for the policy makers in order to uplift the wind power projects that will ultimately contributes in improving the existing energy crisis level of the country.

Keywords

Wind Power, Project Management, Community Acceptance, Uncertainty, Ambiguity, and Decision-Making.

1. Introduction



Modern technologies push the world in a new era of green environment. Now a day's corporate sector emphasizes on the renewable energy sources due to the scarcity of the natural resources [1]. It is technology that brings revolutionary change in the business as well as in the lifestyle of society. In the context of renewable energy sources, wind energy is taken into account one amongst the foremost advanced technologies for the applying of renewable energies that is experiencing the strongest growth. The planning and implementation of wind



technologies needs a powerful socio-economic element [2]. Over the past 20 years, the gap between energy demand and its supply has become more and more apparent, with renewable energies and energy sources recently attracting the eye of policymakers and researchers, with customers [3]. In all above-mentioned cycle acceptance of technology plays a vital role, as those who admired and accepted the new development in technologies considered as developed societies however those who didn't know as under developing societies[4]. Therefore, Technology acceptance has become one in every of the foremost important subject.

Pakistan targeted to obtain the status of the highest number of renewable energy users till 2050 and to reach the aim they adopted the wind power source for 70% reliability. To reach the target, local adoption is an important issue and to synchronize new technology adaptation among local communities [3][5][6]. However, due to lack of education and awareness, implementation of new technologies, political and local base community interference has considered as the main issue in order to make the wind power energy dream into reality in Pakistan [7][8][9][10] The municipalities plans for the development of wind turbines faced a flat growth rich is also endorsed by Pakistan renewable Industry Association[11]. The wind projects in Pakistan with the collaboration of Denmark was launched in 2014 with the aim to support GoP target for renewable energy sources by 2050 as well as to sort out the role for local communities by means of awareness to accept the change in the society and support such projects for their future[12]. Therefore, Wind power projects target of 2050 provide food for thought for the researcher to carry out the research in this direction to analyze the factors involved in hindrance of local acceptance and deployment of wind power.

This thesis is an attempt to explore the social and cultural factors of uncertainties and ambiguities as well as the moving attitudes associated with alternative energy. Despite widespread information of alternative energy developments, previous analysis has not adequately explained the relevant social factors [13][14]. It is suggested, however, that the nature, strength and spatial extent of these effects may vary according to the case the native context and also the price of the country. "Therefore, it will be necessary to look at the species the affected landscape within the project and the way it is perceived by the domestic authorities and also the Sindh. In some geographic areas, the Associate in Nursing Offshore website may be the most popular[15][16] on onshore alternatives, but in different geographical areas found differently [17]. In search of various obstacles to the social acceptance of the wind come some studies found the effects of wind turbines on animals, especially birds[18] and the technological characteristics such as the size of the rotary motor and the noise: factors that occur less important[19].

Problem Statement

The U shape development curve for public attitudes toward different projects has been observed by many previous studies, which covers three dimensions of acceptance i.e. pre-installation, post-installation and during installation of different projects range between low, high streams of acceptance [18][13][19]. As the wind power projects are on top priority list in government developmental projects due to its environment friendly nature, but at the same time it is facing some sort of resistance from the local communities as it grasps a huge piece of land as well as due to its huge structure they live in constant fear state because this modern equipment is new to them [20].

Therefore, this study intends to explore and analyze those contextual factors (particularly in the case of Pakistan) involved in hindrance of local acceptance and deployment of wind power projects. The study will additionally focus on the factors which produce a sense of

insecurities in local communities with the aim to find out the factors that could possibly improve the acceptance of the wind power projects in the local communities.

