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A modified theory of planned behavior for e-waste recycling intention based on the mediating role of expectancy.

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Abstract

The effectiveness of theory of planned behaviour (TPB) model has been identified in the prior studies where the scholars tried to explain people's recycling intentions, on the other hand, many studies striving to find more antecedents of TBP to add explanatory power of original TPB model. However, this study paid attention to the weak relationships between antecedents of TPB and recycling intentions in a particular setting. It addressed the gap in the e-waste recycling setting and rebuilt the TPB model by adding a mediator "expectancy" between antecedents and recycling intentions. The study collected 363 students' responses through the questionnaire in North-eastern cities of China. The findings revealed that expectancy served as a powerful mediator between antecedents of the TPB model and recycling intentions. It implies that people's expectancy plays a crucial role in motivating recycling intentions. Besides, this study exerted "social trust" as an antecedent of the TPB model for the first time. Results showed that social trust could actively motivate people's attitudes to recycle e-waste. All of these findings could benefit policymakers and scholars.

Keywords: E-waste recycling intention, Modified theory of planned behaviour, Mediating role of expectancy and Recycling intention in China

1. Introduction

Scholars believe that the world's electronic waste (e-waste) is the main contributor to the current environmental pollution which is the greatest concern of the policymakers (Rolf, 2005), individuals' health problems (Xiang Zeng et al., 2016) and the depletion of natural resources (Robinson, 2009). Although recycling has been widely recognized to be an essential and sustainable effort to manage e-waste but stills the recycling rate is not up to the mark to keep abreast of large quantity of e-waste which amounted to 41.8 million tons in 2014 globally and may upsurge year by year (Xianlai Zeng et al., 2016). Therefore, the scholars and the policy-makers need to learn the reasons why the e-waste recycling rate is low and explore more factors that would enhance people's e-waste recycling intentions or encourage people to actively take part in real e-waste recycling practices (Wan et al., 2017).

As for increasing people's e-waste recycling intentions, and thereby recycling behaviours, understanding the elements affecting an individual's e-waste recycling decision-making process is of great importance (Bamberg et al., 2007). Most scholars conformably agree that cognitive factors and social influences are two main determinants when people make a decision to protect the environment (Han et al., 2017; Landry et al., 2018).

The Theory of Planned Behaviour (TPB) introduced by Ajzen (1991) has been used widely for elucidation various intentions as well as for explaining various behaviours (Armitage & Conner, 2001) (Armitage, 2001). TPB implies that people's intention can be determined through three elements: 1) positive subjective valuation of the behaviour (attitude), 2) influence from friends and relatives around us and other people of exerting the behaviour (subjective norm) and 3) external and internal limits of performing this behaviour (perceived behavioural control). To enrich the TPB model and to increase TPB's explanatory influence, many researchers have tried to add additional antecedents into TPB. Moral norm is one variable that received wide recognition from the scholars. Moral norm refers to individual's moral considerations to do something, if he does not do, ethical condemn would arouse in his mind (Zhang et al., 2013) and perceived recycling benefits (Klößner, 2013) (awareness of consequences) is also a powerful antecedent that has been confirmed in the context of recycling intention.

However, prior studies rarely explore the reason why the relationship between antecedents of TPB and recycling intentions is insignificant or weak in some particular settings. In order to fulfil this gap, we proposed the mediating role of people's expectancy in generating e-waste recycling intentions. Expectancy was first proposed in expectancy theory by Vroom (1964). It refers to that people's 'belief efforts 'can generate good performance or results (Hsu et al., 2014). If people start to believe the possibility of finishing doing something, they will motivate themselves to do that. Likewise, the difficulty in recycling e-waste in some regions in China, people's expectancy in finishing e-waste recycling may serve as an effective factor in arousing recycling intentions. Therefore, the weak or insignificant relations between TPB variables can be explained by people's expectancy. Although scholars have agreed with the complexity of the e-waste recycling process (Li et al., 2017), research has devoted limited attention to the stakeholders involving in this process and consumers' comments or ideas on other stakeholders. So, we have added social trust, which was rarely discussed in the pro-environmental context, into this research model. Social trust can be explained as the public reliability on the responsible persons who are in charge of taking various decision as well as who have the authority to take actions for managing the technology, ensuring environmental betterment, or other realms related to public health, safety and basic need (Imanina et al., 2016). People's trust in e-waste disposal organizations or other related sectors is essential in a time of the recycling process. Only when consumers choose to trust in these organizations, they can show the tendency to recycle e-waste. Furthermore, previous studies debated on the internal relationship among the variables used in the TPB model. There are mixed findings regarding the relations of TPB variables. Consumers' food waste disposal behaviour is affected by the people's attitude towards it, their subjective norm, and the perceived behavioural control on it and it has been revealed by Stancu et al. (2016). However, Park and Ha (2014) confirmed that subjective norms directly influence attitude while indirectly affect behavioural intention. Facing mixed findings, we planned to do further study on the relationships between TPB variables.

The issues addressed in this research have three main contributions to e-waste recycling literature. First, the study attempts to provide some theoretical explanations about people's expectancy in a pro-environmental context. Second, the study cites expectancy and social trust in e-waste recycling settings for the first time ever. Third, it creates a different conceptual model centring on the existing TPB model. It will not only validate the confusing relations between original TPB variables but also enrich the TPB model.

