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Acceptance and Satisfaction with the use of Solar Rooftop Technology: A Case Study in Thailand

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Abstract

This study aims to examine consumer acceptance and satisfaction with the use of solar rooftop technology in Surat Thani Province, as well as to explore the relationship between personal factors and satisfaction, and between acceptance and satisfaction with the technology. A quantitative research approach was employed, utilizing an online survey questionnaire distributed to 107 consumers who had already adopted solar rooftop technology. The findings indicate that consumers exhibit a high level of acceptance and satisfaction with the technology, with mean scores of 4.262 and 4.248, respectively. The highest level of acceptance was observed in intention to use (4.296), while perceived value for use recorded the highest satisfaction (4.274). Hypothesis testing revealed that among the 11 demographic factors examined, only monthly income and source of information significantly influenced satisfaction. Specifically, consumers with an average monthly income of less than 15,000 THB reported lower satisfaction levels than those with higher incomes. Additionally, individuals who received information from television/radio exhibited lower satisfaction than those who obtained information through online media or word-of-mouth. Moreover, a moderate to strong positive correlation was found between technology acceptance and satisfaction ($r = 0.496$ to 0.696), particularly between perceived ease of use and intention to use and satisfaction with perceived value for use. These findings provide valuable insights for solar rooftop service providers in developing marketing strategies and service models tailored to different consumer segments. In particular, efforts should be directed toward enhancing services for lower-income groups and communicating the ease of use and cost-effectiveness of solar rooftop technology through online channels to encourage adoption and enhance long-term satisfaction with clean energy solutions.

Keywords: Technology acceptance, Satisfaction, Solar rooftop, Renewable energy, Surat Thani Province

1. Introduction

Energy plays a critical role in the economic and social development of all countries worldwide. However, the heavy reliance on finite fossil fuel resources not only threatens long-term energy security but also contributes significantly to environmental pollution and climate change. As a result, many countries are increasingly prioritizing the development of renewable and sustainable energy sources, particularly solar energy, which has vast potential as an unlimited and environmentally friendly source of electricity (Department of Alternative Energy Development and Efficiency, 2022). According to Thailand's 2022 Energy Situation Report, the country's electricity generation remains predominantly dependent on fossil fuels, with natural gas accounting for 53%, coal and lignite for 17%, and imported energy for 16%, while renewable energy contributes only 10% of total electricity production—a relatively modest proportion (Energy Policy and Planning Office, 2022). Among renewable energy sources, solar power accounts for 24.7%, and its share has been steadily increasing. One of the most promising applications of solar energy is solar rooftop technology, which involves installing photovoltaic (PV) panels on building rooftops to generate electricity. This decentralized energy solution enables users to install and manage their own energy systems, utilizing existing rooftop space for self-consumption, reducing long-term electricity costs, decreasing reliance on external power grids, and enhancing individual energy security (Energy Regulatory Commission, 2019).

Despite these advantages, the widespread adoption of solar rooftop technology remains limited due to several barriers, including high installation costs, limited public awareness and understanding of the technology, and insufficient policy support from the government. Understanding the key factors influencing consumer acceptance and satisfaction with solar rooftop technology is essential for promoting its broader adoption and ensuring that it is implemented effectively. Surat Thani Province presents high potential for solar power generation due to its geographical location, which allows for consistent solar radiation throughout the year. The average solar radiation intensity in Phunphin District is 18.682 MJ/m²/day, and in Koh Samui, it is 18.249 MJ/m²/day, both of which exceed the national average (Department of Alternative Energy Development and Efficiency, 2023). Additionally, Surat Thani has a strong economic growth rate, and its residents demonstrate higher purchasing power and openness to adopting new technologies, making it an ideal area for studying consumer acceptance and satisfaction with solar rooftop systems. The study of consumer acceptance and satisfaction with solar rooftop technology in Surat Thani Province is of significant importance due to the region's high potential for solar energy production. This potential is attributed to its geographical suitability, higher-than-average solar radiation intensity, and substantial electricity demand among consumers. Despite these favorable conditions, the adoption rate of solar rooftop technology remains relatively low, accounting for only 0.33% of total electricity users in the province (Provincial Electricity Authority, 2022). Therefore, an in-depth examination of the factors influencing acceptance and satisfaction with this technology from the perspective of local consumers is crucial. Such an investigation will yield valuable insights that can be leveraged to develop targeted and effective strategies for promoting solar rooftop adoption in a manner that aligns with the local context and consumer needs. The findings will also contribute to the broader goal of scaling up renewable energy adoption and addressing existing knowledge gaps regarding technology acceptance behavior in Thailand, particularly at the regional level. Moreover, this research aligns with the national agenda to promote the adoption of sustainable and renewable energy sources.

