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# Factors Affecting the Willingness to Install a Solar Photovoltaic System - A Case in Vinh Long City, Vietnam

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***Abstract*:** The solar energy was received great support from Vietnamese Government by the Decision No. 11/2017/QD-TTg on incentive mechanism for solar power projects development. However, the installation of solar photovoltaic systems is rather low recently. This study assesses several variables affecting the willingness to install a solar photovoltaic system. A randomly survey was conducted at 180 households in Vinh Long city of the Vietnamese Mekong delta that using a five-scale Likert questionnaire. For the socio-demographic features (gender, aging, education, income), the income of respondents is significantly different but negative correlation to the eagerness to install a solar photovoltaic system. Within respondents' perceptions (usefulness, environment, risk) and influences (society, policy, finance), variables of finance and policy are statistically association to the motivation to install a solar photovoltaic system, but their correlations are in opposite direction. The study also found that solar power information should broadly disseminated to the local community so that people can gain more knowledge on this renewable energy source.

***Keywords:*** *renewable energy, socio-demographic characteristics, solar power installation influence, solar power installation perspective, willingness to install*

## 1. Introduction

In recent decades, the climate change, greenhouse effect and energy depletion have become global concerns and challenges. The worldwide countries and organizations have proposed many response solutions, of which renewable energy is a priority solution. In line to this approach, solar energy is a potential second renewable energy sources (after wind energy) which exploited and developed by many countries (BP p.l.c, 2021). In Vietnam, with incentive policies from the central government, many solar energy projects have strongly developed in the period 2019 - 2020. By the end of 2020, the whole country had 105,212 rooftop solar photovoltaic (PV) systems with a capacity of 9,730.87 MWp, accounting for about 25% of the total installed capacity of the national power system (Vietnam Electricity Company, 2021). According to the Power Plan VIII scenario, the installed capacity of solar PV in the country will increase from 16.6 GW in 2021 to 20.1 GW in 2030, and sharply increase to 71.9 GW in 2045 (Vietnamese Government, 2023).

Vinh Long is a province in the Mekong Delta area with an average sunshine of 7.5 hours per day; the average annual sunlight reaches 2,550 - 2,700 hours (Vinh Long Statistic Department, 2023) that offer favorable conditions to apply solar energy. By the end of 2020, the whole province had 1,740 solar PV projects that connected to the grid with a total capacity of 50,555.24 kWp. In Vinh Long city, there are 533 solar PV systems installed and connected to the national grid with a total capacity of 7,776.92 kWp, which accounting 30.63% of the quantity and 14.3% of the total solar PV capacity of the province. However, solar PV systems installed in 7 central wards account for 84.43% of quantity and 89.44% of capacity, much higher than 4 suburban wards with only 15.57% of quantity and 10.56% of capacity (Vinh Long Electricity Company, 2020). This difference may be due to the alteration in economic conditions between the two areas or due to limited access to information of people living in suburban area.

Based on peak capacity and average sunshine hours, it is estimated that solar PV output in Vinh Long city is about 1,652,593 kWh/month. The population of Vinh Long city is about 138,981 people in 2020 (Vinh Long Statistics

Department, 2023), the average electricity consumption of people is 75 kWh/month/person (Thang & Chinh, 2021), from which it is estimated that the electricity consumption of the city is about 10,423,575 kWh/month. In other words, when solar PV output reaches its maximum, it only satisfies about 15.85% of the provincial electricity consumed, showing that the proportion of solar energy is still relatively low.

In the context of increasing the use of solar energy to meet the national goal of electricity development, understanding the households' attitudes and perception towards solar energy. This study was conducted to survey the variables that impact people's willingness to install a solar PV system, thereby proposing solutions to promote the investment of this renewable energy source at household scale.

## 2. Methodology

### 2.1 Survey area and sample size

Vinh Long city, the capital of Vinh Long province, was chosen as the study area (Fig. 1). The city with a population of about 138,981, has an area of 47.82 km$^2$ and urban density of 2,907 persons/km$^2$ (Vinh Long Statistics Department, 2023). The city has total 11 wards with 7 central wards (Ward 1, Ward 2, Ward 3, Ward 4, Ward 5, Ward 8, Ward 9), and 4 sub-urban wards (Truong An ward, Tan Ngai ward, Tan Hoa ward, Tan Hoi ward).

