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Study on the intention to choose recycled water based on consumption value theory

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ABSTRACT

Recycled water is an effective way to rescue water shortage and serious water pollution. Public acceptance of recycled water is the key factor for the implementation of a recycled water project. Therefore, based on the theory of consumption value, this study chooses the functional value quality, functional value price, social value and emotional value as the independent variables, and choice behavior in recycled water as the dependent variable. By using the partial least squares method, 466 questionnaires collected from Xi'an are used to analyze the influence of different values on choice behavior, and to explore the mediating role of emotional value between other values and choice behavior. The results show that: functional value price, social value and emotional value promote the public's choice of recycled water; functional value quality, functional value price and social value have a significant impact on the emotional value. In addition, the research finds that emotional value plays an intermediary role in the functional value quality, social value and choice behavior. Finally, the guiding role of different consumption values on recycled water selection behavior is verified.

Keywords: Recycled water reuse; Choice behavior; Theory of consumption values

1. Introduction

Along with economic development, population growth, and people's pursuit of quality of life, the demand for water resources for human activities has increased nearly eight times in the past 100 years [1]. However, while demand has increased dramatically, water resources decrease substantially due to increasing water pollution, resulting in a serious imbalance between supply and demand and threatening the sustainable development of arid regions of northern China [2]. Taking measures to alleviate water resource shortage is of great significance to promote urban economic development. In this regard, recycled water reuse is regarded as one of the best solutions for water pollution and scarcity [3].

In addition to being a stable water source based on urban sewage, recycled water has significant economic, environmental, and social benefits compared to other ways such as trans-regional water transfer and desalination treatment among the many water resource strategies [4,5]. Many wastewater treatment technologies can be used to achieve recycled water having a better quality than that of the existing potable water standards [6], and recycled water has been widely used in agricultural irrigation [7]. The environmental protection supervision system maturity has further promoted the development of the recycled water industry, and governments have upgraded and transformed the wastewater treatment plants on a large-scale, which has significantly increased the supply of recycled water in cities [3]. The limited environmental carrying makes recycling utilization of water resources has become an important way to rescue water shortage. And the recycled water market has shifted gradually from industrial production and agricultural irrigation to urban cleaning, fire-fighting water, and other high value-added urban services [8].

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However, adequate supply and low market demand make it difficult to develop the recycled water market. As of 2018, the total annual recycled wastewater used in China was 7.13×10^{10} m^3, accounting for only 15.33% of the total treatment volume [9]. Studies have shown that the public's attitude and low intention of using recycled water constitute the biggest obstacle to its popularization [10]. Therefore, exploring the factors influencing the choice behavior has become a key factor in developing the recycled water market development.

At present, many studies are "point-to-point" research, mainly analyzing the price, water quality, usage and other sensitive factors of recycled water [11]. Furthermore, the potential safety and health issues, regulation, and lack of public acceptance of recycled water are also key indicators influencing market expansion [12]. However, few studies pay attention to the choice of recycled water from the perspective of the public. Attitudes and intentions fall under the "motivation stage", which is still different from the "execution phase" (choosing recycled water) [13]. The attitude and choice of urban residents toward recycled water is essentially a consumer's decision-making process for the products.

Based on the theory of consumption values (TCV), this study explores the influencing factors of choice behavior (CB) in using recycled water. To identify the factors influencing the choice behavior toward recycled water, this study analyzes the influence of different values on CB based on the TCV. Consumers express their like and dislike attitudes toward the perceived value of recycled water. The public's emotional value (EMV) cannot exist independently of the other factors, and the preference for recycled water is likely to be influenced by quality and price. This study provides fresh insights into the use of recycled water. Additionally, this study explores the moderating effect of consumer EMV in CB. Recycled water is both the subject of urban development strategy while is the object of urban residential choice behavior in a market economy system. The choice behavior in recycled water reflects consumer's concern in green products, further confirming that this theory can be applied not only to traditional goods, but also to broad goods with green attributes. This study is designed to exploring the influencing factors of the public's choice to use recycled water and provides suggestions for relieving the pressure on water resources.