Given these considerations, this study specifically examines consumer acceptance and satisfaction with solar rooftop technology in Surat Thani Province by applying the Technology Acceptance Model (TAM). TAM is a widely recognized theoretical framework for explaining individual acceptance of new technologies. This study investigates how perceived usefulness, perceived ease of use, intention to use, and actual usage behavior influence consumer acceptance and satisfaction with solar rooftop technology in this region. The empirical findings from this study will provide practical insights for local consumers, policymakers, and industry stakeholders, enabling them to formulate and implement strategic initiatives that effectively promote solar rooftop adoption in Surat Thani Province. Ultimately, these efforts will support the wider deployment of solar energy, contributing to the sustainable development of clean energy solutions in alignment with national energy policies.

2. Literature Review

This study reviews relevant literature, concepts, theories, and prior research related to consumer acceptance and satisfaction with solar rooftop technology in Surat Thani Province. The findings from this review serve as a foundation for developing the study's conceptual framework and research hypotheses.

2.1 Fundamentals of solar rooftop technology

Solar rooftop technology refers to solar photovoltaic (PV) systems installed on the rooftops of buildings or residences to convert solar energy into electricity for self-consumption or for feeding excess power back into the utility grid (Energy Regulatory Commission, 2019). A solar rooftop system consists of several key components, including solar panels, inverters, mounting structures, electrical wiring and safety devices, bidirectional electricity meters, and monitoring systems. The system operates by capturing solar radiation, generating direct current (DC) electricity, converting it into alternating current (AC) electricity, and supplying power to the electrical system with control, monitoring, and safety mechanisms in place.

2.2 Advantages and challenges of solar rooftop technology

The advantages of solar rooftop systems include their ability to reduce long-term electricity costs, lower greenhouse gas emissions, enhance property value, and facilitate easy installation without requiring additional space. Furthermore, these systems benefit from government incentives and policies that encourage renewable energy adoption (Department of Alternative Energy Development and Efficiency, 2019). However, several limitations remain, such as high initial investment costs, limited system lifespan, dependency on sunlight availability, and vulnerability to natural disasters or theft.

2.3 Potential for solar rooftop adoption in surat thani province

Surat Thani Province has high potential for solar power generation, as evidenced by its solar radiation intensity, which averages 18.682 MJ/m²/day in Phunphin District and 18.249 MJ/m²/day in Koh Samui—both exceeding the national average (Department of Alternative Energy Development and Efficiency, 2023). Additionally, the province has a significant demand for household electricity consumption, with 412,827 registered electricity users (Provincial Electricity Authority, 2022). This demonstrates both technical feasibility and consumer readiness for adopting solar rooftop technology in the region.

2.4 Concepts and theories of technology acceptance

This study applies the Technology Acceptance Model 3 (TAM 3) (Venkatesh & Bala, 2008) as the primary theoretical framework to explain the factors influencing consumer acceptance of solar rooftop technology. The original TAM model was developed by Davis (1989) [3] based on the Theory of Reasoned Action (TRA), proposing that technology acceptance is primarily determined by two key beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEoU). Later, Davis (1989) [4] expanded the model by incorporating Attitude Toward Use as a mediating variable, enhancing the explanatory power of the acceptance model. Subsequently, Venkatesh and Davis (2000) [19] introduced TAM 2, which integrated external factors influencing Perceived Usefulness, such as social influence and job relevance, increasing the model's ability to explain 50-60% of the variance in technology acceptance. In 2008, Venkatesh and Bala further refined the model by developing TAM 3, which combined TAM 2 with an expanded framework for Perceived Ease of Use, initially proposed by Venkatesh (2000) [19]. TAM 3 has been widely recognized as a comprehensive model for explaining the factors influencing the ease of use of information technology, making it a widely accepted theoretical foundation for studying individual adoption of new technologies. This study adopts TAM 3 as its conceptual framework, focusing on four key factors: 1) Perceived Usefulness 2) Perceived Ease of Use 3) Intention to Use and 4) Actual Usage Behavior. Additionally, this study also examines consumers' basic knowledge of solar rooftop technology, aiming to provide deeper insights into the acceptance and satisfaction associated with its adoption.