2. Theoretical aspects and hypothesis development

2.1 TPB and recycling intentions

Assortment and retrieval of values of components (e.g.: metals) from the used items and refusal to dispose of items is known as recycling. In addition, according to Park and Ha (2014) defined recycling intention is the commitment of individuals to participate in recycling. Thus, e-waste recycling intentions refer to consumers' willingness to the accumulation of electronic appliances as much as possible, retrieve the valuable components from the appliances and dispose of them so that it cannot do any harm to the atmosphere and lives (UNEP, 2011). During the last few decades and with the revolution of electric appliances, scholars have been found to explore consumer's perception to recycling e-waste. Moreover, they have been found to use variables from social psychology to explore consumer's recycling

intentions (Wan et al., 2017). One of the popular approaches that has been widely used by scholars to explicate recycling intentions is the Theory of Planned Behaviour (TPB). Ajzen (1991) proposed the widely used TPB which is the modification of the Theory of Reasoned Action (TRA). The theory puts that intention is the direct antecedent to a particular recycling behaviour, three independent antecedents: attitude, subjective norm and perceived behavioural control collectively determine the final intention. Table 2 represents the prior use of the three antecedents in prior studies. Attitude reflects a person's behaviour into a particular thing (e.g. good or bad behaviour) such that if individual favours that behaviour, the intention to act would be high. TPB which is an extension of TRA advocates that the person's behaviour completely depends on the attitude to the behaviour and subjective norms. Subjective norm shows one's perceived pressure to conform to other people's behaviour, or to put it in an evolutionary way, subjective norm indicates peoples' pressure to conform to a generally accepted behaviour just to avoid being criticized and isolated by other people. Additionally, it demonstrates a person's perceptions of expectation from other people to action concerning the behaviour. Perceived behavioural control indicates the barriers one finds to perform a certain behaviour, which is an extra variable added to TRA by Ajzen. It not only refers to personal barriers to perform a behaviour (such as lack of time or money) but also the exterior obstacles to carry out a behaviour (such as lack of infrastructures of dropping off waste). The applications of the TPB model have found in many fields since its introduction (Aguilar - Luzón et al., 2012; De Leeuw et al., 2015) including recycling intentions and behaviours (Chan & Bishop, 2013; Wan et al., 2014a). The preceding application of TPB in recycling intentions has been summarized in table 1.

Ajzen (1991), who proposed TPB model, confirmed that intentions are the function of three different elements: attitudes towards behaviour, subjective norms and perceived behavioural control. They all directly linked to intentions. Most of the later scholars also get the same conclusions in public transport use (Bamberg & Schmidt, 2003), general conservation behaviour (Kaiser et al., 2005). However, some researches have shown that subjective norms directly influence attitude whereas has an indirect impact on intentions (Bamberg et al., 2007; Bratt, 1999). It is factual that a person's attitudes are affected by people and environments around him (Petty & Cacioppo, 2018). Festinger (1954) implied that it is difficult to attain an absolute standard for an attitude. In other words, not all people would have the same attitude towards one particular object. As a result, people tend to form their own attitudes toward something according to other peoples' opinions or actions who are important to him or who have authority in this field, because people would have a sense of belonging and safety in this case. So, in the background of e-waste recycling, we proposed our first hypothesis as follows:

H1: Subjective norms are positively related to attitude toward e-waste recycling.

It is said that when people face a strange, ambiguous and uncertain situation, may be difficult to make a decision, they would follow other people's behaviours to lower down the risks (Cialdini & Trost, 1998). Ho (2002) examined the possible causes of recycling behaviours of households in Singapore, in which it was indicated that peoples' recycling intentions increased accordingly based on his neighbours' behaviours. Bamberg et al. (2007) proved that others' belief and behaviours may play a role in helping people judgment. Whether a behaviour is difficult to perform because of internal inability or external obstacles, in this study, we just confine perceived behavioural control to external barriers (such as the lack of e-waste recycling sites). Thus, people tend to judge the barriers that exist or how difficult the e-waste recycling behaviours is through other people's ideas and actions, if most people recycle e-waste, they would have a perception that this behaviour may be not very difficult, and then decide to do that. Hence, this study proposes that subjective norms influence perceived behavioural control.

H2: Subjective norms can decrease consumers' perceived behavioural control.

Table: 1. Prior application of TPB to explore recycling intentions

Authors	Aim
Mak et al. (2019)	Aiming to promote recycling waste from development work.
Botetzagias et al. (2015)	Aiming to investigate the role of moral norms and demographic predictors in TBP for recycling.
Oztekin et al. (2017)	Aiming to investigate the gender perspectives on the factors that can predict recycling performance.
Wang et al. (2019)	Aiming to investigate the people's willingness to on-line recycling behavior.
Wang et al. (2016)	Investigated the household electronic waste recycling in China.
Wan et al. (2017)	Shows attitude on recycling intention from 2 different perspectives.
Poškus and Žukauskienė (2017)	Aiming to predict the recycling intention of 5 personalities.
Mahmud and Osman (2010)	Aiming to investigate the recycling intention of school students in Malaysia.
Kumar (2019)	Explored the electronic waste recycling among young adults based on cross-culture.
Wan et al. (2014b)	Showed the influence of perceived policy.
Park and Ha (2014)	Applied TBP and Norm Activation model on consumers.

Table: 2. Prior use of three antecedents of TPB

Variable Name	Prior implication's sources
Subjective Norm	Wan et al. (2014a), Park and Ha (2014), Knussen et al. (2004), De Leeuw et al. (2015), Chen and Tung (2010)
Attitude	Park and Ha (2014), Zhang et al. (2013), Wan et al. (2014a), Poškus and Žukauskienė (2017), Knussen et al. (2004), De Leeuw et al. (2015), Chen and Tung (2010)
Perceived Behavioral Control	Park and Ha (2014), Zhang et al. (2013), Wan et al. (2014a), Poškus and Žukauskienė (2017), Knussen et al. (2004), De Leeuw et al. (2015), Chen and Tung (2010)

2.2 The antecedents of the TPB model

Different reasons from different origins (such as social context, internal consideration) contribute to people's comprehensive evaluation of one particular thing. Awareness of benefits, awareness of negative effects, subjective norms and social trust are being considered the basis of the TPB model. Different researchers have found a significant relationship with these four with behaviour. Park and Ha (2014) mentioned awareness of benefits can influence the behaviour towards a particular object, awareness of consequences was introduced in Schwartz's NAM model, demonstrated the influence of subject norms in individual's behaviour and different researchers has emphasized the social trust to influence the behaviour.