2. Literature Review

2.1 Theoretical Evidence

This research concerns the acceptance model of Davis's theory. The technology acceptance model was developed by Davis (1989) and is one of the most common models of research models for predicting the use and acceptance of data systems and technology users. individual. TAM has been extensively studied and verified by completely different studies that study the behavior of technology acceptance in many information system constructions. In the tam-o'-shanter model, there are 2 observed quality factors and the perceived ease of use is a relevant behavior of computer use [20]. Davis defines perceived quality because it is subjective by the likelihood for potential users that the use of a specific application system can improve a person's professional or personal performance[21]. An easy use (EOU) can be defined because of the extent to which the potential user expects the targeting system to suppress the effort. According to tam-o'-shanter, simplicity of use and perceived quality are the most important essential determinants of the actual use of the system. These 2 factors are influenced by variables of external factors. [22][23] have projected a replacement version of the tam-o'-shanter, known as TAM2, which is a new variable for the current model. [24] in a study published in the MIS quarterly review. He proposed the uniform theory of the Technology Acceptance and Use Model (UTAUT). The various studies conducted by the researchers attempted to modify tam-o'-shanter by adding new variables. Agarwal and Prasad (1998a, 1998b) adapted tam-o'-shanter by adding the concept of compatibility to the technology acceptance model. [24][25] intervened in the replacement of variable game factors and study the acceptance of the world network. [25] intended to change the tam-o'-shanter by adding variables such as experience, self-actuality, perceived risk, and social influence [26] [27].



2.2 Empirical Evidence

Public opinion seemed more favorable to wind energy, as educational researchers had foreseen in the 1980s the difficulties of effectively implementing wind farms in their country, especially the visual effects and reactions to wind energy. to this. [28][29]in Sweden; [30][31] argue that most Read more about the acceptance of social networks that you can download via the Internet, and socio-psychological, contextual, socio-economic and spatial. The analysis, the group and the great Called RAL (Random Parameters Logit), the analysis of international analysis results for the acceptance of social networks in preparation for the preparation of the preparatory phase of the preparatory phase projects, Analysis of the price and disputes and denominations in the parts of the parties. According to POLIMP first transitional policy , the decisive influence on the position of the broad audience at the Elian Energy. Other researchers offer you the opportunity to share your experience with the public transport company.[35][36] e.g. B. on the importance of solving the problem in a successful wind energy project. The choice of position is a crucial factor in the acceptance of social welfare, the contradiction of opposition to the aspirations and the appointment of the system of main disputes[37][38]. [39] is an aboriginal community. If owners and sellers of real estate understand that wind turbines are a good source of data collection and collection with an effective result of the well-paid-ratio-in the lower courts of last week wind. An alternative localization inappropriate will therefore strengthen the negative settings towards the wind farms. In general, the general practice of the cancellation of the initiative is as follows, in the sections entitled, informing them of the case law and case law. [39] strongly argue that it is important to involve Initial installation processes are essential for extending support at the zone level. it is | it's often | it will also be supported by [26][32], advising United Nations agencies that community co-management systems will doubtless increase the probabilities of a triple-crown agreement which will profit either side. moreover, empirical proof suggests that private and public communities are generally subject to initial opposition in order to be accepted [40][31]. Negative positions towards the wind farm, on the other side of the road however, this participation alone cannot be improved because acceptance is always the result of a complex interaction of various factors.wind inscription, this surface unit associated with the features of the program itself. to estimate which community star options are most influential on the intention to enter important deductions for developers and managers of the future wind community are coming in Pakistan.

2.3 Evidence from Pakistan

Pakistani wind turbines are generally installed in the coastal areas of southern Islamic Republic of Pakistan to explain and exploit the wind power potential of the selected area. However, the selected wind passage is the city of Jamshoro, In 2023, the Meteorological Department of Pakistan (PMD) launched a wind energy evaluation campaign in South Pakistan. Meteorological masts were installed with anemometers at a height of 10 and 30 m. Analysis of the data collected by these masts confirmed the presence of a logical gust in the coastal strip of Sindh province[38]. More than 40,000 villages in Pakistan are not connected to the national grid and the most isolated villages in the south can be electrified by micro-wind turbines. It is estimated that more than 5,000 villages can be electrified by wind power in Sind [21][32][38]). Official reports indicate that potential sites for the development, installation and accountability of wind facilities are available in Sindh Province, Thatta, Karachi,Hyderabad and Badin districts, as well as in Baluchistan, Gwadar and the coastal belt of Makran. This pass is a fair wind resource and over 48,000 MW is generated on paper [11][34][40].