2. Theoretical review and study design

2.1. Theoretical review

The public's behavior toward the environment is complex and involves many disciplines, including psychology, economics, and marketing. Scholars have explained the influence mechanism behind the behavior from different perspectives based on various theories [14,15].

Theory of reasoned action (TRA) assumes that people are rational, and believes that attitude and subjective norm are the key factors influencing individual behavior. However, individual behavior is subject to intervention from the external environment in an organization. Thus, Ajzen and Madden [16] experimentally introduced the factor of perceptual behavioral control into TRA theory, and developed it into the theory of planned behavior (TPB), believing that behavior is influenced by attitude, subjective norm, and perceived behavioral control. The study of individual behavior has experienced a paradigm shift from "rational man" to "behavioral man". TPB can better explain the influencing factors of behavior intention and is widely used in the study of human social behavior [17].

Subsequently, implementation intentions theory was put forward to further supplement the TPB. Gollwitzer [13] found that both acceptance and behavior intention belongs to the "motivation stage", which is different from the "implementation stage". Respondents are easily influenced by social pressure and choose answers that are not their real wishes in the questionnaire survey of acceptance intention [15,18].

Sheth et al. [18] first proposed TCV to analyze the influencing factors of purchasing from the perspective of consumer behavior. The traditional TCV considers that consumers' purchasing behavior (or choice behavior) is influenced by five values: functional value, social value, emotional value, conditional value and cognitive value. Meanwhile, these five consumer values are independent of each other. Subsequently, Sweeny et al. [19] found that the quality and price included in function value have different effects on behavior of consumer. Therefore, Sweeny split the functional value into functional value quality (FVQ) and functional value price (FVP) and eliminated the potential variables of conditional value and cognitive value. Therefore, this study explores the mechanism of choice behavior toward recycled water based on the modified model.

2.2. Study design

2.2.1. Research hypotheses

2.2.1.1. Function value and choice behavior

The function value of a product is its perceived utility based on its functional and physical properties that can be derived from its features or attributes, such as reliability, durability, and price [18]. Among them, reliability and durability refer to the quality of a product, and the price mentioned in the concept includes the price itself and the evaluation of the price (reasonable, affordable). Functional value has long been considered as the primary driver of consumer choice [20–22]. Wang et al. [23] found that the quality and price of goods had different effects on its perceived value. Suki [24] found that FVQ was a significant factor influencing product purchase behavior, while FVP had no significant effect on the purchase of green products. Similarly, Khan and Mohsin [25] noted that the price factor of a product had a more significant effect on the choice behavior than the quality factor when explored the purchase behavior intention of green products in terms of both quality and price. Combined with Sweeny's findings, this study argues that the impact of product quality and price on decision-making should be considered when exploring decision behavior of consumers. Based on this, this study proposes the following hypotheses:

- H1: quality factors positively influence the decision behavior of consumers in recycled water.
- H2: price factors positively influence the decision behavior of consumers in recycled water.

2.2.1.2. Social value and choice behavior

Social value (SV) refers to the perceived utility derived from an association with one or more specific social groups [18]. SV is similar to the subjective norms, reflecting external social pressure. Lin and Huang [26] and Biswas and Roy [21] pointed that environmental protection was the responsibility of the government and businesses that indicted SV had no significant influence on green product choice behavior. Additionally, Suki [24] found that SV had the paramount impact on purchasing green products when categorized users into three usage groups (light users, average users and heavy users) based on the frequency of purchasing green products. SV is similar to the subjective norms that many studies consider as an important influencing factor when analyzing sustainable consumption behaviors [21,27]. Some consumers strongly believed that buying green products would create a good impression on others and social norms led to incremental recognition of green products [24]. In this connection, consumers' perception of the SV of recycled water is highly likely to influence their product choices. Therefore, this study proposes the following hypothesis:

- H3: social value positively influence the decision behavior of consumers in recycled water.