Park and Ha (2014) proposed that awareness of benefits is a reflection of an individual's attitude toward an object, therefore it can predict one's attitude toward the object. Under the circumstance of e-waste recycling, researchers believe that awareness of benefits has great significance. It can actively promote the formation of attitude toward recycling e-waste such as a person who has a better understanding of positive outcomes of recycling e-waste, he/she will have the positive and favourable mentality toward recycling and will be more interested in recycling e-waste, Fishbein and Ajzen (1977). So, researchers propose that.

Awareness of consequences is another significant thing that can influence people's behaviour. A person who is conscious of the negative effects, he will be more influenced to take action. Schwartz (1977) introduced the NAM model for the first time based on philanthropic behaviour, and the NAM model was designed by him to explore the pro-environmental behaviours/ intents of individuals. Initially, awareness of consequences was introduced to convey people's awareness of harmful results because of the act of omission. This concept substantially implies that whether an individual knows the detrimental consequences from his/her specific action omission. This awareness can activate one's moral norm to perform particular action which can reduce or prevent adverse influence (Cordano et al., 2011; De Groot & Steg, 2009). Awareness of negative impact has been proved as the powerful antecedent of the recycling intention in previous research (Chen & Tung, 2010; Wan et al., 2012). Bamberg and Möser (2007) also suggested that awareness of consequences has significance in arousing people's awareness to do pro-environmental behaviours. Awareness of benefits helps to stimulate awareness against the harm of the particular actions. They stated that only when a person is aware of the bad consequence of his behaviour, he can strongly force himself to perform a behaviour. However, some scholars explained awareness of consequences in another way, such as Davies et al. (2002) thinks that it refers to consumers' consciousness of knowing the level of desirable consequences of certain behaviour. This is being considered as a more popular statement regarding this concept. According to Lee et al. (2012), people prefer to

hear about and know the benefits of their good behaviours instead of the bad effects of their bad behaviours or avoiding doing some good acts. Follows and Jobber (2000), indicated that consumers have good attitudes and inclinations to purchase environmentally responsible products when they realize this behaviour has good effects on the environment. Considering this, in the present study, we use awareness of benefits as a paraphrase of awareness of consequences.

H3: Awareness of benefits is positively related to attitude toward e-waste recycling.

According to the TPB model, subjective norms have a direct link to the individual thinking of the social appeal that the person should complete that action. This perception motivates people to comply with social pressure, accordingly, influences people's intention to do that behaviour. Schwartz (1977) explained that people would care more about the effects of his own performance on others and the environment when they have conceptions of the benefits of some environmentally friendly behaviours. They incline to pay attention to the opinions and comments from people who are pro-environmental. Hence, researchers supposed that one's awareness of the benefits of e-waste recycling tends to be in relation to subjective norms. That indicates that people with awareness of benefits have more possibility to deliberately pay attention to the recycling actions and ideas that have been generally accepted by people who are important to them or knowledgeable about environmental issues.

H4: Awareness of benefits is positively related to subjective norms.

Trust is a construct that has obtained many types of research in the technology acceptance field and different researchers have described it in different ways. Rousseau et al. (1998) provided a widely-used definition, which is "trust is a psychological state comprising the intention to accept vulnerability based on upon positive expectations of the intentions or behaviour of another". However, Bradach and Eccles (1989) have different way to view the trust, according to them the trust is something different that can lessen the fears that is expected from the partner's action. When identified the function of users' trust in electronic business, Kini and Choobineh (1998) referred trust as the belief in the system and how it works, particularly believe in its capabilities, reliability and safety of the system, under a vulnerable situation. Later, Siegrist et al. (2000) gave an official definition to social trust: "people's willingness to believe and make decisions based on the authorities who have the right and responsibility in particular realms, such as technology, environment and so on". It can be assumed that people do not evaluate a particular object or behaviour directly because of the scarcity of knowledge about that specific object. Rather, the public would count on their understanding of the particular authority and determine whether to believe it (Siegrist & Cvetkovich, 2000; Wan et al., 2014b). One of the major advantages of social trust is it can reduce the complication and vagueness that people usually face. Empirical studies have shown that social trust is an important dimension in attitudes toward technology (Huijts et al., 2014). As for e-waste recycling in China, until now, consumers have not adequate knowledge of e-waste and the disposal process of e-waste. This is similar to the above-mentioned conditions. According to the above-said perspectives, we recommend the following hypothesis:

H5: Consumers' social trust in e-waste disposal organizations has a positive effect on their attitude to recycling e-waste.

2.3 The expectancy of finishing e-waste recycling.

Expectancy is one of the variables of expectancy theory, which was put forwarded by Vroom (1964), which has been used mostly for explaining human motivation under organizational and entrepreneurial settings (Barba-Sánchez & Atienza-Sahuquillo, 2017; Chiang & Jang, 2008). Expectancy delineates individuals tend to make decisions in line with the perceived probabilities of different choices (Chiang & Jang, 2008). It conveys that individual will take actions if he/she feels his/her endeavour can lead to good performance which may be important to or attractive to oneself (Olson et al., 1996). Expectancy is an individual's perception of the likelihood of accomplishing a particular behaviour through efforts (Putwain et al., 2019). It is associated with an individual's previous understanding, self-confidence, the perceived effort of the performance goal and feedback or evidence from the people who have experienced (Gatewood et al., 2002).

Expectancy is a compound; it can be affected by one's past experiences and one's perceptions come from the personal and social environment. It is considered as the motivational construct which can influence the individual's choice of deeds, levels of targeted goal, determination, private enterprise, and the purposes in a range of situations, Olson et al. (1996) noted that expectancies are originated from: direct experience, indirect experience, and other beliefs.