Although some studies such as [36] to discredit the quality of NREL flagship information, they can undermine the project's success, but only in a very limited theater KPK. Le the Pakistani province blessed with a considerable amount of wind who does not have several countries. Around the provincial capital, the wind speed changes between half a douzaine.2 and 7.4 meters per second (between 13.8 and 16.5 miles per hour). Even in the industrial city of the city, the change varies between half and 6.9 douzaine.2 (between 13.8 and 15.4 miles per hour). In addition to the city and the state capital, there are various areas of the Asian nation having a thick wind force.

Table 1. Factors of Uncertainty and Ambiguity

Uncertainty	Ambiguity
Tangible issues like methods, procedures and structures	Political, religious, moral values
Problem solving	Dialogue
Solution	Mutual understanding
Allocation of resources like time, money, labour and space	Identity, self esteem, loyalty, rejection, etc
Negotiation	Personal dimension
Agreement	

Research Questions

Research Question 1: What are the factors that contribute to local community acceptance of wind power projects?

Research Question 2: What are the uncertainties & ambiguities i.e contextual factors involved in hindrance of local community adoption for the deployment of wind power projects, specifically during the project?

2.4 Research Objectives

Research Objective 1: To explore the factors leads to the acceptance of wind power projects among the local community.

Research Objective 2: To identify the uncertainties & ambiguities during the project that cause hindrance for the local community in accepting and deployment of wind power projects.

2.5 Significance of the Study

This study examined factors such as the influence of local acceptance and governance, project development and the use of wind energy. This study also describes the concepts of uncertainties, ambiguities their dimensions and evaluate community acceptance factors that add uncertainty and ambiguity, create controversy for wind projects, assess community participation in the decision-making process, and manage uncertainty and ambiguity in planning and the development of wind projects. It is worthwhile to carry out institutional



and regulatory research as well as social research to obtain new scientific knowledge on the sustainable development of socio technical systems under the strong influence of uncertainty factors. For academia, this increased the opportunities for wider dissemination of wind energy information and offered empirical suggestions that contributed to future prospects relevant to wind projects.



3. Research Methodology

This study intends to explore the factors associated with the wind power projects specifically in the context of the local community in coastal areas Pakistan. The main aim of the study is to discover the in-depth dynamics pertinent to wind power projects that besides knowing the importance and benefits of wind power energy why local community resists in accepting such sort of project in native surroundings. There are two main streams of research i.e. Quantitative and Qualitative study. As the study aims to explore the contextual factors, therefore, the study is qualitative in nature. There are many investigation types can be used in the research studies but in this study because of its qualitative nature I will use descriptive sort of investigation in order to derive the themes that which factors considered as more significant and which one is to be less important in the context of local community. In this research Epistemology philosophy is applying because Epistemology includes acceptable knowledge of a certain field of study and the work of natural scientists is based on a perceptible social entity. The search strategy is approached on the basis of data collection. Epistemology is known with respect to the appropriate data of a particular field of study. It is divided into two aspects. Scientific resources and scientific emotions. The "resource researcher" deals with information derived from the biologist's attitude. On the other hand, the "probe researcher" supports the feelings and attitudes of employees towards their managers. The "resource seeker" is interested in the development of positivist philosophy, while the "emotional researcher" focuses on the interpretative philosophy. Philosophy is classified as positivism, realism and interpretiveism in the field of the philosophy of analysis. The Sindh Province especially coastal areas of Pakistan has a population of local community 13 million [18] where wind power plants are installed and operational. Such areas are purposively taken for the study in order to collect neutral interviews, and any relevant information pertinent to wind power projects. The data for the study was collected by means of an open-ended questionnaire (interview). The idea for asking questions has been taken from the previous studies [23][11][15][34][29] Data and Data Collection. This study was of mixed blend both primary and secondary data. Primary data was collected by one-one interview from the residence while secondary data was collected from the past studies in order to make alignment of the study in a more substantial and academic manner. The study used SPSS and Nvivo version 12 both software's for measuring the descriptive and as well as for identification of themes.