2.2.1.3. Function value, social value and emotional value

Emotional value (EMV) refers to the perceived utility of a product that consumers experience based on their feelings or emotional states [18]. When associated with a specific emotion, the product will gain EMV. Sheth et al. [18] thought that the five perceived values were independent of each other and influenced the choice behavior together. However, Sweeny pointed out that each value dimension was probably not independent through a number of studies. Emotion is one of the three dimensions of attitude likely to be influenced by consumers' functional and social value perceptions. For example, the superior performance of a mobile phone may increase consumers' love for it. Similarly, comments from friends and relatives about a product can cause consumers to change their emotions towards that product. Based on this, this study proposes the following hypotheses:

- H4: function value quality positively influences emotional value.
- H5: function value price positively influences the emotional value.
- H6: social value positively influences emotional value.

2.2.1.4. Emotional value and choice behavior

Purchase behavior is often associated with emotional responses, and consumers' likes and dislikes for a certain commodity will influence the final purchase decision. Kushwah et al. [28] found that EMV had a positive effect on ethical consumption intention compared with choice behavior. Choice behavior is influenced by emotional values. Consumers with positive emotional values perceive that green product choices will have a positive impact on the environment and finally increase their investment in green products [26]. Gonçalves et al. [29] explored consumers' behavior when purchasing green products and found that their positive emotions could promote environmental behavior to a greater extent. In other words, consumers' emotional values have an important influence on the choice of recycled water. Therefore, this study proposes the following hypothesis:

- H7: emotional value positively influences the decision behavior of consumers in recycled water.

2.2.1.5. Mediating role of emotional value

It has been shown that the emotional of the customer has a strong influence on product choice. EMV influences customers' evaluation of products and provides the basis for behavioral decisions. Sheth et al. [18] showed that emotional value is most influential in discriminating between smokers and non-smokers when applied to buying decisions, product decisions and brand decisions. EMV is both an outcome variable of functional value and social value and an important predictive variable of choice behavior, mediating the effects of other values on choice behavior [25]. Based on this, this study proposes the following hypotheses:

- H8: emotional value plays a mediating role between functional value quality and decision behavior in recycled water.
- H9: emotional value plays a mediating role between functional value price and decision behavior in recycled water.
- H10: emotional value plays a mediating role between social value and decision behavior in recycled water.

2.2.2. Construction of the theoretical model

Partial least squares-structural equation modeling (PLS-SEM) model can deal with the error caused by variable measurement well and has no requirement for data distribution. The model is still effective when the data does not conform to the normal distribution [30,31]. Therefore, combining the characteristics of data distribution, this paper constructs a structural model of FVP, FVQ, SV and EMV on choice behavior in using recycled water based on partial least squares (PLS) model using SmartPLS 3.0 software (Fig. 1).

3. Method

3.1. Data sources

The recycled water market has shifted gradually to urban cleaning, road spraying, fire-fighting water and other high value-added urban services as the result of the imbalance between supply and demand of water resources in China. As the node city of the Silk Road and the "Belt and Road", Xi'an, plays a pivotal role in the economic development in Shaanxi province and the northwest region of China. However, in the context of the rapid development of industrialization and urbanization, the contradiction between supply and demand of water resources has become more acute. In addition, the increasing pressure on resource carrying capacity and environmental capacity has made the

regional economic development more severely constrained by water resources. Therefore, this study focuses on the urban residents and selects seven locations with a large population to collect samples through questionnaires in Xi'an.