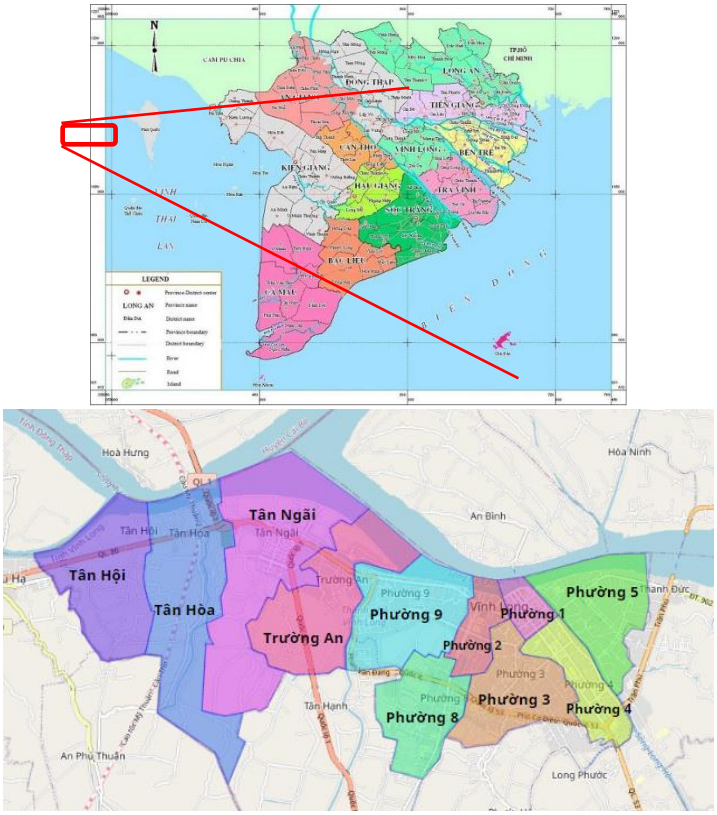


**Fig. 1** The map of study area with 7 central wards and 4 sub-urban wards

### 2.2 Survey structure

The questionnaire sheet was divided into two main sections.

(i) In the first part, the survey questions were linked to the socio-demographic attributes such as gender, aging, education level, and income of the respondents (qualitative factors).

(ii) In the second part, the five-point Likert scale embedded was used in the questionnaire to explore quantitative factors toward solar PV system (Likert, 1932). The questions were divided into two groups of independent variables and dependent variable. The independent variables include six observation sets of (US) usefulness perceptions, (EN) environmental perceptions, (RI) risk perceptions, (SO) social influences, (PO) policy influences, and (FI) finance influences. While the dependent variable is the willingness to install a solar PV system (IN). All questions were proposed with a 5-scale Likert answer of: (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Completely agree (Table 1).

Before collecting data via an onsite interview, a pilot survey to test the reliability of questionnaires was carried out using 20 respondents within the campus of Can Tho University, Vietnam. The pilot testing results showed the achieved values of Cronbach's alpha were 0.822, 0.784, 0.702, 0.672, 0.651 in corresponding to variables of SO, US, FI, PO, EN which showed high internal consistency among the data. But for the RI variable, an acquired value of Cronbach's Alpha was 0.595 which lower than the satisfied value of 0.6 (Nunnally, 1978). Then, the exploratory factor analysis (EFA) was conducted to investigate the relationship between surveyed variables in all observation factors (Hair et al., 2014). The EFA results show that all factor loading coefficients are greater than 0.5 for all variables in the factors. However, the variable of RI5 is loaded at an individually factor group, so this variable needs to be removed from the measurement variables for the official study.

