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Intrinsic motivation for reducing single-use plastics: The compensation effects of basic psychological needs

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ABSTRACT

Increasing single-use plastic consumption has caused tremendous consequences for the ecosystem; therefore, consumers are being encouraged to reduce this. Despite numerous research about single-use plastics, we still have little understanding into how individuals' intrinsic motivation for less single-use plastics can be developed. This study extends the self-determination theory about human motivation and the functioning of basic psychological needs which are essential for behavior change to study how three basic psychological needs can influence intrinsic motivation for reducing single-use plastics. Also, the negative interaction effects of each pair of basic psychological needs on intrinsic motivation were examined in this study. A sample of 468 responses collected in a stated preference survey was used to test the theoretical framework. Findings reveal that intrinsic motivation for reducing single-use plastics can be influenced by the satisfaction of basic psychological needs. Interestingly, the research has extended the self-determination theory by highlighting compensation effects among the fulfillment of basic psychological needs on intrinsic motivation for reducing single-use plastics.

1. Introduction

Single-use plastics, also known as disposable plastics, are often used for plastic packaging that tends to be used once and discarded into the nature afterwards (Chen et al., 2021). Examples of single-use plastic consumption include polyesters for fabrics and textiles, plastic beverage bottles, food wrappers, plastic grocery bags, and foam take-away containers (Liu et al., 2021b). In Vietnam, plastics are increasingly used in many industries, ranging from consumer goods, electronics, textiles to packaging. In 2019, 8.89 million tonnes of plastic products were produced in Vietnam (VNA, 2020) and annually, about 2.62 million tonnes of plastics are disposed of (World Bank, 2021). Increasing use of single-use plastics has caused tremendous consequences for the ecosystem worldwide because it may take up to between 450 and 1000 years for plastic waste to decompose (Center for Biological Diversity (2020)). To address this issue, there has been repeated call for measures to motivate pro-environmental consumption behaviors (PECB) that can reduce single-use plastic consumption (European Commission, 2018).

PECB has been referred to as behaviours that are supposed to generally reduce environmental harm (Steg and Vlek, 2009). Research on PECB has become a significant stream in Marketing (Pickett-Baker

and Ozaki, 2008; Moser, 2015; Patel et al., 2017). Among extant research on motivations for PECB, the self-determination theory (SDT) has been widely used to explain that behaviors are strongly related to the development of intrinsic motivation (Deci and Ryan, 1985; Ryan and Deci, 2000). Thus, if individuals are intrinsically motivated to participate in an activity primarily for the enjoyment brought about by the activity itself, they are more likely to engage in that behavior. This corroborates with what has been proposed by Van der Linden (2015; 2018) that interventions leveraged by intrinsic motivation can motivate PECB more substantially than those leveraged by policy incentives based on rewards or other external factors. Extant literature has fully supported the positive association between intrinsic motivation and PECB (e.g.: Pham et al., 2021; Ryan and Deci, 2000; Aitken et al., 2016). Thus, to promote PECB, it is essential to look into factors that can develop intrinsic motivation for PECB among consumers. In the context of reducing single-use plastic consumption, previous research tend to focus on consumers' awareness of negative consequences of excessive plastic use (Otsyina et al., 2018) or introducing tax or fee on single-use plastic bags (Thomas et al., 2016). Other previous research examined multiple factors that can influence the reduction or recycling of single-use plastic consumption, for example social pressures (Ari and

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Yilmaz, 2017), social media (De Fano et al., 2022), or non-monetary nudge (Romano and Sotis, 2021); and so on. Nevertheless, how intrinsic motivation for reducing single-use plastic consumption is developed still remains largely unexplored.

Under SDT, intrinsic motivation is postulated to be developed by satisfying three basic psychological needs: the need for autonomy, competence, and relatedness (Deci and Ryan, 1985). However, a review into existing literature on intrinsic motivation for PECB has indicated two main research gaps. Firstly, previous literature has been inconclusive about how these needs might influence intrinsic motivation for PEC. For example, perceived competence was found to be the most influential predictor of intrinsic motivation for voluntary simplistic clothing consumption practices while the relationship between perceived autonomy and intrinsic motivation is concluded to be negative, weak and not significant (Taljaard and Sonnenberg, 2019). On the other hand, perceived autonomy and perceived competence were reported to play a limited role in influencing for sustainable consumption compared to the prominent role played by perceived relatedness, especially in an Asian cultural context (Abdulrazak and Quoquab, 2018). Secondly, while the independent effects of these needs have been studied, how they interact with each other in influencing intrinsic motivation for PECB has been largely ignored. In fact, existing literature has evidenced different types of interactions among basic psychological needs in some other contexts (e.g.: Kluwer et al., 2020; Liu et al., 2020; 2021a). However, in the context of PECB, especially reducing single-use plastic, the interaction between the fulfillment of basic psychological needs has not been explored. Therefore, this research addresses these literature gaps, extending knowledge about reducing single-use plastics, especially buying plastic-free products, bringing refillable coffee mugs or reusable grocery shopping bags, or buying products with plastic packaging alternatives, as suggested by Casaló et al. (2019). Specifically, we bridge the gap in understanding how intrinsic motivation for reducing single-use plastics can be influenced by the satisfaction of three basic psychological needs, i.e. the need for competence, the need for autonomy, the need for relatedness. Furthermore, we extend the knowledge of the interaction effect of each pair of psychological needs on intrinsic motivation for reducing single-use plastics.