2.5 Concepts and theories of consumer satisfaction

Consumer satisfaction refers to an individual's evaluation based on the comparison between perceived performance or quality of a product or service and their prior expectations before using it (Kotler, 2016) [10]. If the perceived performance exceeds expectations, the customer experiences satisfaction; conversely, if it falls short, the result is dissatisfaction. The level of satisfaction varies depending on the benefits received in comparison to expectations, which may be shaped by personal experience or word-of-mouth recommendations (Oliver, 2015) [12]. Satisfaction is also defined as a consumer's response to expectations, assessing whether the characteristics of a product or service adequately meet their needs (Shin & Kim, 2008) [17]. Additionally, satisfaction is seen as a brand ranking process based on past experiences, where a satisfied or dissatisfied consumer significantly influences perceived service quality, ultimately affecting customer loyalty (Mullins, 2016) [11]. Mullins further identified four key dimensions of consumer satisfaction: emotional factors, cognitive factors, behavioral factors, and environmental factors. This study adopts Kotler's (2016) [10] framework on consumer satisfaction, focusing on three core factors: perceived value for use, after-sales service, and maintenance and support. It aims to examine how consumer perception and expectations regarding the efficiency, quality, and benefits of solar rooftop technology influence satisfaction among consumers in Surat Thani Province. From the literature review, the researcher synthesized the observable variables and their definitions, which are summarized in Table 1.

Table 1: Summary of Observable Variables and Definitions

Variable	Component	Indicator	Reference
Technology Acceptance of Solar Rooftop (TAC)	Perceived Usefulness (TAC_1)	The degree to which an individual believes that using the technology or system will enhance their efficiency in work or daily life.	Venkatesh & Bala (2008)
	Perceived Ease of Use (TAC_2)	The degree to which an individual believes that using the technology or system requires minimal effort, making it easy to learn and use.	
	Intention to Use (TAC_3)	The individual's intention or likelihood of using the technology or system in the future, influenced by perceived usefulness and ease of use, leading to actual adoption.	
	Actual Usage Behavior (TAC_4)	The actual use of the technology or system in daily life, manifested through usage frequency, duration, and various usage patterns.	
Satisfaction with Solar Rooftop Technology (SAT)	Perceived Value for Money (SAT_1)	The perception that the system operates efficiently and provides value relative to the cost incurred.	Kotler (2016)
	After-Sales Service (SAT_2)	The perception of the quality of post-installation services, including customer care and support.	
	Maintenance (SAT_3)	The perception of the ease of maintenance and the quality of repair and upkeep services.	

2.6 Related Studies

A review of previous research indicates that several studies have explored solar rooftop technology adoption and the factors influencing consumer purchase intentions for solar energy systems across various contexts. Despite differences in research settings, common influential factors affecting technology acceptance have been identified. These factors include technology-related attributes such as perceived usefulness, ease of use, quality, and reliability (Jirapavatragoon, 2023; Tangjaturasopon, 2023; Patumutarungsri, 2022) [7, 18, 13]; price and marketing promotions (Bhasabutr, 2022) [1]; consumer-related factors, including attitudes, reference group influence, knowledge, and experience (Wajasuwan, 2022; Kocharatkaewfa, 2023) [20, 9]; and contextual factors such as government policies and support (Bunrod, 2021) [2], all of which align with the Technology Acceptance Model (TAM) framework. This study focuses on examining key factors that are expected to significantly influence solar rooftop technology adoption in Surat Thani Province, including perceived usefulness, ease of use, risk perception, and consumer knowledge (Khienchanaj, 2021; Prommool, 2022; Phuengyam, 2023) [8, 16, 15]. However, the unique contribution of this study lies in its in-depth investigation of Surat Thani Province, a region with high solar energy potential but a relatively low adoption rate of solar rooftop technology despite its suitability for solar power generation.

By focusing on consumers with actual experience using solar rooftop systems, this study seeks to uncover in-depth insights that explain the underlying reasons behind the current adoption gap and provide targeted recommendations for enhancing adoption strategies that align with local consumer needs. Therefore, the findings from this research will not only contribute to the existing body of knowledge on solar energy adoption behavior in Thai households but also provide empirical evidence to support the development of policy frameworks and localized measures for promoting solar energy adoption. These insights will serve as a key mechanism for driving the expansion of household adoption of clean energy solutions, aligning with Thailand's sustainable energy development goals. Based on the literature review, the conceptual framework for this study is illustrated in Figure 1.