**Table 1.** The measurements variables in the study

| Code | Measurement variables | Assessment scale | | | | |
|---|---|---|---|---|---|---|
| | ***Independent variables*** | | | | | |
| Usefulness perception factors | | | | | | |
| US1 | Solar is a renewable and endless source of energy | 1 | 2 | 3 | 4 | 5 |
| US2 | Solar electricity can be used anywhere | 1 | 2 | 3 | 4 | 5 |
| US3 | Solar PV system is actively use in domestic and production | 1 | 2 | 3 | 4 | 5 |
| US4 | Solar PV system save energy cost in a long-term using | 1 | 2 | 3 | 4 | 5 |
| Environmental perception factors | | | | | | |
| EN1 | Raising knowledge in the issue of climate change | 1 | 2 | 3 | 4 | 5 |
| EN2 | Using solar PV system reduce greenhouse gas emissions | 1 | 2 | 3 | 4 | 5 |
| EN3 | Using solar PV system is less polluting than fossil energy | 1 | 2 | 3 | 4 | 5 |
| Risk perception factors | | | | | | |
| RI1 | Getting products and services that are not as promised | 1 | 2 | 3 | 4 | 5 |
| RI2 | Solar PV system do not meet longevity expectations | 1 | 2 | 3 | 4 | 5 |
| RI3 | Receiving poor quality solar PV system | 1 | 2 | 3 | 4 | 5 |
| RI4 | Solar panels generate toxic substances to environment | 1 | 2 | 3 | 4 | 5 |
| RI5 | Unable to sell electricity due to State policy | 1 | 2 | 3 | 4 | 5 |
| Social influence factors | | | | | | |
| SO1 | Relatives, friends, colleagues introduced solar PV system | 1 | 2 | 3 | 4 | 5 |
| SO2 | Neighbourhood have used a solar PV system | 1 | 2 | 3 | 4 | 5 |
| SO3 | View advertisements on solar PV system | 1 | 2 | 3 | 4 | 5 |
| Policy influence factors | | | | | | |
| PO1 | Creating favourable conditions to install solar PV system | 1 | 2 | 3 | 4 | 5 |
| PO2 | Funding support contract to install solar PV system | 1 | 2 | 3 | 4 | 5 |
| PO3 | Promulgating policies on solar PV system to households | 1 | 2 | 3 | 4 | 5 |
| Financial influence factors | | | | | | |
| FI1 | Family income is not high | 1 | 2 | 3 | 4 | 5 |
| FI2 | The installation cost is high compared to the income | 1 | 2 | 3 | 4 | 5 |
| FI3 | Payback time of a solar PV system is long | 1 | 2 | 3 | 4 | 5 |
| | ***Dependent variables*** | | | | | |
| IN | The willingness to install a solar PV system | 1 | 2 | 3 | 4 | 5 |

### 2.3 Survey implementation

For more precision of the measurement, the larger sample size is need, but it is time-consuming and costly. Therefore, according to the empirical formula of Hair et al. (2014), the sample size in this study is determined based on: (i) the minimum sample size, and (ii) the number of surveyed variables. The minimum sample size of 50, preferably 100; the independent variable ratio of 5 : 1 were considered. There are 21 independent variables of 6 observation factors, so the appropriate sample size should be $21 \times 5 = 105$ samples. This sample size is larger than the minimum size of 100, so a minimum sample size of 105 respondents is need.

The study conducted interviews 20 participants at each of 11 wards in Vinh Long city that fulfilled the selection criteria making a sample size of 115 for all the locations. There are 220 participants who not yet installed the solar power system were randomly selected and approached door-to-door in their households to participate in the survey. The face-to-face survey assisted a high percentage of valid questionnaires.

The survey implementation was done in June 2022. The time to take a respondent filling a questionnaire was 8 to 10 minutes. Among 220 interviewed sheets, 40 sheets were not fulfilled as the respondent selected the same value or two values for whole measurement variables. The rest 180 interviewed sheets that higher than the required survey sample size are satisfied for data analysis.

### 2.4 Data analysis

The Microsoft Excel 2021 software is used to input data that recorded from surveyed questionnaires and presented descriptive statistics of the respondents.

The IBM SPSS Statistics 20 software is used to statistics data on measurement variables that influencing the household's decision to install a solar PV system. The statistical tools were used including the Cronbach's Alpha reliability analysis to test the reality of the questionnaire sheet at pilot survey, the two-by-two Analysis of Variance (ANOVA) to examine the relationship between socio-demographic factors and dependent variable, the Post Hoc multiple comparison test to identify the different from each factor within a socio-demographic variable group, the Pearson Product Moment Correlation test to obtain the correlation between dependent and qualitative variables, the Linear Regression Analysis to observe the relationship between the dependent and quantitative variables.

## 3. Results and Discussions

### 3.1 Socio-demographic characteristics of respondents

The results of descriptive statistics are presented in Table 2. Out of 180 respondents, there were most unequal gender representations of about 80.0% males and 20.0% females. The dominant ratio of male in this study is not fit to the national statistic of 50.6% and 50.1% female in Vinh Long province and in Vietnam, respectively (General Statistic Office, 2022). The respondents' ages were ranged between 21 and 70 years (33.1 ± 8.8 years), in which 40.0% of the respondents under 30 years old, 56.7% of the respondents from 30 to 50 years old, and 3.3% of the respondents over 50 years old.

