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More than moral motivations: The moderating role of human capabilities on the relationship between personal norms and pro-environmental behavior

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ABSTRACT

The capability approach posits that human development should be seen according to the extent to which individuals can be, do, and have whatever they value in life: an expansion of individual opportunities that could be related to the adoption of pro-environmental behaviors (PEB). The present research tested this assumption by employing two approaches for measuring capabilities (aggregated and separated by dimensions) through a normative model in an online survey among Brazilians (N = 694). The findings show that people with stronger personal norms towards the environment engage more strongly in PEB. Furthermore, the results show that, in general, the relationship of human capabilities with PEB is not strong and depends on the capabilities dimensions (general capabilities, and human needs capabilities) and specific types of PEB (general PEB, and household waste and recycling). However, these main effects were sometimes overridden by the moderating effect some capabilities dimensions have on the relationship between personal norms and specific types of PEB. In this research, the human agency capabilities dimension more consistently resonated with PEB, negatively moderating the relationship between personal norms and PEB, irrespective of the PEB type. Human needs and social being capabilities positively moderated only one relationship each, between personal norms and environmental citizenship and household waste and recycling, respectively. Therefore, specific dimensions of capabilities seem to operate as an important boundary condition for people to act upon their personal norms to behave in specific pro-environmental ways.

1. Introduction

The world's ecosystem faces severe problems related to climate change, biodiversity loss, and degradation and pollution of the natural environment that are rooted in human behavior (UNEP, 2021). Several studies have investigated strategies to increase the number of pro-environmental behaviors (PEB) (Lima et al., 2023; Nielsen et al., 2021; Steg, 2016), which include those behaviors that damage the environment relatively little, or even benefit the environment (Steg and Vlek, 2009). However, their focus has largely been on the psychological aspects of human behavior, without considering capabilities that individuals actually have to adopt these behaviors. Including a capability

approach perspective (Sen, 2010) can increase the understanding of the factors related to PEB, factors that can also interact with these psychological aspects, increasing or decreasing their effect on PEB. Only few studies to date have analyzed the relationship between capabilities, psychological aspects and PEB (e.g., Leßmann and Masson, 2015). The main distinctions of the capabilities for the PEB literature are its focus on freedom and agency (Sen, 2010), which could affect individuals' relationships with sustainability (Lima et al., 2021; Sen, 2013) through their behavior.

The capability approach (Sen, 2010) assumes that the development of a region should be seen in terms of an expansion of the freedoms of individuals (to be and have whatever one values), i.e., human

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development, rather than purely economic development. The two main concepts in the capability approach are functionings and capabilities. Functionings are an individual's being and doing, such as choosing to follow an ecological career or to buy from a certified company. Capabilities, also referred to as human capabilities in this research, is the opportunities that individuals have to be and have whatever they value. Examples of capabilities include being able to choose any kind of career to follow, or any product to buy in the market. The distinction between functionings and capabilities is made because of the aspect of freedom/opportunities embedded in the capabilities concept (Sen, 2010). For example, the act of walking to work may be due to an individual's choice to exercise or to reduce CO₂ emissions, or the lack of another option (e.g., lack of public transportation or lack of resources to buy a vehicle); it is the same functioning but a completely different set of capabilities.

The human development literature (Duroy, 2008), and, more specifically, the capability approach perspective (Comim et al., 2007; Sen, 2013), suggests that increasing individuals' opportunities might increase the adoption of PEB. However, few investigations have been done to check these assumptions (Leßmann and Masson, 2015), as the literature mainly refers to socio demographic data for analyzing capabilities that individuals have (Blankenberg and Alhusen, 2019). Although socio demographic data present relationships with human capabilities, it does not fully represent the opportunities individuals have to be and do whatever they value. Thus, specifically addressing the role of capabilities on PEB can contribute to the literature by supporting a new perspective in analyzing PEB. In this way, this research aims to examine the relationships between human capabilities and PEB. To achieve this goal, the research relied on normative models of PEB, which are extensively used in the literature (e.g., Bamberg et al., 2007; De Groot et al., 2021; Steg et al., 2011). More specifically, this study's main objectives are to (1) assess the direct relationship of capabilities and specific dimensions of it on the adoption of three different kinds of PEB: General PEB, household waste and recycling, and environmental citizenship; and, (2) the moderating role of these dimensions on the relationship between personal norms and the three types of PEB.