2. Literature review

According to SDT, intrinsic motivation refers to doing things because they are enjoyable (hedonic intrinsic motivation) or meaningful (eudaimonic intrinsic motivation) (Deci and Ryan, 1985; 2000). In other words, if an individual is intrinsically motivated, they perform an activity because of the interest, enjoyment or inherent satisfaction experienced from the activity itself rather than for external pressures or rewards. SDT proposes types of motivations ranging from amotivation, externally regulated (controlled) motivation, to internally regulated (self-determined) motivation (Deci and Ryan, 2000). Intrinsic motivation is considered a better model of predicting behaviours than other types of motivation. Furthermore, Deci and Ryan (1985) also posits that intrinsic motivation is at the highest level of self-determination and theorizes that intrinsic motivation can be strongly associated with participation in an activity. It has been confirmed that the higher the levels of self-determination of a certain behavior, the higher likelihood that behavior is engaged in or conducted (Osbaldiston and Sheldon, 2003; Pelletier and Sharp, 2008).

The next important question is how to develop intrinsic motivation. Among four mini-theories of SDT, the cognitive evaluation theory (CET) examines social contexts under which three basic psychological needs, namely *the need for competence*, *the need for autonomy* and *the need for relatedness*, are satisfied in order to facilitate intrinsic motivation for particular behaviors (Deci and Ryan, 1985; 2000). The satisfaction of these basic psychological needs is vital in the environment which can support and facilitate people to develop autonomous motivation, the basis for individuals to maintain intrinsic motivation and become more

self-determined. When these needs are satisfied, the process of fostering intrinsic motivation can be energized (Deci et al., 2001).

In fact, empirical evidence in PECB in general has shown that the satisfaction of three basic psychological needs is a critical predictor of intrinsic motivation. For example, regarding pro-environmental transportation behavior, the higher level of perceived environmental competence, the higher level of autonomous motivation toward the environment (Aitken et al., 2016). Additionally, higher perceptions of autonomy and relatedness for PECB were found to be associated with higher intrinsic motivation for resource conserving behaviors (Cooke et al., 2016). The relationship between the satisfaction of these basic psychological needs and intrinsic motivation for PECB (recycling, environmental-oriented activism, or preserving behaviours) was also confirmed by Kaplan and Madjar (2015). However, in the context of reducing the single-use plastic consumption, the relationships between those needs and PECB are rather silent and need further study.

More importantly, extant research show inconclusive findings regarding interactions of those needs in several different contexts. In fact, independent effects of basic psychological needs on intrinsic motivation in PECB domain have been explored (e.g.: Cooke et al., 2016; Lavergne et al., 2010; Abdulrazak and Quoquab, 2018). From another perspective, in the organizational behavior context (Dysvik et al., 2013), synergistic interactions between these needs as predictors of intrinsic motivation were reported among employees in one organization. However, this research also reported only the synergistic effect between the needs for competence and autonomy on intrinsic motivation to complete tasks among staff in multiple organizations while the other two interaction effects were not significant. In another research setting, Kluwer et al. (2020) provided empirical evidence for the interaction effects of relatedness and autonomy on relationship maintenance among partners. Additionally, only the interaction between autonomy satisfaction and relatedness satisfaction was found to predict cognitive deconstruction (Liu et al., 2020). On the other hand, the compensatory association between autonomy and relatedness satisfaction was reported to affect positive affect, negative affect, and aggressive feelings (Liu et al., 2021a). However, in the context of reducing single-use plastic consumption as a type of PECB, the interaction between the fulfillment of basic psychological needs has not been explored. Therefore, to address this literature gap, the focus of this research is to extend the CET, a mini theory of SDT by investigating how perceived autonomy, perceived competence, perceived relatedness, and their interactions influence intrinsic motivation in the context of reducing single-use plastics as one type of PECB.

3. Hypothesis development

3.1. Perceived competence

The need for competence is defined as “feeling effective in one’s ongoing interactions with the social environment and experiencing opportunities to exercise and express one’s capacity” (Deci and Ryan, 2002, p.7). According to CET, higher levels of perceived competence imply high levels of enjoyment from the confidence with their ability (Deci and Ryan, 1985). Accordingly, as individuals progressively self-evaluate how competent they are in an activity, changes in their perceived competence will lead to changes in their intrinsic motivation for that activity. In other words, the more competent a person perceives he is at an activity, the more enjoyment he will experience and the more intrinsically motivated he will be to engage in the activity. Empirically, perceived competence was effective in motivating individuals to tackle difficult environmentally friendly behaviours (Green-Demers et al., 1997). Likewise, research findings of Pelletier (2002) indicated that higher levels of competence were associated with higher levels of self-determinations for purchasing environmentally friendly products or recycling. Besides, competence in helping the environment was indicated to be an antecedent of autonomous motivation toward the

environment (Aitken et al., 2016).