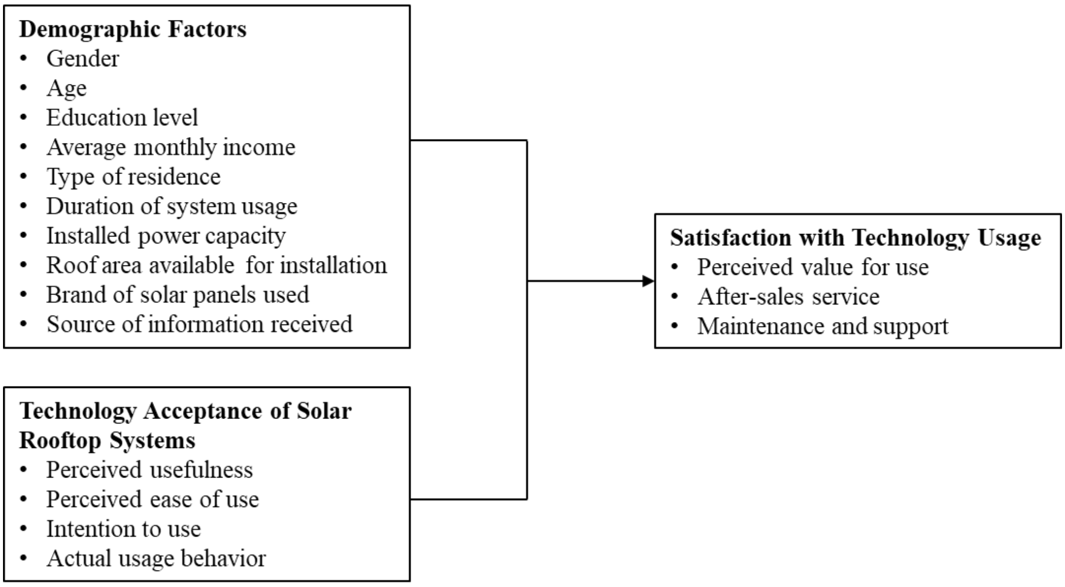

Fig 1: Research Framework

This framework leads to the formulation of the following research hypotheses:

- Hypothesis 1 (H1): Differences in demographic factors result in variations in consumer satisfaction with the use of solar rooftop technology.
- Hypothesis 2 (H2): Acceptance of solar rooftop technology is positively correlated with consumer satisfaction in using the technology.

3. Research Methodology

This study, titled "Acceptance and Satisfaction with the Use of Solar Rooftop Technology by Consumers in Surat Thani Province," employs a quantitative research approach to examine the level of technology acceptance, consumer satisfaction, and the relationship between these two variables. The study aims to provide empirical insights into consumer behavior toward solar rooftop adoption in the Surat Thani region. The research methodology is designed as follows:

3.1 Research Design

The target population for this study comprises homeowners who have installed solar rooftop systems for electricity generation in Surat Thani Province. Focusing on this specific group allows for the collection of in-depth insights from individuals with first-hand experience, providing valuable data on factors influencing acceptance and satisfaction with solar rooftop technology. Additionally, the study examines challenges and limitations encountered by actual users, offering a comprehensive understanding of consumer perceptions within the regional context. The sample size was determined using G*Power software, setting the parameters as follows: Effect size $f^2 = 0.15$ (moderate effect size), α error probability = 0.05 (significance level of 0.05), Power (1-β error probability) = 0.95 (95% test power), and Number of predictors = 2 (corresponding to the number of independent variables in the research framework). The calculation indicated that a minimum of 107 participants was required, ensuring an optimal balance between resource efficiency and statistical power for reliable hypothesis testing. A purposive sampling method was employed, selecting only respondents who met the specified eligibility criteria. To facilitate access to qualified participants, initial coordination was conducted with local solar rooftop installation companies, seeking their cooperation in identifying suitable customers. Following this, direct contact was made with the selected sample group to collect the necessary data. The distribution of the sample was based on the population density of each district within Surat Thani Province, as shown in Table 2.

Table 2: Population Distribution by District in Surat Thani Province (2022)

District	Population	Percentage (%)	Sample Size
Mueang Surat Thani	189,816	17.76%	19
Kanchanadit	109,109	10.28%	11
Don Sak	36,923	3.74%	4
Ko Samui	67,448	6.54%	7
Ko Pha-ngan	18,692	1.87%	2
Chaiya	51,646	4.67%	5
Tha Chana	54,694	4.67%	5
Khiri Rat Nikhom	44,166	3.74%	4
Ban Ta Khun	16,050	1.87%	2
Phanom	39,131	3.74%	4
Tha Chang	34,181	2.80%	3
Ban Na San	69,781	6.54%	7
Ban Na Doem	24,073	1.87%	2
Khian Sa	48,754	4.67%	5
Wiang Sa	62,188	5.61%	6
Phrasaeng	69,267	6.54%	7
Phunphin	93,566	8.41%	9
Chai Buri	28,323	2.80%	3
Vibhavadi	15,855	1.87%	2
Total	**1,073,663**	**100%**	**107**