Therefore, the expectancy of e-waste recycling can also be propelled by personal experiences. For example, previous recycling behaviours, just as Maki and Rothman (2017) indicated that prior behaviour had a positive effect on people's pro-environmental intentions under the circumstance that he got a relatively good feeling when he finished that behaviour. The expectancy of e-waste recycling can also be attributed to communication, response, or evidence from other experienced people (Gatewood et al., 2002).

2.4 Potential mediating role of expectancy

In this study, the expectancy of finishing e-waste recycling is well-defined as "the possibility one perceives of accomplishing e-waste recycling behaviours through efforts". This perceived possibility is affected by many factors, just as mentioned above. The factors can be categorized into two aspects, one is the self-based perspective, which means elements related to oneself, such as personal experience and psychological arousal or emotions; the other is externality-based perspective, that means the external factors would also matter, such as other people's opinions and pressure and the obstacles of living surroundings.

As for a self-based perspective, different researchers can be found to show the direct relationship between attitude and pro-environmental behaviours and intentions to behave eco-friendly. In the proposed model, given the fact that some scholars (Poškus, 2015; Wan et al., 2014a) rarely found a significant association between attitudes towards recycling and intention to recycling, researchers view expectancy of e-waste recycling as the mediating mechanism relating attitudes toward e-waste recycling to intentions. That is, persons who have the favourable attitudes are more probable to reduce some negative emotions of doing e-waste recycling because they feel more confident and hold firmer convictions that they can fulfil the e-waste recycling tasks (Bai et al., 2018). Accordingly, the expectancy of finishing recycling e-waste will be higher. In the relation of the hypothetical instruments influencing expectation, we propose that attitudes are related to the individuals' judgment of difficulty on a particular behaviour. Gul et al. (1994) confirmed that the position of controlling interacted with task difficulty to affect employees' attitudes. Vice versa, a good attitude can consequently result in a perception of lower task difficulty. Therefore, they are likely to anticipate a higher possibility of fulfilling an assignment. So, we hypothesize that:

H6: Positive attitude toward e-waste recycling could increase the expectancy of finishing recycling e-waste.

As for externality-based perspective, an individual's belief in the external capabilities such as the existence of e-waste recycling facilities and the easy accessibility of recycling sites to execute the course of action can produce given attainments (Knussen et al., 2004). Lakhan (2016) mentioned that established recycling chutes have a rare influence on household recycling and rarely changed household recycling consciousness. This may be caused by the mediating role of expectancy in finishing recycling. Individuals prefer to exert efforts on things that are of high expectancy (Hackman & Porter, 1968). People rarely choose actions beyond their abilities, on the contrast, they are inclined to perform actions that are within their capabilities (Bandura, 1982). In the setting of recycling e-waste, having convenient facilities and sites maybe not necessarily related to people's intention to recycle e-waste, however, it makes people feel unable to finish it within their abilities. That is, the perceived behaviour control on e-waste recycling can cause a drop-in people's expectancy to do it and then influence their recycling intentions.

H7: Perceived behaviour control on e-waste recycling can decrease people's expectancy to do it.

Besides, other people's opinions in terms of recycling e-waste can also influence one's perception (Wan et al., 2018). Thus, people's judgment of the likelihood of whether the recycling e-waste can be achieved is based on other people's feedback and behaviours. People's inclination to follow the trend can easily be influenced by others (Brown et al., 1986). In addition, the pressure from other people would force people to do one particular behaviour, this can be called an intangible and invisible motivation. When people feel obliged to recycle e-waste due to the fact that other people do that, they would manage to do that in order to keep abreast of others (Knussen et al., 2004). Then, it is obvious that people would perceive that they can finish recycling e-waste with efforts, though existing some barriers. Hence, this study proposes that subjective norms can give rise to the perceived probability of recycling e-waste.

H8: Subjective norms can increase consumers' expectancy of recycling e-waste.

Expectancy can be considered as an invisible ability, it's effect on people's conception and perception can

extensively influence people’s choices to expend their effort, people’s attitude towards challenges and obstacles (Gatewood et al., 2002; Locke, 1997). Many empirical studies in many fields have confirmed the role of expectancy in activating people’s motivation and intention to do something. As for work motivation, Isaac et al. (2001) argued that everyone in the organization had opportunities to become leaders. Someone may choose to work hard to be a leader when he knows that he can finish that with efforts. However, individuals who were unwilling to expend efforts or felt that this goal is out of his reach may forgo the opportunities. Wu et al. (2007) empirically validated OSS developers’ intentions to continue OSS development using data of 148 OSS participants and results revealed that their intentions were influenced by their expectancy. In terms of entrepreneurship, Shaver et al. (2001) have found that self-motivated skilled entrepreneurs are intended to put necessary efforts toward new venture creation. All types of entrepreneur’s planned determination level have a great influence on expectancy as well as both are related which has been found from an empirical study by Renko et al. (2012) by using data from the cross-section, and over time, the intended effort and operative firm’s status both are positively related. In the environmental protection field, rare studies have researched expectancy. Only one study about pro-environmental behaviour among the youngest traveller’s group while they are on a tour provided a little information. Its result revealed that travellers’ expectancy of doing environmentally-friendly behaviours directly correlated with their intentions. So, in a similar background to e-waste recycling, we also believe that.

H9: Consumers’ expectancy of recycling e-waste positively affects their intention to recycle.