3.2. Questionnaire

The first part of the questionnaire contained 15 items in 5 dimensions: FVQ, FVP, SV, EMV and CB, all items were adapted from Zailani et al. [20] and Khan and Mohsin [25] (Table 1). To ensure the continuity of the observed variables, all the questions were measured on a seven-point Likert scale from 1 ("strongly disagree") to 7 ("strongly agree"). The second part of the questionnaire collected basic information including gender, age, education level, and income level of the respondents. Income levels were grouped according to quintiles of per capita disposable income of the permanent population.

According to the current norms of recycled water reuse, recycled water reuse methods were divided into five categories: groundwater recharge, industrial water, agricultural water, urban water (urban greening, flushing toilets, road sweeping, car washing, construction of building and firefighting), and landscape environmental water [8]. Combined with the uses of recycled water and public acceptance, this study explored the choice behavior of using recycled water in two scenes: the self-service car washer and the renovation of water pipelines in old communities.

3.3. Sample characteristics

This survey was conducted on October 23, 2018. A total of 481 questionnaires were recovered, and 466 valid samples were obtained after excluding the invalid samples that respondents who did not complete the survey and whose survey duration was less than half of the median of the total survey duration. Out of 466 respondents, there are 286 females (61.4%) and 180 males (38.6%). The most respondents are between 20 and 50 years old (93.6%). With regard to income, respondents' monthly income are classified according to the per capita disposable income of the permanent population in the Xi'an Statistical Yearbook which are divided into quintiles. In terms of education, 337 respondents have a bachelor's degree or higher.

4. Results

4.1. Assessment of the measurement model

Before testing the hypotheses, this study used indicator reliability, convergent validity, discriminant validity and internal consistency reliability to assess the measurement model [32]. The convergent validity of the PLS-SEM model is mainly based on the factor loadings and the average variance extracted (AVE). And the criterion is that the factor loadings is greater than 0.7 and the AVE value is greater than 0.5 in order to explain the latent variables reasonably [32,33]. As shown in Table 2, all items factor loadings were greater than 0.7, which indicated that the reliability of the individual items was established. The minimum AVE was 0.672 and the maximum was 0.720, and all constructs were above 0.5 that tested the convergent validity was validity. The reliability test aimed to judge the reliability of the questionnaire, which is generally conducted using the Cronbach's coefficient (Cronbach's α), and the composite reliability (CR) indicators of the latent variables.

Table 1
Index system of the consumption value theory on the choice behavior of recycled water

Latent variable	Observable	Indicator	Mean value	Standard deviation
Function value quality	FVQ1	Recycled water has reliable quality	5.06	1.188
	FVQ2	Recycled water performs consistently	4.81	1.231
	FVQ3	Recycled water has an acceptable standard of quality	5.45	1.225
Function value price	FVP1	Recycled water is reasonably priced	5.17	1.174
	FVP2	Recycled water would be economical	5.15	1.212
	FVP3	Recycled water offers value for money	5.32	1.157
Social value	SV1	Using recycled water would help me to feel acceptable	5.64	1.114
	SV2	Using recycled water would make a good impression on the other people	5.19	1.206
	SV3	Using recycled water would give its owner social approval	5.25	1.226
Emotional value	EMV1	Using recycled water would feel like making a good personal contribution to something better	5.03	1.264
	EMV2	Using recycled water would feel like the morally right thing	5.23	1.220
	EMV3	Using recycled water would make me feel like a better person	4.91	1.280
Choice behavior	CB1	I am willing to use recycled water in daily life	5.49	1.046
	CB2	I am willing to stick with such a recycled water service	5.52	1.105
	CB3	I am willing to make a partially recycled water energy retrofit in my current neighborhood	5.40	1.090

Table 2
Assessment of the measurement model

Latent variable	Observable	Cronbach's alpha	CR (composite reliability)	AVE (average variance extracted)	Loading	T-test
	FVQ1				0.851	47.529
FVQ	FVQ2	0.757	0.861	0.673	0.813	35.981
	FVQ3				0.796	37.230
	FVP1				0.845	49.348
FVP	FVP2	0.764	0.863	0.678	0.790	26.062
	FVP3				0.834	55.121
	SV1				0.796	37.111
SV	SV2	0.755	0.860	0.672	0.846	53.271
	SV3				0.816	42.196
	EMV1				0.806	29.849
EMV	EMV2	0.794	0.879	0.708	0.880	81.045
	EMV3				0.837	44.621
	CB1				0.847	51.695
CB	CB2	0.805	0.885	0.720	0.860	56.588
	CB3				0.838	50.444