The study involved local residents, community representatives, and members of households living in proximity to active wind energy facilities. Selection requirements were as follows:

- Residency in the coastal zones hosting the wind installations.
- A minimum of five years' continuous residence to guarantee a thorough understanding of the project life cycle.
- Age older than 18 to confirm legal consent and a mature viewpoint.
- A commitment to participate freely in individual, in-depth interviews.



To capture a wide range of community views, a purposeful sampling strategy was adopted, guaranteeing representation across age, gender, and vocational backgrounds. that the data has been collected from a wide range of the respondents i.e. 50 having the age bracket from below 20 to above 40 years includes overall details about their qualifications. Information was gathered through open-ended interview guides designed to prompt expansive answers. The items were informed by the literature, drawing on methodologies from [2][14][18][25][26][32][38] thereby ensuring a strong theoretical foundation while permitting participants to articulate their experiences in their own language. This inquiry employed a mixed-methods strategy, merging primary and secondary sources. Primary Data: Obtained through face-to-face, semi-structured interviews with.

Data Analysis

This chapter is comprised on the observations that the researcher received from the respondents pertinent to acceptability of wind power projects in Sindh province of Pakistan. By means of face to face interview data has been collected and carefully scrutinize with the aim to answer the research questions of the study. The research questions are as follows;

Research Question 1: What are the factors that contribute to local community acceptance of wind power projects?

Research Question 2: What are the uncertainties & ambiguities i.e contextual factors involved in hindrance of local community adoption for the deployment of wind power projects, specifically during the project?

In order to answer the above mentioned questions thematic approach has been adopted for the study in which firstly the key contributing factors were identified followed by the specific contextual barriers that keep the local community refrains in accepting the wind power projects. Following is the list of the respondents describes the characteristics of the respondents;

Reporting Analysis From the above mentioned table it has been revealed that the data has been collected from a wide range of the respondents i.e. 50 having the age bracket from below 20 to above 40 years includes overall details about their qualifications and marital status etc. After analyzing the data following tables has been derived;



Table 2. Analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 20	1	2.0	2.0	2.0
	20-25	12	24.0	24.0	26.0
	26-30	15	30.0	30.0	56.0
	31-35	9	18.0	18.0	74.0
	36-40	5	10.0	10.0	84.0
	Above 40	8	16.0	16.0	100.0
	Total	50	100.0	100.0	

In this table we find out mostly participant are young majority lies between 20 to 30 age group total 50 participants.

Table 3. Descriptive Statistics for Status 2: Descriptive Statistics for Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	26	52.0	52.0	52.0
	Single	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

In this table we find out mostly participant are married but the ratio is so close between married and single peoples both status of people taking part in this survey.

Table 4: Descriptive Statistics for Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Matric	4	8.0	8.0	8.0
	FA/FSc.	19	38.0	38.0	46.0
	BA/BSc./BS	26	52.0	52.0	98.0
	Masters	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

According to education we divided public into four basic models like Matric, FA,BA,MSC.we fond out in our study most public having education of FA and BSC.



Table 5. Cluster of Main Themes

Coding	Basic Themes	Organizing Theme
Area	Local area geographic does matter in the acceptance of the Wind Power Projects.	Territorial Factors
Reuse of Land		
Natural Beauty		
Visual Impact		
Hilly areas		
Barren Land		
Local Assistance		
Health Issues	Importance of family as well as traditional legacy pertinent to property and exposure towards the technology.	Personal/Social Factors
Awareness		
Conflict of Interest		
Education		
Wealth		
Family Disputes		
Fear of Fall		
Believe		
Blades	Manufacturing design of the wind power plants and its working capacity does matter.	Technological Factors
Height		
Size		
Noise		
Solar Energy		
Speed		
Air Pressure		