2. Theoretical background

Capabilities are a multidimensional concept, that is, excelling in one aspect of life (i.e., dimension) does not compensate for a profound deprivation in another dimension (Henderson and Follett, 2020). For example, being healthy does not compensate for a lack of education and vice versa. However, there is not a consensus about what dimensions should be considered in capabilities measurements, to the extent that differences in the considered dimensions of capabilities have been seen in several studies (e.g., Al-Janabi et al., 2012; De Rosa, 2018; Lorgelly et al., 2015; Simon et al., 2013). Although these studies show differences on aspects such as specification grade, number of dimensions and types of capabilities, the dimensions also seem to share some common characteristics.

It is possible to define three further generic dimensions of capabilities that seem to represent all the measures commonly used: (i) capabilities related to biological and physical human needs (human needs CAP), which are capabilities that ensure physiological well-being; (ii) capabilities related to the fundamental interests of a human agent (human agency CAP), which include capabilities related to the autonomous development of oneself in relation to work, skills, and critical thinking; and (iii) capabilities related to the fundamental interests of a social being (social being CAP), which entail capabilities concerning community involvement in the form of political freedom and access to goods and services (Nielsen and Axelsen, 2017). By accepting these three dimensions, a higher degree of generalization can be achieved, as they are going to be present despite the specific dimensions contemplated while measuring capabilities. Hence, besides relying only on capabilities as a whole, this research also considered these three

dimensions as suggested by Nielsen and Axelsen (2017). This approach aims to analyze if dimensions of capabilities can be useful in better understanding what capabilities should be improved to support specific types of PEB.

2.1. Capability approach and pro-environmental behavior

More developed regions - in terms of income and human development - seem to present higher levels of environmental protection, both in the public domain (Furlan and Mariano, 2022; Lima et al., 2022) and in individual behaviors (Morren and Grinstein, 2016; Pisano and Lubell, 2017). This is in accord with the affluence hypothesis, in which individuals in more developed countries would have their basic needs fulfilled and start to have higher levels of concern toward quality-of-life issues (Duroy, 2008). Thus, through the capability approach perspective, the expansion of an individuals' opportunities in life, i.e., capabilities, could be linked to a greater occurrence of PEB. However, this might not always be the case, as some studies suggest that individuals in developing regions present higher levels of some kinds of PEB (Duroy, 2008) (see Milfont and Markowitz (2016) for a review). The controversial results seen between human development and PEB may be explained by two reasons: 1) as human development is a multidimensional concept, by considering a composite index (e.g., HDI) as is done in most research, there might be an overlap among the dimensions related to PEB; and, 2) the psychological aspects inherent to human behavior that motivate the adoption of PEB.

Using an overall measurement of capabilities may possibly bias the aggregate value, with dimensions differently related to the behavior analyzed. We therefore employ an overall measurement of human capabilities, and three general dimensions that embrace the dimensions usually employed in theoretical and empirical capabilities research. The aggregate measurement of capabilities considers the overall level of capabilities that an individual has, rather than distinguishing the dimensions of each (e.g., physical health and knowledge). By considering dimensions of capabilities in a disaggregated manner, however, it is possible to make an analysis with dimensions that have aspects that can be more or less related to a specific PEB. For example, human needs CAP could be more strongly related to PEB that demand more physical effort to be performed; human agency CAP could be more related to PEB that demand more practical and theoretical knowledge to be performed; and social being CAP might demand more social relationships.

Research relying only on human capabilities to analyze PEB lacks psychological variables that affect the behavioral structure of individuals. In the capability approach, the capability set of individuals are related to what they "reason to value" and so a screening process based on individuals' values selects, among all possibilities from the individual conversion factors, the possibilities that would compound their capabilities and functionings (Osmani, 2016). Capabilities, therefore, are not the motivation for the behavior, but it is what allows the individual to pursue the motivation. As "the whole point of the capability approach is to find ways of enabling people to lead the kind of life they have reason to value" (Osmani, 2016, p. 10), inner aspects of individuals (e.g., psychological features) would be the motivation behind the "reason to value" and the capabilities would represent which functionings the individual could achieve. Considering that multiple studies strongly suggest that PEB includes complex functionings (Dean et al., 2021; Lamm et al., 2022; Larson et al., 2015) and capabilities (Blankenberg and Alhusen, 2019; Meinzen-Dick et al., 2014), it would be relevant to integrate the different dimensions of capabilities with a strong psychological factor that has been shown to explain various types of PEB. Personal norms seem to fit this condition, as literature shows they are theoretically and empirically one of the key predictors for (various types of) PEB (de Groot et al., 2021). Hence, the present study will combine human capabilities with this psychological factor.