In the context of reducing single-use plastics context, the need for competence may be related to having adequate skills and information to reduce the purchase or use of products made from or packaged in single-use plastics. Perceived competence can also be illustrated by knowing where alternatives for single-use plastics are offered. We argue that in the context of single-use plastics, perceived competence would also lead to intrinsic motivation. In this case, high perceived competence makes consumers feel confident where and how to use less single-use plastics (cf. Deci and Ryan, 1985). In turn, their confidence will make them enjoy using less single-use plastics because now they can do it easily or effectively. Thus, we formally hypothesize that:

H1: In the context of single-use plastic consumption, there is a positive relationship between perceived competence and intrinsic motivation.

3.2. Perceived autonomy

Autonomy refers to volition and choice (Deci and Ryan, 2000). Perceived autonomy is associated with the feeling that individuals pursue activities of their own volition (Ryan and Connell, 1989). Theoretically, Deci and Ryan (1985) indicate that minimal use of pressure and control (high autonomy) results in high intrinsic motivation. Therefore, offering people an optimal amount of choice can reinforce their intrinsic motivation. Likewise, people tend to display less intrinsic motivation when they do not feel free to follow their inner interests (Deci et al., 2001). In other words, provision of behavior options for individuals to choose themselves can make them feel a sense of enjoyment with their own volition, which will satisfy their need for autonomy. Empirical evidence has shown that autonomy support is shown to help people internalize the targeted environmental behavior more proactively (Joussemet et al., 2008). Furthermore, perceiving higher autonomy is reported to associate with higher levels of self-determined motivation for energy saving or minimizing plastic packaging waste (Cooke et al., 2016; Lavergne et al., 2010).

In reducing single-use plastic consumption, consumers' need for autonomy can be fulfilled by their volitional purchase or use of fewer products made from single-use plastics under no external pressure. In this case, consumers have high perceived autonomy if they are provided with accessibility to availability of alternatives for single-use plastic products. Alternatives for single-use plastic include bringing refillable coffee mugs; using plastic free alternatives like stainless steel, bamboo, pasta, and rice straws; using reusable grocery bags; or using plastic packaging alternatives like bioplastics, bagasse, or palm leaves. Thus, we argue that higher levels of perceived autonomy in reducing single-use plastics are also likely to result in higher levels of intrinsic motivation. This is because when provided with alternatives for single-use plastic products, consumers can make their own choice under no pressure or control (cf. Deci and Ryan, 1985). Thereby, consumers may experience the enjoyment from the feeling that their choices to reduce single-use plastics are based on their true interests, which will result in intrinsic motivation. Thus, we formally hypothesize that:

H2: In the context of single-use plastic consumption, there is a positive relationship between perceived autonomy and intrinsic motivation.

3.3. Perceived relatedness

Theoretically, individuals' need for relatedness refers to the desire to experience the sense of connectedness to others while they are conducting a certain behavior. The enjoyment individuals experience from being connected to others plays a role in influencing and maintaining intrinsic motivation (Deci and Ryan, 2000). Furthermore, it is also suggested that when an individual's behavior can link them with other social groups, their sense of relatedness will be strengthened (Holbrook and Hirschman, 1982), which will then result in greater enjoyment,

hence increasing their intrinsic motivation and intensifying their engagement in those behaviors. Empirical support has been fairly conclusive that the higher level of perceived relatedness, the higher level of self-determined motivation for pro-environmental behaviours (Cooke et al., 2016). When consumers' psychological need for relatedness was satisfied, they were motivated to buy biodegradable household cleaner or drive a hybrid car.

In the context of reducing single-use plastic consumption, consumers may experience a high level of perceived relatedness if they can interact or get connected with other surrounding people who are also reducing single-use plastics. They may receive emotional support from others for their behaviors. Informal discussion with others can enhance their perceived relatedness. We argue that perceived relatedness in reducing single-use plastic is positively associated with intrinsic motivation. This is because consumers may experience enjoyment from being connected to others in a meaningful way through reducing single-use plastics (cf. Deci and Ryan, 2000; Abdulrazak and Quoquab, 2018). This enjoyment will make them intrinsically motivated to conduct those behaviours. Thus, we formally hypothesize that:

H3: In the context of single-use plastic consumption, there is a significant positive relationship between perceived relatedness and intrinsic motivation.

3.4. The interaction among perceived autonomy, perceived competence, and perceived relatedness

While three basic psychological needs have independent impacts, interactions among them need to be investigated. In the context of single use plastic consumption, we expect all the needs to interact negatively with each other to impact intrinsic motivation. *First, for the interaction between perceived autonomy and perceived competence*, consumers who have their own control or are given many choices over a behavior do not need further information or knowledge to feel satisfied with their behavior. In the context of reducing single-use plastics, having adequate skills and information to reduce the purchase or use of products made from or packaged in single-use plastics may not add any additional satisfactory impact but could be even considered to add more information costs. *Second, for the interaction between perceived autonomy and perceived relatedness*, if individuals are under no control to choose a behavior from existing alternatives, they can always experience enjoyment (cf. Deci and Ryan, 1985). When they are provided with choices, they experience enjoyment from participating in their behaviours just because they want to do so, regardless others' activities. Thus, in reducing single-use plastics, with volition or freedom of choice, consumers may not need further feeling of being connected to others to act. *Third, for the interaction between perceived competence and perceived relatedness*, consumers with a high level of perceived competence can confidently know about alternatives for single-use plastic products. Thus, they can choose the most appropriate alternative and enjoy their behavior of reducing single-use plastic products (cf. Deci and Ryan, 1985). In this case, they do not need to feel connected to others to be confident about their single-use plastic reduction behaviours. In some cases, when the consumers perceive them to be more knowledgeable than significant others, other people's opinions may even be considered inappropriate.