So, the research model is as below:

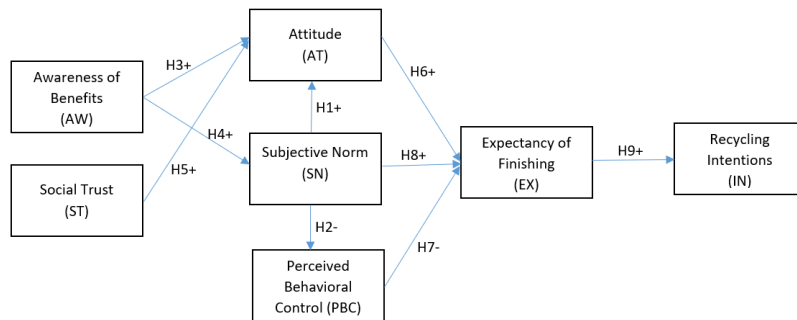


Fig.1. Research model

Note 1: (+), (-) indicates the positive and negative impact respectively.

3. Methodology

3.1 Measurement

The theories used in this study are awareness of benefits, social trust, subjective norm, perceived behavioural control, attitude, expectancy, and e-waste recycling intentions. This study reviewed the prior authenticated researches from the different perspectives and the measurement scale has been adapted from the findings of prior researches. Awareness of benefits, subjective norm, perceived behavioural control, and attitude were adopted from (Wan et al., 2017). Social trust included five items adapted from (Liu et al., 2018). Kiatkawsin and Han (2017) have been noticed to use three items to assess the expectance and that three items have been used to assess the expectance in the study too. E-waste recycling intentions comprised four items adapted from (Echegaray & Hansstein, 2017) and (Wan et al., 2014a). In order to get feedback, a five-point Likert scale has been used for all latent variables. The five-point scale ranged from “Extremely disagree” (1) to “Extremely agree” (5).

Pre-test and expert review from the students working in the same area has been done before finalizing the questionnaire. Relative adjustment has been done based on the reviewer's comments and most of the adjustment was wording adjustment, phrasing formatting, etc. Table 3 represents the measurement items that have been used in the study. An introductory letter, brief description of e-waste recycling, basic demographic information and instruction were attached to the questionnaire.

3.2 Procedure

The survey was administered in two big cities in Liaoning province, Shenyang and Dalian, the former is one of the most important industrial cities in China. They both are undergoing a radical change in consumption style in recent years, as a result, some serious environmental problems are emerging with fast development especially in e-waste recycling. Data collection was done at five universities in these two cities. Survey questionnaires were sent to study objects through on-site distribution. All samples are university students, which share relative similar ages, consumption abilities, and have relative more knowledge about social and environmental issues compared with who have less education. The internal validity of the data has been achieved because of the greater consistency in the sample population as well as the sampling profile was relatively homogenous. There was no persuasion to complete the questionnaires, everybody finished on a voluntary basis. In total 390 students filled the questionnaire in approximately ten hours, after that the unusable and incomplete responses was deducted from the total number. Finally, the valid and usable sample size is 363.

3.3 Samples

Out of the valid 363 responses, 57.6% were male and 42.4% were female and all of them aged in between 18 to 35 years, where people between 20 and 23 years accounted for the most samples. The largest two proportions of the respondents are now university students (43.3%) and graduate students (50.4%) , with only 6.3% masters. 71.1% of the student respondents indicated that their monthly disposable money was between ¥1000 and ¥2000, which was a common level of consumption for Chinese college students, detailed information is showed in Table 4.

Table 3: Measurement items and factor loadings

Constructs	Items	Factor Loadings
Awareness of Benefits (AW)	E-waste recycling reduces air pollution, land deterioration, etc.	0.709
	E-waste recycling saves energy and resources.	0.671
	E-waste recycling is a good way to protect the environment.	0.904
	E-waste recycling creates a better environment for future generations.	0.871
Attitude (AT)	E-waste recycling is good.	0.922
	E-waste recycling is meaningful.	0.945
	E-waste recycling is responsible.	0.879
	E-waste recycling is environmentally friendly.	0.850
Social Trust (ST)	I trust e-waste disposal companies can dispose of e-waste reasonably.	0.757
	I trust the collection sites in different communities actually have cooperated with e-waste disposal companies.	0.736
	I trust e-waste disposal companies can reduce pollution when recycling e-waste.	0.814
	I trust e-waste disposal companies have more advanced technology to recycle e-waste.	0.807
	I trust the authenticity and legality of e-waste disposal companies.	0.768
Perceived behavior control (PBC)	E-waste recycling is money-consuming. I do not have enough money to pay for that.	0.613
	E-waste recycling is not convenient, for the location of recycling is far from home.	0.957
	E-waste recycling is not easy, because I have to find collection or recycling sites.	0.687
Subjective norm (SN)	The E-waste recycling behaviours of my classmates influence me to recycle e-waste.	0.863
	The support to recycle e-waste from family members and friends influence me to recycle e-waste.	0.873
	I follow the E-waste recycling behaviours of people who are important to me.	0.760
Expectancy (EX)	I believe it is not difficult to recycle e-waste.	0.814
	I think recycling e-waste is a behaviour that I can fulfil.	0.894
Recycling Intention (IN)	I intend to spend some time to recycle my e-waste.	0.832
	I am willing to pay for a little transportation fee to recycle e-waste.	0.880
	I am willing to speak to my friends about e-waste recycling information.	0.761
	I would like to participate in the e-waste recycling scheme in the future.	0.780

Table 4: Descriptive statistics

Characteristics	Quantity	%
Gender		
Male	209	57.6%
Female	154	42.4%
Age		
Under 19	62	17.1%
20-23	211	58.1%
24-26	69	19%
27-30	12	3.3%
Over 30	9	2.5%
Education		
University	157	43.3%
Graduate	183	50.4%
Master	23	6.3%
Monthly disposable money		
Under 1000	48	13.2%
1000-2000	258	71.1%
2000-3000	50	13.8%
Over 3000	7	1.9%