3.2 Research Instrument

The primary instrument used for data collection in this study was a questionnaire, which was developed based on a comprehensive review of relevant concepts, theories, and previous studies. The questionnaire was designed with a foundation in the Technology Acceptance Model (TAM) (Davis, 1989) [3] and was refined to align with the specific context of this study. The questionnaire structure was developed to ensure comprehensive coverage of the research objectives and conceptual framework and was divided into three sections:

1. General Information of Respondents: This section contained closed-ended questions regarding demographic characteristics and usage behavior of solar rooftop technology.
2. Consumer Acceptance of Solar Rooftop Technology: This section measured consumer perceptions across four key dimensions of TAM using a five-point Likert scale.
3. Consumer Satisfaction with Solar Rooftop Technology: This section assessed satisfaction across three key dimensions based on consumer satisfaction theory, also using a five-point Likert scale.

To ensure the content validity of the questionnaire, it was reviewed by three experts using the Index of Item-Objective Congruence (IOC). Additionally, the reliability of the instrument was assessed using Cronbach's Alpha coefficient before administering the questionnaire to the sample group for actual data collection.

3.3 Data analysis methods

This study employed SPSS software for data analysis, utilizing both descriptive statistics and inferential statistics to interpret the research findings.

- Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to describe the levels of technology acceptance and consumer satisfaction.
- Inferential statistics were applied to test the research hypotheses, including:
- Independent sample t-tests and One-Way ANOVA to compare mean differences across demographic factors.
- Pearson's correlation coefficient to examine the relationship between technology acceptance and consumer satisfaction.

A statistical significance level of 0.05 was set for all hypothesis tests. The results were presented in tabular format with detailed interpretations to determine whether the findings supported the proposed hypotheses. Additionally, the discussion section contextualized the results by linking them to theoretical concepts and previous studies, providing deeper insights into the research topic. The selected research methodology aligns with the study's objective of examining technology acceptance, consumer satisfaction, and their interrelationship regarding solar rooftop technology adoption in Surat Thani Province. The use of validated measurement instruments and rigorous analytical methods ensures that the research findings are reliable and generalizable to the target population.

4. Results

The analysis of demographic characteristics among 107 respondents revealed that the majority were male (64.49%), with nearly half under the age of 30 (46.73%), followed by those aged 30–40 years (36.45%). In terms of educational background, respondents with below a bachelor's degree (47.66%) and those with a bachelor's degree (46.73%) accounted for similar proportions. Regarding income levels, most respondents had an average monthly income between 15,000 and 30,000 THB (51.40%), and detached houses were the predominant type of residence (76.64%). For solar rooftop technology usage, findings indicate that most respondents had 1–2 years of experience (47.66%) or had been using the technology for less than one year (42.99%), suggesting that adoption has gained popularity in recent years. In terms of installation size, the majority of users opted for 3–5 kW solar panel systems (61.68%), typically installed on rooftop spaces of 18–40 square meters (69.16%), which aligns with detached house usage. Regarding brand preferences, the most commonly used solar panel brand was JA Solar (37.38%), followed by LONGi Solar (28.97%). In terms of information sources influencing consumer awareness of solar rooftop technology, internet and online media played the most significant role (50.47%), followed by word-of-mouth recommendations from acquaintances (32.71%). These findings highlight the importance of digital media and social networks in disseminating information about solar rooftop technology. The detailed demographic characteristics of the sample group are presented in Table 3 and Table 4.

Table 3: Demographic Characteristics of the Respondents

Demographic Characteristics	Frequency	Percentage (%)
Gender		
Male	69	64.49
Female	38	35.51
Age		
Below 30 years	50	46.73
30 – 40 years	39	36.45
40 – 50 years	14	13.08
Above 50 years	4	3.74
Highest Educational Level		
Below Bachelor's Degree	51	47.66
Bachelor's Degree or Equivalent	50	46.73
Master's Degree or Equivalent	6	5.61
Above Master's Degree	0	0.00
Average Monthly Income		
Less than 15,000 THB	13	12.15
15,000 – 30,000 THB	55	51.40
30,001 – 45,000 THB	33	30.84
More than 45,000 THB	6	5.61
Type of Residence		
Detached House	82	76.64
Townhouse/Townhome	8	7.48
Commercial Building	12	11.21
Others	5	4.67
Total	**107**	**100**