Table 5. Cluster of Main Themes

Lack of Interest by Government officials	Reluctant approach from the concern bodies. Pressure from political/local government bodies.	Management/Political Factors
Stakeholders Interest		
Facilities		
Impact Assessment and Predictions		
Accurate Measures	Monitoring and Evaluation of project from starting point to final installation	Regulatory Factors
Installation as per Rules		
Experts Visits		
Budget	Cost and Benefit Analysis Compensation to the local households	Financial Factors

Findings

On the basis of the above mentioned themes and sub-themes it can be concluded that there are several factors that contributes in the future prospect of the development of the wind energy in the context of Pakistan. The desire to make the society more environmental friendly these factors can be considered as the key enablers that can make the dreams into reality. Following are the main findings of the study discussed in detail by means of interview collected from the respondents;

According to the many respondents X, A,CYZ, “There is no doubt about the energy crisis that currently we are facing in Pakistan, we have large number of natural resources that can really uplift not only existing energy position but as well as the economic spectrum of the country. Whereas, I don’t understand why focusing only wind energy that affect our cultivate lands? there are many areas located in the upper area of KP from where electricity can be generated by means of dams”.

There are some respondents A,D,F,H, “ they describe The noise was a problem with some early turbine styles, but was largely eliminated by improved engineering and appropriate home-based setbacks Wind energy offers cheap, inexhaustible energy for the economy. It also offers jobs andvarious sources of financial gain. Even better, the wind drives the economy but does not cause pollution, generates hazardous waste or depletes natural resources.

Respondents AA,AD,L”Wind turbines, like all other energy technologies, have a number of environmental impacts. However, unlike most typical technologies the effects of natural unity of wind turbines have an impact. This makes it easier for local communities to see and, if necessary, restrict them Wind farms will reinvigorate the economics of rural



communities and bring steady financial benefits to farmers and various landowners through leasing or royalty payments. The public's trust in decision-makers and various interest groups influences the acceptance of renewable energies. Charitable trust of stakeholders depends on the perception of their organizational skills and integrity.

According to many respondents N,AS,AD,O" While the population generally has a positive attitude towards renewable energy, individuals often have to deal with the resistance of the local population. Individuals tend to reject changes in their environment, from private caring for the loss of quality of life .Wind turbine easily be install with minimum human power and in Pakistan all seasons are suitable for wind turbines and maintain is very easy one time installment and longtime benefit.

Few respondents AG,AJ,S that can be prevented by proper installation and landscape techniques. Erosion can be a priority in certain habitats, such as the desert, wherever a hard-packed soil surface needs to be destroyed for installation in wind turbines The framework is useful when evaluating visual effects before starting construction. Opinion polls show that the vast majority of people are in favor of wind energy and support for wind turbines usually increases when they are actually introduced and put into service.

Table 6.

Category	Themes & Patterns	Illustrative Quotes (Respondents)
1. Perceptions of Energy Crisis & Alternatives	- Acknowledgement of severe energy crisis.- Preference for alternative solutions like hydropower in KP to avoid agricultural land loss.	"There is no doubt about the energy crisis... but why focus only on wind energy that affects our cultivated lands? There are many areas in KP where dams can generate electricity." (X, A, CYZ)
2. Economic and Environmental Benefits	- Recognition of wind energy as cheap and inexhaustible.- Early turbine noise issues resolved.- Wind energy creates jobs without pollution or hazardous waste.	"Wind energy offers cheap, inexhaustible energy... offers jobs and financial gain, drives the economy but does not cause pollution or hazardous waste." (A, D, F, H)
3. Environmental and Visual Impacts	- Concern about visual impacts and landscape changes.- Benefits to rural economies through leasing and royalties.- Public trust in decision-makers influences acceptance.	"Wind farms will reinvigorate rural economies... public trust in stakeholders depends on their organizational skills and integrity." (AA, AD, L)
4. Local Resistance and Attitudinal Barriers	- General support for renewables but local resistance to changes in surroundings.- Wind turbines viewed as easy to install with minimal maintenance.	"Individuals tend to reject changes in their environment... wind turbines are easy to install and maintain with long-term benefits." (N, AS, AD, O)
5. Installation and Environmental Concerns	- Risks of soil erosion during installation, especially in fragile habitats.- Visual impact assessments useful before construction.- Public support increases post-installation.	"Erosion can be a priority... opinion polls show support for wind turbines usually increases once operational." (AG, AJ, S)