4. Results

4.1 Confirmatory factor analysis and data quality testing.

Confirmatory factor analysis was performed to test the measurement model using Amos 17.0 with maximum-likelihood estimation. The maximum-likelihood estimation has been used to ensure the greater probability of each observed data. The results of the CFA are presented in Table 3 Our findings indicated that the model satisfactory fit to the data ($\chi^2=670.489$, $df=353$, $P<0.001$, $\chi^2/df=1.899$), $RMSE=0.039$, $CFI=0.965$, $IFI=0.956$, $TLI=0.949$). All scores suggested the acceptance of the measurement model. All standardized factor loadings between latent variables and related items fell between 0.671 and 0.946, which were significant. ($P<0.01$). Each construct contained multiple measurement items, and a composite reliability test was performed to test the internal consistency. Results showed that all were greater than the generally accepted minimum threshold of 0.70 with results ranging from 0.825 to 0.944 (Bagozzi & Yi, 2012). Subsequently, the construct validity of all measurements was evaluated. The calculated AVE values fell between 0.588-0.810, exceeding the recommended threshold 0.50 (Hair et al., 2010), confirming convergent validity. Discriminant validity was also established as all AVEs were greater than squared correlations between constructs (Fornell & Larcker, 1981).

4.2 Structural model

The structural model was performed using structural equation modelling (SEM) with maximum-likelihood estimation, which was to confirm the degree of statistical significance of hypotheses specified by the proposed model. The results showed satisfactory goodness-of-fit statistics according to the suggested indices by Hair Jr et al. (2014) ($\chi^2=464.249$, $df=261$, $P<0.0001$, $\chi^2/df=1.778$, $RMSEA=0.046$, $CFI=0.966$, $IFI=0.966$, $TLI=0.961$, $NFI=0.926$). The results supported all hypothesized paths except for H2, which assumed the direct association between subjective norms and consumers' perceived behavioural control. As showed in Table 4, the impacts of subjective norms ($\beta=0.157$, $P<0.005$), Consumers' awareness of benefits ($\beta=0.511$, $P<0.001$), consumers' social trust in e-waste disposal organizations ($\beta=0.237$, $P<0.001$) on attitude toward e-waste recycling were positive and significant. Therefore, hypothesis H1, H3, H5 were supported. As expected, the link from awareness of benefits on subjective norms was significant ($\beta=0.182$, $P<0.005$), thus, confirming the reliability of H4. However, the relationship between subjective

norms and consumers' perceived behavioural control ($\beta=-0.018$, $P>0.05$), was insignificant. Thus, H2 was not supported. In addition, subjective norms ($\beta=0.583$, $P<0.001$), consumers' attitude toward e-waste recycling ($\beta=0.159$, $P<0.005$), perceived behavioural control ($\beta=-0.211$, $P<0.001$) were found to significantly affect consumers' expectancy of recycling e-waste. These results supported H6, H7, H8. Finally, people's expectancy of recycling e-waste exerted a significant influence on the intention to recycle e-waste ($\beta=0.852$, $P<0.001$), Which means H9 was supported.

Afterward, we have calculated the indirect impact of the variables. According to Table 7, consumers' social trust in e-waste disposal organizations has a significant impact on people's expectancy of finishing e-waste recycling ($\beta=0.266$, $P<0.01$). Social trust ($\beta=0.222$, $P<0.005$), awareness of benefits ($\beta=0.233$, $P<0.005$), subjective norm ($\beta=0.614$, $P<0.005$), attitude toward recycling e-waste ($\beta=0.208$, $P<0.005$) and perceived behavioural control ($\beta=-0.208$, $P<0.005$) also exerted significant indirect influence on Intention to recycle e-waste, these findings indicate that expectancy acted as a significant mediator in our structural model, which confirmed our hypothesis completely. Besides, attitude served as a significant mediator between social trust and expectancy.

Table 7: Indirect effects.

Indirect effect of	AT	PBC	EX	IN
ST	0.037	-0.006	0.266**	0.222**
AW	0.026	-0.004	0.279	0.233**
SN			0.035	0.614**
AT				0.208**
PBC				-0.208**

Note1: SN=Subjective Norm, AW=Awareness of Benefits, ST=Social Trust in e-waste disposal organizations, AT=Attitude toward e-waste recycling PBC=Perceived Behavioural Control, EX=Expectancy of finishing e-waste recycling, IN=Intention to recycle e-waste

** $P<0.01$

5. Discussion

5.1 Research summary

In this research, we studied relationships among the constructs of the TPB model. Besides, we merged several personal and social elements (awareness of benefits, social trust in e-waste disposal organizations and expectancy of recycling e-waste) to increase the explanatory power of the original TPB model. The findings indicated that awareness of benefits was an effective antecedent of subjective norms and attitude toward e-waste recycling, consumers' social trust in e-waste disposal organizations also contributed to explaining people's attitude. In addition, consumers' expectancy of recycling e-waste was a powerful mediator between attitude/perceived behavioural control and intention to recycle e-waste. Therefore, individuals tend to assess the possibility of recycling e-waste before they intend to do it.

5.2 Implications for researchers and practitioners.

The findings suggested that consumers' expectancy of finishing e-waste recycling was a powerful mediator between attitude, subjective norm, perceived behavioural control and recycling intention. That means people's expectancy of accomplishing recycling e-waste was a new and essential driver of people's intention to do it. In other words, when people's expectancy serves as a variable in the TPB model, attitude, perceived behavioural control and subjective norm weren't directly correlated with intention. Very few prior studies examined the people's expectancy in the perspective of pro-environmental behaviours except Kiatkawsin and Han (2017) found that expectancy positively affected young travellers' intention to behave pro-environmentally while traveling. Based on the present study, we can comprehend that only when consumers perceive that they can recycle e-waste successfully, they can have a genuine intention to recycle e-waste, even though undergoing some difficulties and barriers. Under this

circumstance, public sectors and advocacy groups should put great emphasis on consumers' expectancy of achieving e-waste recycling. Everyone would assess the possibility and result of a particular issue before they perform. Same as this, consumers will evaluate the probability of finishing recycling e-waste if they put effort to do that. Therefore, related official sectors should deliver some positive information to consumers, for example: as long as someone spends a little time, he/she can recycle e-waste and possess a better environment. This kind of message can lower down consumers' psychological barrier and strengthen their confidence as well as expectancy of finishing e-waste recycling. According to the finding of Juvan and Dolnicar (2014) who studied the gap between attitude and behaviour, respondents stated many reasons for the gap. However, our finding supports a possible new method to foster recycling intentions. It refrains from considering green behaviours as a habit but instead propagates the recycling behaviours are not out of reach. In fact, everyone can do it with a little energy and time.