Table 2 showed that Cronbach's α of all latent variable from 0.755 to 0.805, which indicated the questionnaire had high reliability [34]. Social value had the lowest composite reliability (0.860) and choice behavior had the highest composite reliability (0.885), and the composite reliability (CR) of all constructs were higher than the cutoff of 0.7 by Hair that showed the internal reliability of the questionnaire were acceptable [35].

In addition, this study judged the discriminant validity of measurement structure using the correlation between the constructs and the square root of the AVE. The discriminant validity is acceptable when the square root of AVE is greater than the correlation coefficient between the constructs [36]. The results in Table 3 showed that the measurement model had good discriminant validity.

Table 3
Discriminant validity analysis

	FVP	EMV	SV	FVQ	CB
FVP	**0.823**				
EMV	0.555	**0.842**			
SV	0.547	0.696	**0.819**		
FVQ	0.483	0.632	0.544	**0.820**	
CB	0.568	0.607	0.610	0.473	**0.848**

Note: Diagonal bold text is the square root value of AVE and the lower triangle is the Pearson correlation coefficient.

4.2. Assessment of the structural model

After verifying the validity and reliability of the measurement model, this study further evaluates the adequacy of the structural model. PLS-SEM model is usually evaluated based on the coefficient of determination (R^2), significance of path coefficients and predictive correlation. R^2 is used to determine the degree of contribution of the dependent variable by the independent variables, and Q^2 is used to evaluate the predictive relevance of the model [37,38].

In this study, the significance of the path coefficients was tested by using the bootstrap procedure of resampling 5000. As shown in Fig. 2, FVQ, FVP and SV all have a significant influence on EMV with coefficients of 0.316, 0.165, and 0.434. EMV explained 59.3% of the variance in the model. Therefore, H4, H5, and H6 were supported. To test the mediation hypotheses, Fig. 3 illustrated the total effect of FVQ, FVP, and SV on choice behavior. Whereas Fig. 2 showed the sum of the direct and indirect effects, which were based on the product of the path coefficients for each path in the mediational chain. The value of variance accounted for (VAF) is used to judge the mediating effect [35]. The VAF value of FVQ, EMV and choice behavior path was 64.17% (0.077/(0.077 + 0.043) = 64.17% > 20%), which indicated that EMV were partial mediators between quality and choice behavior. Therefore, H8 were supported. FVP, EMV, and SV all have a significant influence on the choice behavior of recycled water, except the FVQ, which is not significant. Choice behavior explained 48.5% of the variance in the model. Therefore, H1 was not supported, and H2, H3, and H7 were supported. The VAF value of FVP, EMV and choice behavior path was 13.20% < 20%, which indicated that EMV had no mediating effect between quality and choice behavior. Therefore, H9 were not supported. The VAF value of SV, EMV and choice behavior path was 27.89% > 20%, which indicated that EMV were partial mediators between SV and choice behavior. Therefore, H10 were supported.

In addition, this study evaluated the predictive capacity of the model by Stone-Geisser's Q^2. Generally speaking, When Stone-Geisser's Q^2 is greater than 0, it indicates that the model has predictive correlation [39]. As shown in Fig. 2, Q^2 is 0.414 and 0.342, indicating that the model had acceptable predictive relevance.