About 43.3% of the respondents had university education, 8.3% of the respondents had college education, 3.9% of the respondents had vocational education, 36.7% of the respondents had high school level education, and 7.8% of the respondents had secondary school level education. This survey shows a big gap between the highest income households and the lowest income households in the study site (200,000,000 Vietnamese Dong (VND) against 4,000,000 VND per month). Though the average income of surveyed households is 20,350,000 VND/month/household that in line to the average national income of 5,945,000 VND/month/person (General Statistic Office, 2022).

The diversity of education, aging and income of respondents shows that the survey results include opinions from various education levels, diverse generations, and varied financial conditions that ensuring the generalizability and representative of the surveyed samples.

**Table 2.** A descriptive information of the respondents

| Variables | Options | Count | Percentage (%) |
|---|---|---|---|
| Gender | Male | 144 | 80.0 |
| | Female | 36 | 20.0 |
| Age (years old) | < 30 | 72 | 40.0 |
| | 30 - 50 | 102 | 56.7 |
| | > 50 | 6 | 3.3 |
| Education (level) | University | 74 | 43.3 |
| | College | 15 | 8.3 |
| | Intermediate | 7 | 3.9 |
| | High school | 66 | 36.7 |
| | Secondary school | 14 | 7.8 |
| Income (million VND per month) | < 20 | 103 | 57.2 |
| | 20 - 50 | 73 | 40.6 |

| | | |
|---|---|---|
| > 50 | 4 | 2.2 |

**3.2 Effect of socio-demographic factors on the willingness to install solar PV**

In this study, an ANOVA analysis was applied to examine the relationship of each socio-demographic variables (gender, aging, education, income) to the dependent variable of the willingness to install a solar PV system.

The result of ANOVA analysis in this study is obtained of: $F(1, 178) = 2.778$, $p = 0.097$, $r^2 = 2.813$. The F value, which is the ANOVA coefficient, smaller than $F_{0.05}$ critical value of 3.842 usually indicates a level of un-significance between variables. The p-value greater than 0.05 shows there were not significantly difference between the gender of a respondent and the willingness to install a solar PV system. In line to this result, Aldy et al. (2012) mentioned that the gender was not statistically significant differences in the context of willingness to pay for clean energy in the United State. However, Ayodele et al. (2021) reported an opposite perspective of higher ratio of female expected to pay for green electricity as female now active more income earners in Nigeria. The contrary between this study and Ayodele's study could be due to different ratio of female respondents (42.2% versus 20.0%) in the total of interviewees.

There are some studies point out that aging is one of the common factors for consumers to decide on green energy adoption. A previous study of Jayaraman et al. (2017) indicated that young generation from 20 to 40 years of age are favour to buy a solar panel system, while Borchers et al. (2007) reported that people from 30 to 50 years old have higher willingness to pay for green energy. However, this study did not figure out the significantly difference between groups of people below 30 years, people from 30 to 50 years, and people over 50 years to the willingness to install a solar PV system. The ANOVA testing result was achieved of: $F(2, 177) = 0.155$ (< 2.996), $p = 0.857$ (> 0.05), $r^2 = 0.160$, clearly shows that there is not significantly interaction between the age of an individual and the willingness to install a solar PV system.

In this study, the education level of respondents is not significantly difference to the willingness to install a solar PV system by the ANOVA test: $F(4, 175) = 0.566$ (< 2.372), $p = 0.688$ (> 0.05), $r^2 = 0.584$. This finding is coincided with the result obtained from earlier study of Yoo & Kwak (2009) which shows not statistically significance between education and the willingness to pay for green electricity in Korea. On the contrary, other studies of Ayodele et al. (2021), Zhang & Wu (2012), and Wiser (2007) revealed education level of the respondents had significantly difference to their commitment on applying renewable electricity. Stand in the middle, Braito et al. (2017) found advanced education supportive for collective solar power investments, but relatively unimportant as predictor for individual investments. In Vietnam, though the solar panel was introduced in 2009 (Vu Phong Energy, 2020), but this energy source just rapidly growing since 2017 by the Decision No. 11/2017/QD-TTg state on the incentive mechanism for developing solar power projects (Vietnamese Government, 2017). It seems solar electricity to be a new energy source at household scale so that people had not experiment much on it.