As expected, the relationship between TPB's constructs and expectancy showed strong correlations. The result is in line with Liu et al. (2009). All of these affirmed that the antecedents of original TPB actually elicit people's motivation, psychologically affect people's expectancy and personal ideas. The practical implications for public authorities on encouraging recycling e-waste can be attained from our results. Firstly, subjective norm served as an essential and effective explanation to consumers' expectancy, therefore, public authorities can put recycling as a social trend, they can organize some recycling experience sharing meeting, people who recycle e-waste share their experience and feeling with other students or committee members who don't recycle. The impact or pressure from peer group, neighbours, and friends can make a difference in people's intentions and behaviours. Secondly, people's perceived behavioural control refrain people's efforts to recycle e-waste. Objective obstacles, such as lack of recycling infrastructure, not knowing the actual site of recycling, the long distance to recycling site should be solved as soon as possible. As the environmental problems becoming serious, public sectors must put more money to construct the recycling devices and sites. Besides, the positive promotion of existing recycling sites, including their specific location and recycling mechanism, seems very important. Many people don't know the existence of e-waste recycling occasions. Thus, exposure to e-waste recycling areas is indispensable. Public sectors can post some posters of relative e-waste recycling information on public areas, such as notice boards in bus stations and residential areas. In addition, an online website is suggested to announce e-waste information because of more and more internet users. Finally, positive attitude was another factor, which can increase people's expectancy. Good attitude toward recycling means people are sure that recycling is beneficial and meaningful, accordingly, they may be willing to recycle e-waste. Keeping a good attitude is bound to reduce people's psychological barrier, then they will expect they can recycle e-waste successfully.

Awareness of benefits is an added antecedent of attitude and subjective norm in our study. Our findings validate the effectiveness of the awareness of benefits. Therefore, public sectors must pay attention to promoting the concept of benefits of recycling e-waste in order to heighten people's environment perception. Public authorities can focus on public communication or in-school education about the environment issue. For example, schools should foster students' awareness of the benefits of recycling e-waste regularly. The committee should host several e-waste recycling knowledge seminars in different residential areas to convince consumers of the importance and benefits of recycling e-waste. As long as consumers have thought of benefits of recycling e-waste, they will take a positive attitude toward e-waste recycling and they will also pay attention to the recycling behaviours and information from other people around them.

Social trust used to be cited in the setting of whether consumers can accept, buy and use at technology or product (Huijts et al., 2014; Ross et al., 2014). However, the influence of social trust in fostering consumers' attitudes toward protecting the environment was investigated in a few studies. Our study observed that social trust is a critical antecedent of consumers' attitude toward recycling e-waste. In the context of e-waste recycling, China is still in the developing period, as we mentioned before, only limited e-waste disposal organizations in some cities and few committees are in connection with these disposal organizations. Therefore, tactic to enhance people's trust in these disposal organizations is a big problem, this trust is called social trust in our study. From the result, some practical implications can be drawn. The government should cooperate with disposal organizations to validate the reliability and legitimacy of them. And the government can spread information to inform people who can trust these disposal organizations. In this way, people's anxiety about the genuineness of disposal organizations can be eliminated. Social trust can foster people's attitudes gradually.

Finally, the outcomes of our research recommended that the subjective norm did not directly influence e-waste recycling expectancy, instead, subjective norms influence recycling expectancy indirectly through attitude. This

finding is consistent with previous research that considered subjective norm play an essential role in recycling intention by developing a favourable attitude toward recycling (Park & Ha, 2014). This result confirmed that opinions and information from people around someone can affect one's attitude to some degree, so relative sectors should promote recycling as a desirable social trend to make full use of the power of subjective norm. However, something is out of our expectation, subjective norm did not reduce consumers' perceived behavioural control of recycling e-waste, which is different from prior research (Bamberg et al., 2007). This result implied that other's behaviour and beliefs cannot directly influence one's perception of behavioural control.

6. Conclusions

Electronic products have sprung up with fast and incredible speed. As a consequence, the amount of e-waste has upsurge accordingly and caused enormous negative environmental impact (Fu et al., 2008). People's recycling behaviours can substantially contribute to reducing the environmental harm of e-waste (Borthakur & Govind, 2017; Xiang Zeng et al., 2016). Fully understanding the factors that elicit people's e-waste recycling intentions and behaviours is a fundamental and basic task for policymakers and other practitioners.

Considering that e-waste disposal solutions are different in different cities in China. We picked out several typical cities to explore a special mode to solve the e-waste recycling problem. In studied cities, recycling e-waste is still limited to a small group of people and it is not the task priority of public authorities. Given realistic conditions, the present study contributes to e-waste recycling literature in the following ways. First, this study integrated people's awareness of recycling e-waste and people's social trust in e-waste disposal organizations into the original TPB model to explore more key factors that account for consumers' recycling decisions. Second, we have added a new construct-expectancy into our framework to provide a potential thread for future studies. Expectancy used to be applied in enterprise-related circumstance to explicate people's work motivation. It is an essential element to urge people in the workplace to accomplish tasks that are challenging but within their capability. Our research firstly introduced expectancy into recycling context and our findings confirmed that expectancy is a powerful mediator that can lead to people's intention to recycle e-waste. Third, this research re-examined the internal relationship among TPB variables. Finally, the proposed theoretical framework can be applied to recycling behaviours in different backgrounds (e.g.: traveling and so on).