Thus, in the context of single-used plastic consumptions, we expect the compensation effects among the three needs in that in case of high perception of one basic psychological need, the fulfillment of other needs may not be important. While there has not been empirical evidence in this field yet, our arguments may be in line with what has been speculated by Ryan and Deci (2017) and Van den Broeck and associates (2016) that compensation effects may exist among needs fulfillment in some particular contexts. Therefore, we formally posit the following hypotheses:

H4: In the context of single-use plastic consumption, perceived autonomy negatively interacts with perceived competence to impact on intrinsic motivation.

H5: In the context of single-use plastic consumption, perceived autonomy negatively interacts with perceived relatedness to impact on intrinsic motivation.

H6: In the context of single-use plastic consumption, perceived competence negatively interacts with perceived relatedness to impact on intrinsic motivation.

The hypothetical relationships between variables are depicted in Fig. 1 below.

4. Method

4.1. Study context

To test the theoretical framework, we conducted a survey in Vietnam, which is a fast growing and promising consumer market with more than 95 million people (Nguyen, T.T.M., 2019). Moreover, the use of single-use plastic products is increasing at an alarming rate in Vietnam (VNA, 2020; World Bank, 2021). For example, in just two big cities of Hanoi and Ho Chi Minh in Vietnam, around 80 tons of products made from or packaged in plastic are discharged to the environment every day (Tay, 2019). Therefore, examining intrinsic motivations for reducing single-use plastics in Vietnam is meaningful.

4.2. Measures

Measures used in this research were modified from well-established studies. All items were scored on a 5-point Likert-type scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). In particular, measures of perceived competence, perceived autonomy and perceived relatedness were derived from the Psychological Need Satisfaction in Exercise Scale (Wilson et al., 2006). The statements were rephrased to fit the context of reducing single-use plastics consumption. The motivation toward the environment scale (MTES) for intrinsic motivation was adapted from Pelletier et al. (1998).

To ensure face validity of the measures, standard translation and back translation procedure were conducted. First, the measurement items were translated from English to Vietnamese by a professional Vietnamese translator. Then, the Vietnamese version was translated back to English by another translator. The two versions were compared to check translations errors. A pilot test with 20 Vietnamese people of different ages, genders, and living areas then were taken to ensure the

clarity and conciseness of the questions. Responses from the pilot test provided some suggestions to adjust the final scale measurement.

4.3. Data collection

Participants in our study were Vietnamese citizens from 18 years old and lived in three big cities of Hanoi, Danang, and Ho Chi Minh in Vietnam. These cities were chosen because environmental pollution, particularly single-use plastic consumption, is increasing there (Tay, 2019). Data were collected from shoppers visiting main supermarkets in three cities in October 2019 via a mall-intercept survey. This method of mall-intercept survey has been employed in previous studies in Vietnam (e.g.: Nguyen et al., 2019) and other countries (e.g.: Khare, 2015; Michon et al., 2008). In this study, a trained interviewer who was present at main supermarkets in three cities chose one out of every three patrons entering the supermarkets' entrance to ask for their approval to complete a questionnaire. This selection method was applied to reduce selection bias. Each respondent was briefed about serious increase in single-use plastic consumption and introduced that the research is conducted about issues related to single-use plastic consumption. Specific examples of single-use plastic consumption behaviours were given, such as buying or using plastic containers, bags, cups, straws, packages when they go shopping at supermarkets or go to restaurants or coffee shops. The interviewer then read each question from the survey questionnaire and noted down the respondents' answers. According to Hair et al. (2018), there should be 20 cases per observable independent variable. With 21 observable independent variables in this study, the ideal sample size should be at least 400. The survey was conducted in two weeks, collecting 491 responses. Due to some missing data, 23 responses were excluded, resulting in a final sample of 468 valid

Table 1

Demographic profile of research respondents and comparison to overall population of Vietnam.

Indicator	Categories	Percentage (%)	Population structure (GSO, 2019)
Gender	Female	80.1	50.2%
	Male	19.7	49.8%
	Other	0.2	N/A
Age	18 to 29 years old	45.5	33.1%
	30 to 49 years old	51.1	44.4%
	Over 50 years old	3.4	22.6
City	Hanoi	39.5	44.3%
	Da Nang	17.1	6.3%
	Ho Chi Minh city	43.4	49.4%