For the income of a household, it reveals a significantly difference to the willingness to install a solar PV system. The ANOVA analysis result obtained the statistically significant values of: $F(2, 177) = 53.072$ (> 2.996), $p < 0.05$, $r^2 = 34.301$. Other studies in Vietnam Mekong delta recorded that the intention of people on installing rooftop solar panels was significantly difference to the installation and repair costs via a survey in Hau Giang province by Liem et al. (2020), and another study in Ca Mau province by Liem & Nhan (2020). At worldwide scale, many studies found that the willingness to install a renewable energy system is significantly difference to household's income. The term "higher income household, more pleasure to install green electricity" was noted via other studies in South Africa (Nkosi, 2016), in Denmark (Mortensen et al., 2016), in Kenya (Abdullah & Jeanty, 2011), in USA (Mozumder et al., 2011), etc.

As the income exposed significantly difference to one's willingness to install a solar PV system, the Post Hoc multiple comparison was tested to identify exactly which income groups differ from each other. The result of Post Hoc testing (Table 3) shows that all p-values are smaller than 0.05. It means that there is significantly difference within three household's income groups of less than 20,000,000 VND, of 20,000,000 to 50,000,000 VND, and of higher than 50,000,000 VND per month.

**Table 3.** Post Hoc testing result of households' income groups

| Dependent variable | (I) Income | (J) Income | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| The willingness to install solar PV system | < 20 mil. VND | 20 - 50 mil. VND | -1.05878* | .12300 | .000 | -1.3015 | -.8161 |
| | | > 50 mil. VND | -2.74029* | .40970 | .000 | -3.5488 | -1.9318 |
| | 20 - 50 mil. VND | < 20 mil. VND | 1.05878* | .12300 | .000 | .8161 | 1.3015 |
| | | > 50 mil. VND | -1.68151* | .41283 | .000 | -2.4962 | -.8668 |
| | > 50 mil. VND | < 20 mil. VND | 2.74029* | .40970 | .000 | 1.9318 | 3.5488 |
| | | 20 - 50 mil. VND | 1.68151* | .41283 | .000 | .8668 | 2.4962 |

*Note: * The mean difference is significant at the 0.05 level*

Finally, the Pearson Product Moment Correlation test was applied to measure the strength and direction of the relationship between the income of an individual and the willingness to install a solar PV system. The obtained Pearson's correlation coefficient r = 0.585 (< 0.05) shows that there is a moderate positive association between them. It means an increasing of household's income leads to increase the willingness to install for a solar PV system. Other studies on the association of income and the renewable energy interesting overall the world also noted the positive influence (Nkosi, 2016) which coincide to this study, while the study of Borchers et al. (2007) recorded negative influence, and Sundt & Rehdanz (2015) reported in moderate effect. Indeed, the correlation between income and the interesting to renewable energy was considered that it is not ideal to generalize in every region around the world (Ayodele et al., 2021).

### 3.3 Effect of quantitative variables on the willingness to install solar PV

#### *3.3.1 Effects of respondents' perceptions*

In this study, the respondents' ability to become aware on solar energy usefulness, environmental aspect and risk concern was recorded. The results show high proportions of people participating in the interview who agreed and strongly agreed with most perception variables, except risk perception variables (Fig. 2).