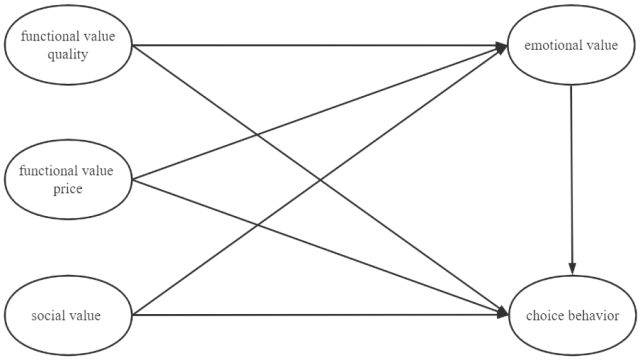

Fig. 1. Theoretical model.

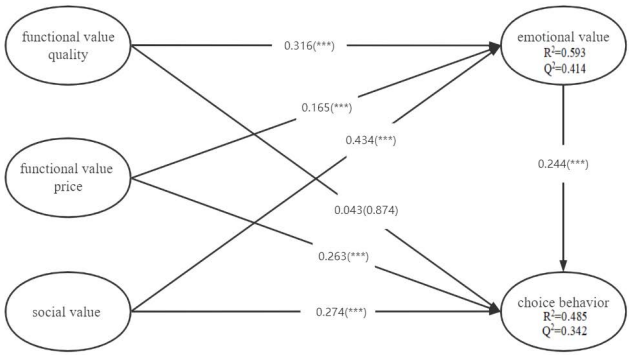

Fig. 2. Structural model.

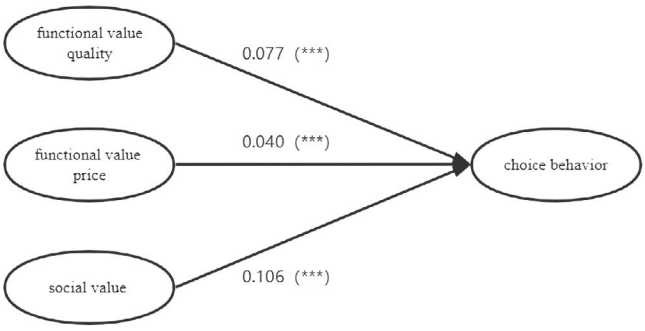

Fig. 3. Mediating model.

5. Discussion

Based on the theory of consumption value (quality, price, emotional and social value), this study explored which factors influence choice behavior towards using the recycled water. In addition, the hypotheses supported that emotional value can adjust the relationship between other values on choice behavior. The public choice behavior in recycled water reflected consumer's concern in green products, further confirming that this theory (TCV) can be applied not only to traditional goods, but also to broad goods with green attribute.

The results found the FVQ has an insignificant impact on choice behavior of using the recycled water, which is consistent with the research results of Lin and Huang [26]. The purpose of this study is to explore the choice behavior of recycled water use under two scenarios of the self-service car washer and the renovation of water pipelines in old communities. Specifically speaking, the use of recycled water includes landscaping water, fire water and toilet flushing. In these scenarios, the contact degree between recycled water and human body is relatively low. In general, with increasing human contact levels, negative stereotypes will be increasingly enhanced [40]. In this study, the level of exposure to recycled water was low, which shows that the quality factor has no significant effect on the choice behavior. As Lin and Huang [26] said, "the reason why the public does not use green products is the lack of understanding of the scope and characteristics of green products, not the lack of interest in green products". During the interview, the study found that most residents support the use of recycled water for car washing and toilet flushing, but it is not surprising that the location of the self-service car washer is not known, which leads to the low willingness to use recycled water. Therefore, the government and water authorities should popularize the use of recycled water and relevant knowledge to the public, so that the residents can have a more intuitive understanding of recycled water. The development of recycled water industry will be greatly improved if this was fulfilled.