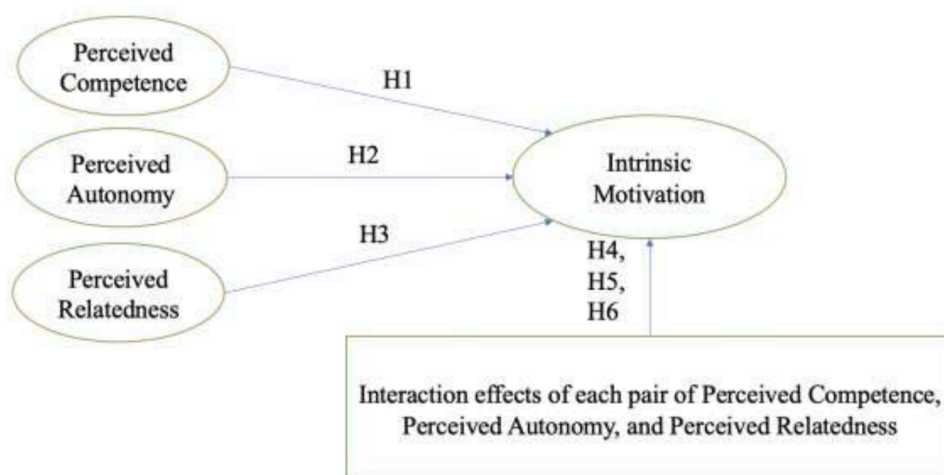


Fig. 1. Theoretical framework of factors influencing intrinsic motivation for PECCB.

responses. Table 1 shows demographic profile of respondents.

To test the representativeness of this sampling, the demographic profile of research participants was compared to that of Vietnam population reported by GSO (2019). 39.5%, 17.1% and 43.4% of respondents were from Hanoi, Da Nang, and Ho Chi Minh city, relatively proportionate to the population percentages in these cities out of the whole population (GSO, 2019). More than half of the respondents were between 31 and 50 years old (51.1%), followed by 45.5% of respondents aged from 18 to 29 years old. Only 3.4% of them are over 50 years old. These proportionates are also similar to the overall population structure in 2019. Therefore, the research sample meets the requirement of representativeness for further analysis. Regarding gender, a very big percentage of the respondents are females (80.1%). Generally speaking, Asian women tend to do more grocery shopping than men, which is also particularly true in Vietnam (Wulandarai et al., 2020). Therefore, because the survey was conducted at supermarkets, it is easily understandable that females made up the majority of respondents.

5. Results

5.1. Data analysis

The study employed a two-step analysis to first evaluate the measurement model and then to examine the hypotheses. The confirmatory factor analysis (CFA) was performed to test reliability and convergent validity of measurement scales with the use of SPSS AMOS 20. The measurement model shows good fit ($\chi^2 = 197.094$; Degrees of freedom = 71; $\chi^2/df = 2.776$; RMSEA = 0.062; SRMR = 0.0335; GFI = 0.944; CFI = 0.971) (Hu and Bentler, 1999). The average variance extracted (AVE) of all constructs is higher than 0.5 and internal reliability of all constructs is higher than 0.80. Therefore, the measures have adequate convergent validities and reliabilities (Hair et al., 1998). Table 2 illustrates the discriminant validities of the independent constructs with all AVE values higher than the squared correlations between each pair of constructs (Fornell and Larcker, 1981).

5.2. Hypotheses testing results

Multiple linear regressions were conducted to test the research hypotheses. This is an appropriate technique for multiple hypotheses with interaction effects. To ensure the reliability of analysis results, several control variables were added, including age, gender and profession and places of living. To control for profession and places of living, dummy variables were created. Analysis results (see Table 3) show that perceived competence, perceived autonomy, and perceived relatedness are positively and significantly associated with intrinsic motivation for PECB ($\beta = 0.330$; 0.318; and 0.279, respectively, with all p -value of less than 0.001). Thus H1, H2 and H3 are supported.

Moreover, analysis results in Table 3 also show that the multiplication variables of each pair of psychological needs were negative and significant ($\beta = -0.273$; -0.133; -0.188, with all p -values smaller than 0.001) indicating compensation effects of interactions among these

Table 2
Discriminant validity of measurement scales.

Constructs	(1)	(2)	(3)	(4)	Internal reliability (α)
1. Perceived competence (PC)	0.646	.365	.244	.494	.846
2. Perceived autonomy (PA)		0.655	.218	.493	.850
3. Perceived relatedness (PR)			0.746	.394	.898
4. Intrinsic motivation				0.671	.910

Note(s): Numbers **bolded** and **italicized** in the diagonal are the Average Variances Extracted. Other numbers are correlation squared between variables.

Table 3
Regression results with Intrinsic Motivation for PECB as dependent variable.