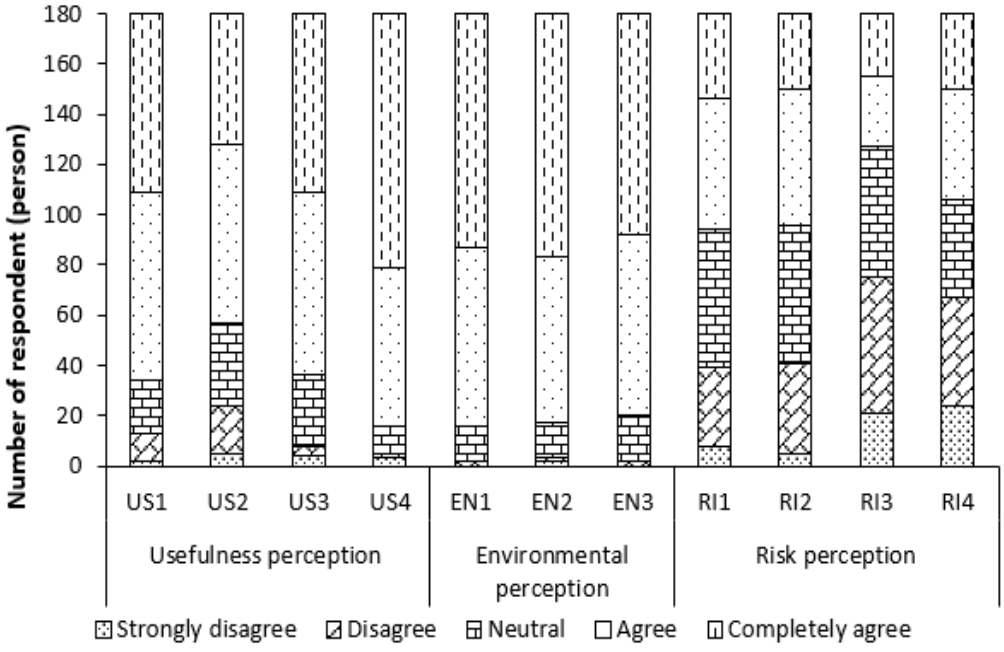


**Fig. 2** Respondents' opinions on perception variables

Within the perception of usefulness, most of the respondents (56.1%) totally agreed that solar power save energy cost in the long-term using (US4). Next, 41.7% interviewees agreed that solar is a renewable and endless energy source (US1). Solar power is actively using in daily life and production activities (US3) received the attention of 40.6% interviewees. By the same rate of 39.4%, variables of US1 and US3 received completely agree from respondents, while the variable of US2 received agree level. In contrary, variables of US1 and US2 were received

negative answers of 6.1% and 10.6% strongly disagree from respondents. Another study of Manh & Son (2020) likewise noted the usefulness of solar energy is the second factor (after finance) that affecting the intention to apply solar PV system of households in Thap Cham city, Vietnam.

For environmental perceptions, most of respondents (51.7%, 53.9%, and 48.9%) were completely agreed to the three variables of raising knowledge in the issue of climate change (EN1), using solar power reduce greenhouse gas emissions (EN2), and using solar power is less polluting than fossil energy (EN3). In respectively, 39.4%, 36.7% and 40.0% of total respondents agreed to the three variables of EN1, EN2, and EN3. In line to this study, Liem et al. (2020) also reported that environmental concerns are positive effect to the decision on solar power installation. In worldwide scale, study in both Italy and Austria indicated environmental concern is the strongest driver for solar energy (Braito et al., 2017); while Kastner & Matthies (2016) found that Germany residents who have strong ecological concern to be more likely to make an investment to renewable energies.

In the perception of risk, there are 4 variables that were considered for evaluation as one variable of unable to sell electricity due to State policy (RI5) was not realized using Cronbach's Alpha analysis. In this type of perception, the respondents had changed their attitude on the assessment scales from disagree to completely agree. For the variable of RI1 - getting products and services that are not as promised, the responses of neutral was 30.6%, agree 28.9%, strongly agree 18.9%, and disagree 17.2%. The variable of RI2 - solar panels do not meet longevity expectations - received the answers of 30.6% neutral, 30.0% agree, 20.0% disagree, and strongly agree 16.7%. Both variables of getting poor quality solar power system (RI3), and of solar panels generate toxic substances to environment (RI4) were got replies on high ratios of strongly disagree with 11.7% and 13.3% correspondingly. Besides that, interviewees responded disagree of 30.0% and 23.9%, neutral of 28.9% and 15.6%, agree of 15.6% and 24.4%, completely agree of 13.8% and 16.7% in respectively to variables of RI3 and RI4. The less of concern on risks perspective in this study is coincide to the study of Manh & Son (2020) analyzing factors affecting the intention to use solar energy technology for households in Thap Cham city, Vietnam. Especially, the high ratio of strongly disagree on the RI4 is inverse to the study of Paiano (2015) that solar PV system create large potential amount of e-waste in coming decades.

It is found that interviewed participants tend to be most concerned on the environmental and usefulness perceptions with more than 80% reply on agree and completely agree, while perception of risk is of less concern in this study. The unwell known on solar energy of people as above mentioned can be an answer to these findings.

***3.3.2 Effects of respondents' influences***

The respondents' capacity on the society, policy, and finance influences was considered on this study (Fig. 3).