In these main effects (FVQ, FVP, SV, and EMV), price has a significant effect on choice behavior, which is consistent with research results of Khan and Mohsin [25]. Price is the core element of developing recycled water market. Reasonable price plays a huge stimulating role in the promotion of the recycled water, meanwhile, which has a fundamental impact on whether the production operations of enterprises can achieve a break-even or even gain profits. In the development of wastewater recycling, Xi'an is one of the earliest cities to develop recycled water in China. Combined with the use of recycled water and per capita disposable income in this study, recycled water will be more popular due to its low price. There are many links involved in the water source collection, production and transportation of recycled water. In addition to the upgrading and reconstruction of wastewater treatment plants (WWTPS), the development and operation of WWTPS need the strong support from tax revenue. In view of this phenomenon, this paper puts forward the following suggestions: First, the coverage area of recycled water should be increased to reduce the cost of recycled water. Second, the price lever should be used to adjust the water structure, widen the price difference between tap water and recycled water, and improve the utilization rate of recycled water. Third, the government should increase investment in the development of recycled water, use subsidies and support policies, and promote the use of recycled water at reasonable preferential prices.

The emotional value is another key factor on choice behavior, which is consistent with the findings of Zanlini et al. [20]. EMV has a positive role in promoting the behavior of renewable water selection. Therefore, in the process of promoting recycled water, it is necessary to highlight not only the advantages of recycled water compared with other alternative water sources, but also highlight the positive emotional experience brought by the use of recycled water to the public. In addition, this study also proves the

mediating role of EMV between FVQ, SV and choice behavior, which further shows that it is very important to improve the public's positive emotion for recycled water. Just like the advertisement of a certain product mentions "guard at all levels, breathe the good air of home", which not only highlights the green and environmental protection characteristics of the product itself, but also makes consumers feel that they buy this product to protect the health of their families. Similarly, in the publicity activities of recycled water, we should connect recycled water with the positive emotions of residents, and further play the positive role of emotional value in the choice of recycled water. Therefore, when the information about recycled water is popularized, we should not only emphasize the significance of using recycled water to alleviate the shortage of water resources in China, but also highlight that the residents using recycled water are like an environmental guard, who are actors in the construction of beautiful environment.

The results show that SV has a significant influence on the choice behavior of recycled water, which is not consistent with Suki [24]. The positive impact of SV in the decision behavior of consumers in recycled water can be explained as follows. First, consciousness of environmental responsibility increases the demand for green products. As an important way to solve the shortage of water resources, the public is willing to pay for recycled water. Second, using green products will make a good impression or increase social social approval. Third, public will choose more green products with the restriction of environment norms. Therefore, we should give full play to the positive role of social norms and peer behavior. Protecting the water environment is not only the responsibility of the government and enterprises, but should be the responsibility of the whole society, and all people should participate. Social norms, as a non-economic and non-coercive means, play an important role in environmental protection. For the promotion of recycled water, we should make full use of social norms to guide some residents to drive more residents to use recycled water.

6. Conclusions

Recycled water reuse is regarded as one of the best solutions for water pollution and water scarcity. However, the public acceptance of recycled water (PARW) is the key factor affecting water utilization and promotion. Based on the TCV, this study constructs the theoretical model of the decision behavior of consumers in recycled water and establishes the model based on partial least squares (PLS) method. The results show that: (1) except that the FVQ has no significant effect on choice behavior, FVP, SV and EMV have positive effects on choice behavior; (2) FVQ, FVP and SV have positive effects on EMV; (3) EMV plays an intermediary role between the FVQ, SV and choice behavior.

This study provides valuable insights to the implementation of a recycled water project, but its limitations need to be further addressed. First, the data of this study is only from the questionnaire survey. Restricted by the development of the recycled water, the vast majority of respondents don't really use it in their daily lives. In future research, broader interviews should be conducted with the investigators. Second, this study analyzes the influence of different values on choice behavior based on the theory of consumption values. However, the influencing factors that affect each value are unclear. In the future research, we would integrate the influencing factors of consumption values to analyze the choice behavior more comprehensively.

Declaration of competing interest

The author declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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