	Model 1			Model 2			Model 3			Model 4			Model 5		
	B	Std. Error	p-value	B	Std. Error	p-value	B	Std. Error	p-value	B	Std. Error	p-value	B	Std. Error	p-value
(Constant)	4.591	.171	<0.001	1.220	.191	<0.001	1.927	.202	<0.001	1.484	.200	<0.001	1.566	.195	<0.001
Gender	-0.290	.076	<0.001	-0.126	.053	<0.001	-0.132	.050	<0.001	-0.124	.052	<0.001	-0.107	.051	<0.001
Age	.106	.044	<0.05	.025	.030	.406	.046	.029	.078	.108	.030	.225	.041	.030	.166
Dummy code for	-0.139	.106	.190	.031	.073	.675	.010	.069	.007	.034	.072	.641	.021	.071	.763
Profession															
Danang vs. Hanoi	-0.152	.091	.097	-0.110	.063	.082	-0.039	.060	.516	-0.070	.063	.265	-0.076	.061	.214
HCM vs. Hanoi	-0.111	.068	.104	-0.057	.047	.221	-0.046	.044	.298	-0.049	.046	.288	-0.038	.046	.410
Perceived Competence (PC)				.300	.033	<0.001	.224	.033	<0.001	.280	.033	<0.001	.250	.033	<0.001
Perceived Autonomy (PA)				.277	.032	<0.001	.186	.032	<0.001	.231	.033	<0.001	.244	.031	<0.001
Perceived Relatedness (PR)				.210	.027	<0.001	.209	.025	<0.001	.211	.026	<0.001	.203	.026	<0.001
PAXPC							-0.161	.021	<0.001	-0.091	.024	<0.001	-0.139	.024	<0.001
PAXPR										0.591			0.605		
PCxPR										0.583			0.598		
R ²	0.109			0.578			0.626			0.591			0.605		
Adjusted R ²	0.099			0.570			0.619			0.583			0.598		

needs on intrinsic motivation. This means the impact of perceived competence and the impact of perceived relatedness on intrinsic motivation gets stronger when perceived autonomy is low. In the same vein, perceived competence negatively interacts with perceived relatedness to impact intrinsic motivation. Thus, when perceived competence is low, the influence of perceived relatedness on intrinsic motivation is strengthened. H4, H5, and H6 are, therefore, supported. The form of interactions among these needs is illustrated in Fig. 2, Fig. 3, and Fig. 4 below.

The slopes depicted in Fig. 2, Fig. 3, and Fig. 4 suggest that variations in perceived competence or perceived relatedness are only associated with intrinsic motivation under conditions of lower levels of perceived autonomy. On the other hand, when perceived autonomy is high, intrinsic motivation relatively remains the same, regardless of the level of perceived competence or perceived relatedness. The same compensation effect can be interpreted in the interaction between perceived competence and perceived relatedness in relation with intrinsic motivation.

6. Discussion and recommendations

6.1. Discussion

Our research analysis results highlight that the satisfaction of three basic psychological needs significantly predicts intrinsic motivation for PECB, especially in the context of reducing single-use plastics. These findings are in line with previous PECB studies (e.g.: Pelletier, 2002; Aitken et al., 2016; Abdulrazak and Quoquab, 2018). In other words, enjoyment experienced from perceptions of the ability, volition, and connectedness while reducing single-use plastic consumption will satisfy three basic psychological needs, thereby influencing intrinsic motivation. Furthermore, the Cohen's D effect sizes of perceived competence, perceived autonomy and perceived relatedness on intrinsic motivation for PECB in our findings are quite substantial, 0.968, 0.968 and 0.948, respectively. These effect sizes are also common in literature. For example, effect sizes of these variables on pro-environmental behaviors in Cooke et al. (2016) were 0.934, 0.956, 0.888, respectively. Likewise, the effect size of perceived competence was found to be 0.953 in Aitken et al. (2016) and that of perceived autonomy was 0.95 in Laverne et al. (2010). Accordingly, the sample characteristics in our research may not affect the effect size in our proposed research model.

More importantly, our findings provided evidence for the negative interaction effects of each pair of these needs on the intrinsic motivation. At first glance, these negative interactions seem to contradict what was revealed in previous studies in other settings (Dysvik et al., 2013; Kluwer et al., 2020). However, this contradiction is not as unexpected as

it may look. First of all, it is argued by Vallerand (2007) that the effects of the fulfillment for perceived competence, perceived autonomy, and perceived relatedness are argued to differ in different circumstances, which may lead to different forms of interaction between these needs. The positive interactions may be evidenced in research fields such as work environment or close relationships because in these contexts, the targeted behaviours are inherently enjoyable to do for self-benefits of those who conduct the behaviours. Therefore, different types of enjoyment experienced from the free choice to perform the targeted behaviours, the skills to conduct them or the sense of connectedness from conducting them may interact positively with each other to reinforce their interaction on intrinsic motivation. The motivation in these cases may only tap on the hedonic dimension of enjoyment (Deci and Ryan, 1985; 2000). However, in the PECB context, especially in Vietnam, alternatives for single-use plastic are perceived to be more expensive or are limited (Nguyen et al., 2020, 2021). Reducing single-use plastics or other PECB may mean choices among balances of self and other benefits. Intrinsic motivation here thus may include both dimensions of hedonic (i.e., enjoyment) and eudaimonic (i.e., meaningful) (Deci and Ryan, 1985; 2000). In this case, filling more than one needs, either perceived autonomy, perceived competence, or perceived autonomy, may be considered redundant or more costly for self-benefits than for the benefits of others or of the whole society. Thus, our findings of negative interaction effects among the three needs are in line with the proposition that compensation effects may exist among needs fulfillment, particularly because if the fulfillment of one need is lacking or limited, the fulfillment of another need will become salient to influence intrinsic motivation (Ryan and Deci, 2017; Van den Broeck et al., 2016).