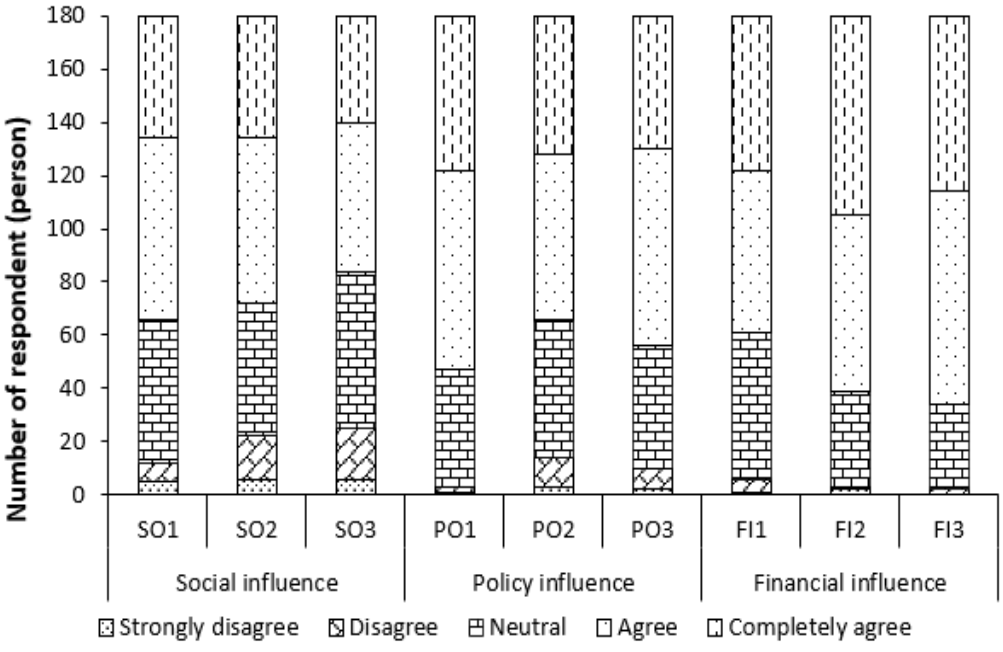


**Fig. 3** Respondents' opinions on influence variables

According to social concerns, most of respondents agreed that the relatives, friends, and colleagues (SO1), the neighbourhood (SO2), and the advertisement (SO3) had affected to their intend on solar power with 37.8%, 34.4%, and 31.1%. The neutral reply was in second ranking with 30.0%, 27.8%, and 32.8%, while the completely agree was in third ranking with 25.6%, 25.6% and 22.2% respectively. Due to only 63.3% of respondents agreed on the social variables of SO1, SO2, and SO3, there are more object groups or approach ways that could be explorer to reach people for solar power attention. Studying on solar panel system in Malaysia, Jayaraman et al. (2017) indicated that social influence has positively and significantly affected on purchasing. Another study in Germany likewise found that the social influences were positive effected to the renewable energies' investment (Kastner & Matthies, 2016).

For the policy influences, variable of creating favourable conditions to install a solar PV system (PO1) was received highest reply on agree and completely agree of 73.9%. Variable of promulgating policies on solar power to households (PO3) was responded at 68.9%, while the lowest reply was 63.3% on the variable of funding support contract to install a solar PV system (PO2). The results are coincided to previous study of Manh & Son (2020) noted that the State policy is the second factor (after finance) that affecting the intention of households to apply a solar PV system in Thap Cham city, Vietnam. Over the world, Braito et al. (2017) indicated that the diverse policy regimes in Italy and Austria brought different attitudes on solar power investment. Crago & Chernyakhovskiy (2017) found that solar policies were inefficient because people would have installed a solar PV system regardless of policy incentives in the Northeast area of the United States.

The financial influences results were figured out clearly the big barrier of investment cost for solar energy. Though only 66.1% of respondents mentioned that their family income is not high enough to install a solar PV system (FI1), 78.3% of respondents recognized that the installation cost for a solar PV system is high compared to their income (FI2). Even 81.1% of them thought that the payback period of invest funding is long (FI3). In general, finance is one of the factors that strongly impact on the intention to apply for green energy. Previous study by Liem et al. (2020) also recorded that people in Hau Giang doubted to installation and maintenance budgets of a solar PV system. In another study on factors affecting the intention to use solar energy technology, Manh & Son (2020) noted that installation fee is the first concern to households in Thap Cham city. In worldwide scale, financial concerns were indicated that had positively and significantly effected in term of perceived economic returns, and perceived cost (Jayaraman et al., 2017), of economic consequences, and investment recommendations (Kastner & Matthies, 2016). The results from current study showed that respondents not much willingness to install a solar PV system, even they could reach the funding support contract. It is needed to explore in detail how the funding could support to residents' case by case that help increasing the motivation to invest for a solar PV system.