4. Discussion

In order to answer the research question one which was about the factors that contribute to acceptance of local community is to provide electricity free of cost with electricity area will be flourish in different sectors land is use for cultivation in the survey and descriptive statistics showed that for every question respondents from the survey were terribly ignorant of the wind energy .Similar results were validated by the preceding studies by [23] which indicatescost-effective application will be very important for the rapid acceptance of this innovation to meet the personal interests of these buyers, financial incentives and benefits. Community participation in the wind energy must be forced to be maximized. As buyers have different degrees environmental standards and beliefs[34] it is essential to inform voters about the economic benefits of participating in wind energy in the community, not just the environmental benefits [22]. The result for the question two is the factors involved in hindrance in local community is people don't want to give their lands there are many land disputes in society vision is disturb death of birds people thought their land unable to reuse and fear of fallen of wind turbines. Renewable energy sources are strong predictors of the interest associated with changing the integrity of a community solar project. Energetic attitudes that the environmental benefits of [36][40], it would be necessary to indicate to him if there is a behavioral attitude gap for community registration, it may be because of a lack of information and knowledge, because it was the most important vital barrier in general. use of alternative energies. The use of renewable energy can be seen as a favorable attitude towards the environment. These results support for various conclusions indicating that environmental issues are, as a rule, a determining factor adoption of solar energy. Energy attitudes that focus on prices and burdens Victimhood, renewable energy can be considered as anti-environment because they emphasize benefits of the continued use of fossil fuels (which are inherently).



5. Conclusion

However, most respondents disagree with the barriers to wind energy, suggesting that the use of wind is not hindered by obstacles, but rather due to the scarcity of sanction mechanisms. Raising awareness of the general public for the community wind and distribute information about the economic benefits of the local wind inscription, with some highlights of the environment, could make the wind community indispensable tool to expand the use of wind energy in Sindh Pakistan, always because share of renewable energy sources in the distribution network. The purpose of this analysis was to investigate the area of Sindh residents and their intention to participate in the wind community. The analysis showed that environmentally friendly attitudes are a series of sensitive indicators of interest wind Community. Registering community wind project can be considered as part of behavior, so the relationship between environmental attitudes and the intention of the degree of association performing behavior is supported during this research. However, true Measuring the community acceptance of the wind turbine cannot be assessed until the program is completed and located in Sindh.

The attitude-behavioral gap in the context of the wind community is unknown. however the analysis of Observed obstacles to wind energy show that lack of information and economic reasons is one of the most important barriers to the use of wind energy, which is probably still applicable to community adoption.

5.2 Implications Future Research Direction

This study intended to explore the themes for the constraints pertinent to acceptance of society the modern energy producing techniques specially the wind power energy in Pakistan. After careful data gathering and analysis it is suggested for the policy makers to look into the gray areas while initiating any sort of wind power system installation like area of the local community and addresses the potential conflicts arises due to this. Similarly the other stakeholders like government should have carried out the proper campaign that will not only resolve the resistance from the local people but will uplift the outcomes expected from the project. On the other hand, compensation and proper settlement for the displaced people should be improved for future planned project because it is the word of mouth that can be used as a market tool in future.

Further to this, the study has some limitations which need to be addressed in future like say for instance the theme has been discovered but still which factor contributing more needs to be catered. Similarly, a longitudinal study will be helpful in assessing the change in the themes for the success of same nature projects. I believe my sample was sufficient to complete the family unit unit phase market, as a measure of homeowners' place associated with better school results and better income [38]. However, guidance on determining the scope and timing in community consultation and engagement has not clearly defined. Engaging the community at a too early and speculative stage without full information of the proposal is not recommended, it might create unnecessary ambiguity and concerns. While the lack of information may also create doubt and lose trust in people, turning into fear and opposition of the project proposal.



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