6.2. Theoretical contribution

Findings of our study have extended the cognitive evaluation theory, a mini theory of self-determination theory in terms of the relationship between three psychological needs and intrinsic motivation. Besides the independent effects of each need on intrinsic motivation pointed out in extant literature, this study highlighted the compensation effects between pairs of psychological needs on intrinsic motivation. In contrast to the positive interaction effects of needs fulfillment identified in existing literature, this study finds evidence for the negative interaction effects of three pairs of needs on intrinsic motivation. These negative interactions can be referred to as compensation effects. In other words, the fulfillment of one basic psychological need may compensate in case the other basic psychological need is not fulfilled. If perceived autonomy is low, high levels of perceived competence or perceived relatedness can compensate to influence intrinsic motivation. Similarly, in conditions of low levels of perceived competence, high levels of perceived relatedness

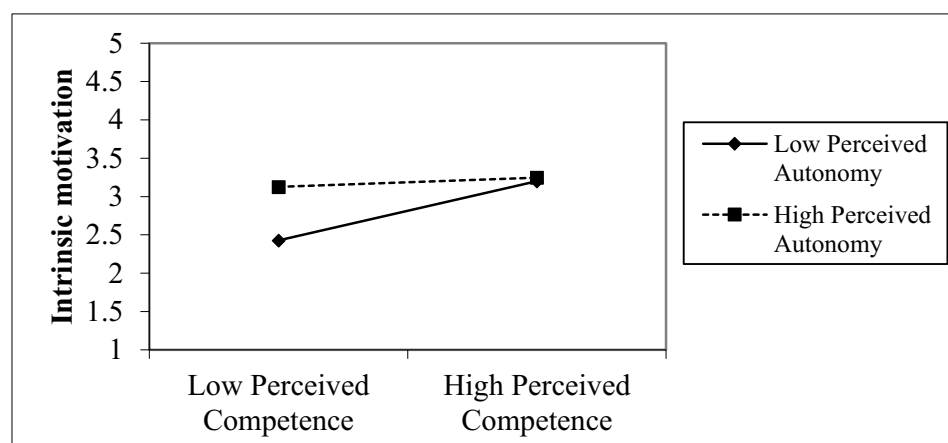


Fig. 2. The compensation effect of perceived autonomy and perceived competence on intrinsic motivation for PECB.

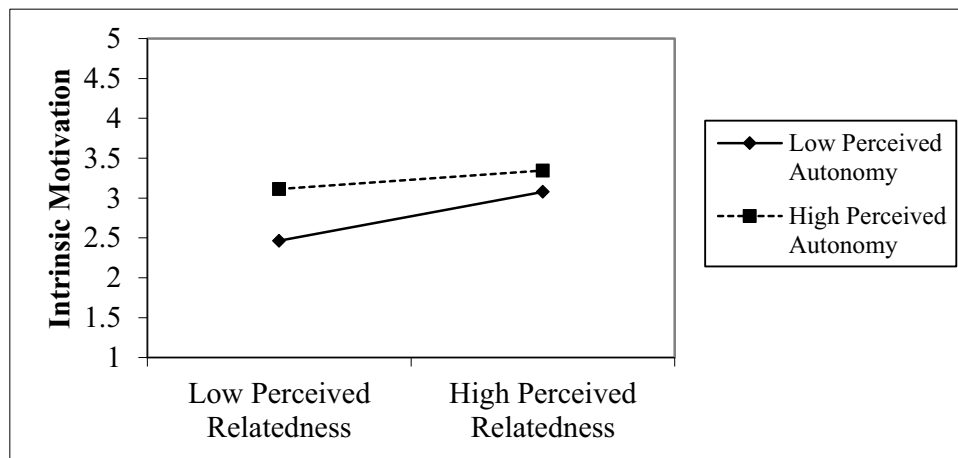


Fig. 3. The compensation effect of perceived autonomy and perceived relatedness on intrinsic motivation for PECB.

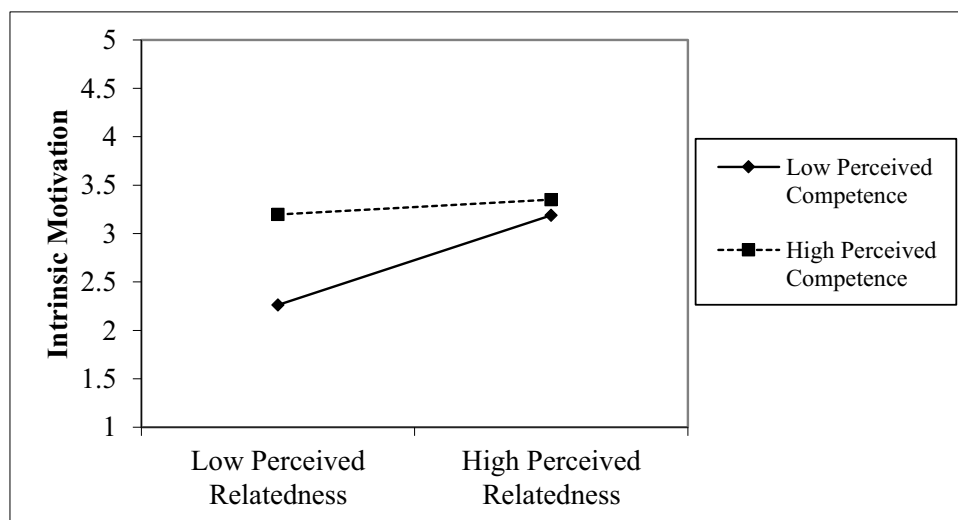


Fig. 4. The compensation effect of perceived competence and perceived relatedness on intrinsic motivation for PECB.