Table 4*:* Solar Rooftop Technology Usage Information of the Respondents

Solar Rooftop Technology Usage Information	Frequency	Percentage (%)
Duration of Solar Rooftop Technology Usage		
Less than 1 year	46	42.99
1-2 years	51	47.66
3-4 years	7	6.54
5 years or more	3	2.81
Installed Solar Panel Capacity		
3-5 kW	66	61.68
6-10 kW	31	28.97
11-15 kW	6	5.61
More than 16 kW	4	3.74
Installation Area		
18-40 square meters	74	69.16
41-80 square meters	26	24.30
81-128 square meters	4	3.74
More than 128 square meters	3	2.80
Brand of Solar Panels		
JA Solar	40	37.38
LONGi Solar	31	28.97
Trina Solar	14	13.08
Others	22	20.56
Source of Information		
Television/Radio	3	2.80
Internet/Online Media	54	50.47
Word-of-mouth from acquaintances	35	32.71
Experts/Installation Companies	15	14.02
Others	0	0.00
Total	**107**	**100**

The evaluation of technology acceptance and satisfaction with solar rooftop technology revealed that respondents exhibited a high level of acceptance (mean score = 4.262 on a 5.00 scale). The highest-rated acceptance factor was intention to use (4.296), followed by perceived usefulness (4.346) and perceived ease of use (4.227). The lowest-rated factor was actual usage behavior (4.178), though it still remained within the high-acceptance range. Similarly, consumer satisfaction with solar rooftop technology was also reported at a high level (mean score = 4.248), which aligns with the high level of technology acceptance. Among the satisfaction dimensions, perceived value for use received the highest mean score (4.274), indicating that consumers perceive solar rooftop installation as a worthwhile investment. This was followed by after-sales service satisfaction (4.249), while maintenance satisfaction had the lowest score (4.221) but remained within the high-satisfaction range. Notably, the greatest variation in consumer responses was observed in intention to use and maintenance satisfaction, suggesting differing consumer perspectives in these areas. The detailed levels of technology acceptance and consumer satisfaction are presented in Table 5.

Table 5: Levels of Technology Acceptance and Consumer Satisfaction with Solar Rooftop Technology

Indicators	Minimum	Maximum	Mean	S.D.
TAC_1	2.67	5.00	4.346	0.577
TAC_2	2.67	5.00	4.227	0.567
TAC_3	1.00	5.00	4.296	0.716
TAC_4	1.67	5.00	4.178	0.711
SAT_1	1.67	5.00	4.274	0.637
SAT_2	2.00	5.00	4.249	0.640
SAT_3	1.00	5.00	4.221	0.691

Inferential statistics analysis

Hypothesis 1: Differences in Demographic Factors Influence Consumer Satisfaction with Solar Rooftop Technology

The hypothesis testing results indicated that among 11 independent variables, only two factors significantly influenced consumer satisfaction with solar rooftop technology at the 0.05 significance level: average monthly income and source of information received. Regarding income levels, LSD post hoc analysis revealed that respondents with an average monthly income below 15,000 THB reported significantly lower satisfaction than other income groups, particularly in terms of after-sales service and maintenance satisfaction. Conversely, respondents in the highest income group (above 45,000 THB) exhibited significantly higher satisfaction in terms of perceived value for use compared to other income groups. For information sources, consumers who received information through television/radio reported significantly lower overall satisfaction than those who obtained information from other sources. This effect was particularly evident in perceived value for use, where satisfaction levels among consumers who learned about solar rooftop technology through online media, word-of-mouth, and expert recommendations from installation companies were notably higher. Other demographic factors, including district of residence, gender, age, education level, type of residence, duration of system usage, installed power capacity, available installation space, and solar panel brand, did not exhibit statistically significant effects on consumer satisfaction. The summarized results of the hypothesis testing are presented in Table 6.

Table 6: Summary of Hypothesis Testing Results

Hypothesis	Independent Variable	Dependent Variable	Test Result	Statistic Value	Sig.
1	District of Residence	SAT	Rejected	F = 1.683	0.058
2	Gender	SAT	Rejected	t = 1.691	0.094
3	Age	SAT	Rejected	F = 1.901	0.134
4	Education Level	SAT	Rejected	F = 1.728	0.183
5	Average Monthly Income	SAT	Accepted	F = 3.354	0.022*
6	Housing Type	SAT	Rejected	F = 0.375	0.771
7	Duration of Usage	SAT	Rejected	F = 0.465	0.708
8	Installed Capacity	SAT	Rejected	F = 1.772	0.157
9	Installation Area	SAT	Rejected	F = 0.984	0.403
10	Solar Panel Brand	SAT	Rejected	F = 1.003	0.395
11	Information Source	SAT	Accepted	F = 4.020	0.009*

Note: Significant at the 0.05 level.