7. Limitations and future research directions

First of all, same with most researches, the issue of generalizability is also a problem of the present research. This study used university students as samples, although university students represent the major contributors to electronic products market and e-waste, it may not be possible to generalize our findings to all consumers. For future research, the sampling range should be greater. Moreover, this research firstly attempted to merge expectancy to the theory of planned behaviour and apply it to the recycling environment, its validity may still be discussed and studied further. Furthermore, due to the data collection method used in this research, surveying every consumer's real behaviour e-waste recycling destination was not possible. So, this research did not include actual recycling behaviours. Perugini and Bagozzi (2001) asserted that individuals' intention is their willingness or readiness to conduct particular behaviours. However, it does not mean the intended action will happen. Thus, future research can try to enlarge the proposed conceptual framework by incorporating actual e-waste recycling behaviours.

As a final point, according to Vroom (1964), expectancy refers to individual's perceived possibility or willingness to successfully finishing doing something through their efforts. Ajzen (1991) asserted that intention is the immediate determinant of behaviour, it represents individuals' willingness to exert particular action. The measurements of expectancy and intention may have the same internal meanings, so the discriminant validity between these two constructs did not reach too high criterion. For future research, more explorations could be done to define expectancy and intention in order to provide a more comprehensive and definite understanding of them and avoid less discrimination between them.

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Other Tables and Figures

Table5: Correlations (Squared correlations), AVE values, means and SD.

	IN	EX	SN	PBC	ST	AT	AW	AVE
IN	1.000							0.664
EX	0.817 ^a (0.667) ^b	1.000						0.731
SN	0.629 (0.40)	0.598 (0.358)	1.000					0.695
PBC	-0.158 (0.025)	-0.222 (0.049)	-0.022 (0.000)	1.000				0.588
ST	0.455 (0.164)	0.428 (0.183)	0.380 (0.144)	0.011 (0.000)	1.000			0.604
AT	0.402 (0.161)	0.339 (0.115)	0.405 (0.164)	0.051 (0.003)	0.475 (0.226)	1.000		0.810
AW	0.311 (0.096)	0.205 (0.042)	0.301 (0.091)	0.089 (0.008)	0.346 (0.120)	0.630 (0.412)	1.000	0.632
Mean	3.745	3.55	3.927	3.633	3.906	4.533	4.533	
SD	0.881	0.860	0.875	1.016	0.841	0.583	0.609	

Figure 2. Graphical Structural Model Results

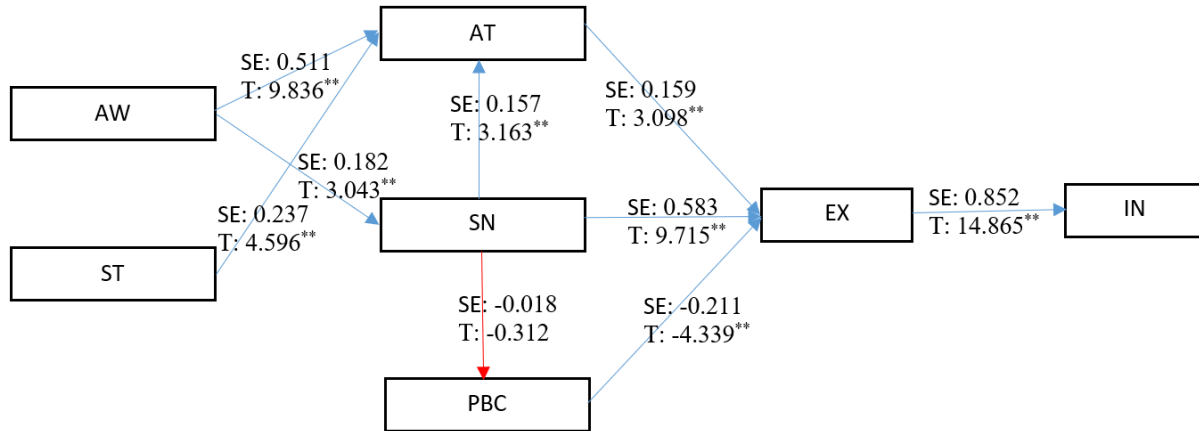


Table 6: Structural model results.

Hypothesis	Standardized Estimate (SE)	T-value	Results
H1 SN→AT	0.157	3.163**	Supported
H2 SN→PBC	-0.018	-0.312	Rejected
H3 AW→AT	0.511	9.836**	Supported
H4 AW→SN	0.182	3.043**	supported
H5 ST→AT	0.237	4.596**	supported
H6 AT→EX	0.159	3.098**	supported
H7 PBC→EX	-0.211	-4.339**	supported
H8 SN→EX	0.583	9.715**	supported
H9 EX→IN	0.852	14.865**	supported

Goodness-of-fit statistics for the model:

$\chi^2=464.249$, $df=261$, $P<0.0001$, $\chi^2/df=1.778$, $RMSEA=0.046$, $CFI=0.966$, $IFI=0.966$, $TLI=0.961$, $NFI=0.926$

Total variance explained:

R^2 of SN=0.195, R^2 of AT=0.506, R^2 of EX=0.489, R^2 of IN=0.726

Total impact on intention to recycle e-waste:

SN=0.521, AW=0.164, ST=0.211, PBC=0.18, AT=0.135 EX=0.852

R^2 of SN=0.195, R^2 of AT=0.506, R^2 of EX=0.489, R^2 of IN=0.726