can compensate to influence intrinsic motivation. This study, thus, may be the first attempt to identify that in the context of reducing single-use plastic consumption, besides being influenced independently by the fulfillment of three basic psychological needs, intrinsic motivation can also be influenced by the compensation effects of each pair of these needs. Accordingly, this study provides novel contributions to extant literature on PECB by emphasizing that besides focusing on independent effects of satisfying each basic psychological need, compensatory effects of these needs on intrinsic motivation should be considered. It might be possible that marketers may consider fulfilling one specific need at one time when the fulfillment of the other need is lacking to reinforce the compensatory effects of these needs on intrinsic motivation.

6.3. Policy implications

Some policy interventions are suggested to foster consumers' intrinsic motivation for reducing single-use plastic consumption. In particular, our study suggests satisfying each basic psychological need. Firstly, because the results show that perceived competence has the strongest influence on intrinsic motivation, policy makers should implement policies which will improve consumers' skills to reduce single-use plastic consumption. This can be done by organizing education and communication programs in which consumers can integrate relevant knowledge and information, or guidance into consumption

decisions related to single-use plastics. In these programs, individuals are shown simple ways of reducing plastic waste to the environment such as buying products with less plastic packaging, using reusable bags or containers when going shopping, or using other alternatives for plastic wrap. Thanks to this, consumers will find enjoyment from their ability to reduce single-use plastic effectively and tend to engage in these behaviors.

Second, to foster consumers' perceived autonomy, governments should make alternatives for single-use plastic products available and accessible to them by supporting or subsidizing enterprises to invest in innovation to make such alternatives cost efficient. Among available and easily accessible plastic free alternatives, consumers will feel they can make their own choice without being under any external pressures. For example, retailers or businesses should increase the visibility of products made from or packaged in recyclable or bio-degradable materials on store shelves. Alternatively, they could consider having a green corner dedicated to such products. This will be a basis for consumers to make their informed decisions based on a variety of choices available.

Finally, more policies should be designed to provide consumers with a sense of belonging. For example, policy makers and marketers may consider organizing education or communication campaigns on social media network, online forums or local agencies that involve government agencies, non-profit organizations, or consumer groups. In these groups, consumers have a chance to exchange ideas of their own PECB. Main

topics discussed in these groups can be examples of good practices or suggestion of feasible solutions to reduce single-use plastics. If any initiative proves practical and efficient for the reduction of single-use plastic consumption, it can be publicly announced and encouraged to be replicated in a wider scale. Accordingly, they will experience the feeling of connectedness and enjoy reducing single-use plastics. If well designed and executed, such policies will bring more enjoyment to consumers, thereby strengthening their intrinsic motivation for conducting PECB.

However, as different individuals may have different innate basic psychological needs and because the fulfillment of those needs may have compensation effects, our study suggests that interventions may be designed independently for different groups of consumers. For example, if consumers already have different alternatives provided, their autonomy may not need to be highlighted. Similarly, for consumers who are highly competent at reducing single-use plastics, programs for different available alternatives or “others also do it” campaigns may not be as effective as expected. Thus, there would be no single program or policy for all groups of consumers. Additionally, policy makers may consider evaluating consumers’ levels of basic psychological needs before tailoring relevant programs or policies for different groups.

6.4. Limitations and recommendations for further research

This study is not without limitations. First, our research used cross-sectional self-reported Likert responses. A longitudinal study in the future could be conducted to further comprehend factors that can influence intrinsic motivation for PECB. Second, a majority of respondents for this study are females. This is due to the fact that these are major visitors to supermarkets, especially in Asian countries like Vietnam (Wulandarai et al., 2020). Although analysis results do not reveal gender differences, findings of the study may not be generalized to all groups of consumers. Future research thus should employ another method of collecting data to balance genders of respondents to ensure a more general viewpoint. Lastly, compensation effects between each pair of basic psychological needs are only examined in the context of reducing single-use plastic consumption. Future research should be conducted to identify if these compensation effects may exist in other green consumption contexts.

To conclude, this research is a response to calls for more nuanced investigation into interaction effects of basic psychological needs on intrinsic motivation, especially for PECB. Thus, our study contributes to the literature on PECB in particular and consumer behavior in general by identifying compensation effects of three pairs of basic psychological needs on intrinsic motivation. Further research in the field thus is needed for other sustainable consumption behaviours and the global sustainable development.

CRedit authorship contribution statement

Hung Vu Nguyen: Conceptualization, Methodology, Software, Supervision. **Mai Thi Thu Le:** Data curation, Writing – original draft, Writing – review & editing. **Long Thanh Do:** Visualization, Investigation, Software, Validation.

Declaration of Competing Interest

The authors 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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