Hypothesis 2: The Relationship Between Solar Rooftop Technology Acceptance and Consumer Satisfaction in Surat Thani Province

The correlation analysis between technology acceptance and consumer satisfaction with solar rooftop technology revealed a moderate to high positive correlation across all variables, with statistical significance at the 0.01 level. The Pearson correlation coefficients (r) ranged from 0.496 to 0.696. The strongest correlations were observed between perceived ease of use and perceived value for use (r = 0.692) and between intention to use and perceived value for use (r = 0.696). These findings indicate that consumers who perceive solar rooftop technology as easy to use and have a higher intention to adopt it tend to value the technology more positively. Conversely, perceived usefulness showed the weakest but still moderate correlation with after-sales service satisfaction (r = 0.505), suggesting that while perceived usefulness contributes to satisfaction, its impact on service-related aspects is less pronounced compared to other acceptance factors. These results support Hypothesis 2, confirming that solar rooftop technology acceptance is significantly and positively associated with consumer satisfaction. Specifically, perceived ease of use and intention to use are key determinants that enhance consumers' perceived value and overall satisfaction with the technology. These findings underscore the importance of designing user-friendly systems and fostering strong user intention, as these factors significantly contribute to higher perceived value and satisfaction levels. The correlation coefficients between technology acceptance factors and consumer satisfaction dimensions are summarized in Table 7.

Table 7: Correlation Coefficients Between Technology Acceptance and Consumer Satisfaction

Acceptance of Solar Rooftop Technology		Satisfaction with Solar Rooftop Usage		
		SAT_1	SAT_2	SAT_3
TAC_1	Pearson Correlation	.632**	.505**	.518**
	Sig. (2-tailed)	0.000	0.000	0.000
TAC_2	Pearson Correlation	.692**	.576**	.613**
	Sig. (2-tailed)	0.000	0.000	0.000
TAC_3	Pearson Correlation	.696**	.550**	.527**
	Sig. (2-tailed)	0.000	0.000	0.000
TAC_4	Pearson Correlation	.643**	.496**	.555**
	Sig. (2-tailed)	0.000	0.000	0.000

Note: Statistically significant at the 0.05 level ($p < 0.05$); Statistically significant at the 0.01 level ($p < 0.01$).

Based on the findings of this study on consumer acceptance and satisfaction with solar rooftop technology in Surat Thani Province, the key results can be summarized as follows:

The majority of respondents were male (64.49%), under 30 years old (46.73%), with an average monthly income of 15,000–30,000 THB (51.40%), and residing in detached houses (76.64%). These demographic characteristics align with the data from the Provincial Electricity Authority (2022), which reported that Surat Thani has 412,827 household electricity users, with a substantial portion adopting solar rooftop systems. Most respondents had 1–2 years of experience (47.66%), installed 3–5 kW systems (61.68%) on 18–40 square meter rooftop spaces (69.16%), and primarily learned about the technology through online media and the internet (50.47%).

The results indicated that technology acceptance and consumer satisfaction were both at high levels (mean scores of 4.262 and 4.248, respectively). The highest-rated factors were intention to use (4.296) and perceived value for use (4.274). These findings are consistent with studies by Jirapavatragoon (2023) [7] and Bhasabutr (2022) [1], which identified perceived usefulness, ease of use, and intention to use as key drivers of solar rooftop technology acceptance.

Hypothesis testing revealed that only income level and information sources significantly influenced consumer satisfaction. Respondents with lower income levels reported lower satisfaction compared to those with higher income levels, particularly in after-sales service and maintenance aspects. Additionally, respondents who received information through television or radio exhibited lower satisfaction compared to those who obtained information from online media, word-of-mouth, and expert recommendations. These findings align with the research of Tangjaturasopon (2023) [18] and Phuengyam (2023) [15], which highlighted the influence of income and information sources on consumer satisfaction and decision-making regarding technology adoption.

Furthermore, a moderate to high positive correlation (r = 0.496–0.696) was found between technology acceptance and consumer satisfaction. Notably, perceived ease of use and intention to use showed the strongest correlations with perceived value for use, reinforcing the Technology Acceptance Model (TAM) proposed by Venkatesh & Bala (2008) and the findings of Bunrod (2021) [2] and Prommool (2022) [16]. The high level of consumer satisfaction observed in this study also aligns with Kotler's (2016) [10] satisfaction framework, which suggests that satisfaction occurs when products or services meet or exceed consumer expectations.

These findings indicate that most consumers perceive solar rooftop technology as valuable and are satisfied with its use. This information is critical for developing targeted strategies to promote wider adoption of solar rooftop systems, thereby supporting the nation's renewable energy development policy in a sustainable manner.