***3.2.3 Regression analysis of quantitative variables***

Before performing the regression analysis, all independent variables were subjected for correlation analysis. The results show there is no multicollinearity among the independent variables (sig. > 0.05, R < 0.7).

Running the linear regression analysis test, the result of ANOVA reports how well the regression equation fits the data through F-test. The value of p = 0.000 which is less than 0.050 indicates that the regression model predicts well significant to the dependent variable. Another result shows the strength of the relationship of the variable in the model and magnitude with which it impacts the dependent variable (Table 4). The analysis results show that there are two variables that affect households' willingness to install a solar PV system including finance (p = 0.000 < 0.050) and policy (p = 0.012 < 0.050).

**Table 4.** Coefficients of regression

| Model | Unstandardized Coefficients | | Standardized | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Coefficients Beta | | |
| (Constant) | 4.313 | 0.562 | | 7.673 | 0.000 |
| US | 0.144 | 0.097 | 0.093 | 1.483 | 0.140 |
| EN | -0.074 | 0.110 | -0.041 | -0.676 | 0.500 |
| RI | -0.021 | 0.064 | -0.019 | -0.324 | 0.746 |
| SO | -0.029 | 0.080 | -0.023 | -0.356 | 0.723 |
| PO | 0.244 | 0.096 | 0.165 | 2.533 | 0.012 |
| FI | -0.721 | 0.062 | -0.661 | -11.600 | 0.000 |

From the linear regression analysis, it is estimating the standardized linear regression equation [1] and the unstandardized linear regression equation [2] as follows:

$$IN = 0.165 \times PO - 0.661 \times FI + \varepsilon \quad [1]$$

$$IN = 4.313 + 0.244 \times PO - 0.721 \times FI + \varepsilon \quad [2]$$

State policy variable has a positive impact on households' willingness to install a solar PV system with a standardized regression coefficient of 0.165; it means with a 1% increase in this variable, the willingness to install a solar PV system will increase by 0.165%. However, financial factors have the most significant influence and have a negative impact on households' willingness to install a solar PV system with a standardized regression coefficient of -0.661; when this variable increases by 1%, the willingness to install a solar PV system will decrease by 0.661%.

According to study from Truong et al. (2017), a solar PV system of 3 - 5 kW is appropriate for electricity producing to a household of 4 to 5 persons. In the meantime, the installation fee for a solar PV system of 3 - 5 kW is approximate 45,000,000 to 75,000,000 VND per set (SE Solar, 2023). This estimated financing budget is much higher than the monthly income of less than 20,000,000 VND (57.2% surveyed households), or even of 20,000,000 to 50,000,000 VND (40.6% surveyed households) in this study. It strongly refers that households should receive financial supports, plus incentive policies leading for a solar PV system investment. The provision can be in various approaches such as tax exemption or subside for imported equipment, clearly funding and renewable electricity trading policies for household scale, preferential loans and capital rotation for people who keen to invest for a solar PV system, broadly promote benefits and usefulness of the rooftop's solar PV system, installment and maintenance supports from the retailer, etc.

## 4. Conclusions

This study assessed the factors influencing residents' willingness to install a solar PV system in Vinh Long city, Vietnam. Within the socio-demographic attributes, the income of an individual is significantly different but in negative correlation to the willingness to install a solar PV system, while other factors of gender, aging, and education have not statistically different to the target. For the respondents' attitudes, variables of usefulness, environment, risk, and society not significantly influence to the willingness to install a solar PV system. Except variable of finance is the most statistically associate and in strong negative association to the motivation of installing a solar PV system, while policy is in significantly different and light positive correlation.

The study also revealed that local tenants paid more attention to environment perceptions of the solar PV system, while the one's risk perceptions were not considered critically. Besides that, it seems not many respondents propose to install a solar PV system due to financial barrier and the lack of solar power experience. To enhance more household's solar PV systems, citizens need more involves from local and State authorities including tax exemption or subside, funding and electricity trading policies, capital rotation and loan, knowledge promotion program, etc.

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