5. Discussion

The high levels of acceptance and satisfaction with solar rooftop technology observed in this study reflect its suitability within the context of Surat Thani Province, which has strong solar energy potential due to its geographical location receiving consistent sunlight throughout the year (Department of Alternative Energy Development and Efficiency, 2023). Additionally, the quality of installation services provided by suppliers has contributed to this positive perception, aligning with the service quality satisfaction theory of Shin & Kim (2008) [17], which suggests that customer satisfaction with service quality directly influences customer loyalty and repurchase behavior.

Regarding factors influencing differences in consumer satisfaction, the findings indicate that income level and information sources play a statistically significant role. Consumers with lower income levels reported lower satisfaction than those in higher income brackets, likely due to differences in expectations and perceptions of value. Additionally, consumers who received information through traditional media (television/radio) exhibited lower satisfaction compared to those who obtained information through online sources or word-of-mouth. This finding may be attributed to the limitations of traditional media, which do not provide in-depth information comparable to digital platforms or peer recommendations.

The positive relationship between technology acceptance and consumer satisfaction supports the Technology Acceptance Model (TAM) proposed by Davis (1989) [4]. In particular, perceived ease of use and intention to use demonstrated strong correlations with perceived value for use, consistent with the findings of Khienchanaj (2021) [8], which identified ease of use as a critical determinant of satisfaction.

5.1 Recommendations for practical application of the research findings

1. Enhancing Service Quality and After-Sales Support – Service providers should prioritize improving service quality, particularly for low-income consumers, to foster higher satisfaction and brand loyalty. This aligns with Shin & Kim (2008) [17], who emphasize that service quality directly influences repurchase behavior and word-of-mouth recommendations.
2. Strengthening Marketing Communication Through Digital Channels and Word-of-Mouth – Businesses should leverage social media marketing, influencer marketing, and user community engagement as primary communication strategies. These channels provide comprehensive and accessible information that effectively reaches target audiences, ensuring that consumers better understand the benefits and value proposition of solar rooftop technology compared to traditional media platforms.
3. Developing User-Friendly Systems with Clear Guidance – The design of solar rooftop technology should emphasize ease of use and intuitive operation, accompanied by clear instructional materials. This aligns with the study's findings, which indicate that perceived ease of use strongly correlates with perceived value for use, reinforcing the research of Khienchanaj (2021) [8].
4. Promoting Knowledge Dissemination and Financial Support – Government agencies should actively raise awareness about the benefits of solar rooftop technology across all income groups. Additionally, policy measures such as subsidies, tax incentives, and low-interest loans should be considered to support low-income households, reduce financial barriers, and expand access to this technology. These recommendations align with the renewable energy promotion strategy of the Department of Alternative Energy Development and Efficiency (2023), aiming to facilitate the widespread adoption of clean energy solutions.

5.2 Recommendations for future research

1. Expanding Qualitative Research – Future studies should incorporate qualitative research methods to gain in-depth insights into user experiences, challenges, and service provider perspectives. This approach will yield valuable information for improving solar rooftop technology and service quality.
2. Broadening Geographic Scope and Sample Groups – Further research should extend beyond Surat Thani Province to cover other regions, including commercial and industrial users, to provide a comprehensive national perspective on technology acceptance and adoption trends.
3. Examining Policy and Government Incentives – Future research should explore the impact of government policies and incentive programs, such as subsidies and tax benefits, on consumer acceptance and decision-making regarding solar rooftop technology. These findings could serve as a foundation for formulating effective energy policies.
4. Integrating Multiple Theoretical Models – Future studies should incorporate additional theoretical frameworks alongside the Technology Acceptance Model (TAM), such as the Theory of Planned Behavior (TPB) and the Customer Satisfaction Model. This would enable a broader examination of factors such as social norms, perceived behavioral control, and service quality, which may further explain technology adoption.
5. Conducting Longitudinal Studies – Future research should adopt longitudinal study designs to track changes in technology acceptance and consumer satisfaction over time. This approach would provide insights into long-term trends and influencing factors, contributing to the development of sustainable strategies for technology adoption.

These recommendations will contribute to the advancement of knowledge on solar rooftop technology adoption and support the sustainable development of renewable and clean energy solutions at a national level.

6. Conclusion

These findings provide valuable insights for solar rooftop service providers in developing
effective marketing strategies. Service providers should focus on designing user-friendly systems, utilizing digital communication channels and word-of-mouth marketing, and tailoring service offerings to meet the expectations of consumers across different income groups. By addressing these factors, service providers can enhance consumer acceptance and encourage wider adoption of solar energy technologies, contributing to the sustainable development of renewable energy at the national level.

7. References

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