2.2. Personal norms and pro-environmental behavior

A fair share of reasons to engage in PEB are rooted in psychological factors (Kollmuss and Agyeman, 2002; van Valkengoed et al., 2022), personal norms being one of the main factors (De Groot et al., 2021). Personal norms are feelings of moral obligation toward a behavior that increases or decreases the propensity to perform it (Schwartz, 1977). Indeed, several studies have found a strong and positive relationship between personal norms and PEB (e.g., Bamberg et al., 2007; De Groot and Steg, 2010; De Groot et al., 2021; Hein, 2022; Steg et al., 2011; Van der Werff and Steg, 2015; Van Riper and Kyle, 2014). That is, the stronger one's personal norm toward a specific PEB, the stronger one's intentions and behaviors in relation to this PEB. However, even if individuals feel a moral obligation to act pro-environmentally, they might not be able to accomplish this behavior because of some sort of constraint (e.g., availability, financial resources) (Bouman et al., 2021; Meinzen-Dick et al., 2014). In line with the capability approach, one might argue that this behavior will be missing in their capability set. Thus, the psychological motivation to perform the behavior only partly explains actual PEB.

In order to perform PEB, individuals must recognize their capacity to do so (Bamberg et al., 2007). In psychological research, this assumption is usually addressed by (1) socio demographic data (Blankenberg and Alhusen, 2019; Lamm et al., 2022), which are often related very weakly and inconsistently to various types of PEB (Sargisson et al., 2020); or, by (2) including the concept of self-efficacy or perceived behavior control (i.e., the perceived opportunities and abilities that people have to perform a certain behavior (Ajzen, 1991), which has been strongly related to different types of PEB (Lamm et al., 2022; van Valkengoed et al., 2022). However, self-efficacy or perceived behavior control are usually measured and directed toward specific behaviors and perceptions of such specific behavior only (Bockarjova and Steg, 2014). Moreover, it might not necessarily reflect the actual control the individual has to perform the specific types of PEB being analyzed (Klößner, 2013). We argue that the capability approach, hence the focus on what individuals are able to be and do in their lives and not on the quantity of resources or preferences given to a specific behavior (Comim et al., 2007), can be a way to broaden the theoretical approach (Sniehotta et al., 2014) in relation to how individuals perceive their condition to perform a PEB. Thus, capabilities can be a useful addition to psychological factors, such as personal norms, for explaining PEB.

2.3. Conceptual model and hypothesis

The main aim of this research is to assess the direct and moderating effect of human capabilities on PEB. Higher levels of human capabilities offer opportunities for individuals to support sustainability goals (Leßmann and Masson, 2015), as capabilities are related to individuals' opportunities to be (e.g., sustainable lifestyle), do (e.g., PEB), and have (e.g., environmental consumption) (Comim et al., 2007). Thus, following the affluence hypothesis (Duroy, 2008) and previous research (Leßmann and Masson, 2015), higher levels of human capabilities would be related to higher levels of PEB.

Higher levels of capabilities can help overcome the different barriers that prevent individuals from performing a desired PEB, even when there is a strong motivation, such as personal norms (Kollmuss and Agyeman, 2002; Meinzen-Dick et al., 2014). The process of human development, which expands human capabilities, increases the opportunities that individuals have to accomplish PEB, which could potentially be associated with a higher number of (different types of) PEB being performed. With more freedom and opportunities to act, individuals can convert the motivation to act into PEB (Leßmann and Masson, 2015). Thus, higher levels of capabilities could potentially strengthen the relationships between psychological predictors of PEB (e.g., personal norms) and PEB. However, broadening the set of choices for individuals could also make it more difficult to choose the best option

according to an individual's own preference (Schwartz, 2004). Hence, although capabilities could strengthen the relationship between psychological predictors and PEB, they might also weaken this relationship. Considering that different levels of capabilities can modify the propensity to engage in PEB directly as well as indirectly through the role it might have on the relationship between psychological factors and PEB, this research not only focuses on the direct relationship between capabilities and PEB, but also investigates the moderating role of capabilities on the relationship between personal norms and PEB. Investigating the direct and moderating role of capabilities can contribute to a better understanding of how increasing individuals' opportunities in life (i.e., capabilities) can facilitate or hinder the adoption of PEB.

The present research first aims to validate the relationships between personal norms and PEB, something which is well established in the literature (e.g., Bamberg et al., 2007; De Groot et al., 2021; Hein, 2022; Van der Werff and Steg, 2015). Next, the research assesses the relationship of human capabilities with PEB, both by analyzing the direct relationship of capabilities on PEB and the moderation role of the relationship between personal norms and PEB. The conceptual model presented in Fig. 1 summarizes the research aims.

Thus, the research aims to test the following three main hypotheses:

Hypothesis 1. Personal norms toward general PEB are positively related to general PEB.

Hypothesis 2. Human capabilities are positively related to general PEB.

Hypothesis 3. The relationship between personal norms and general PEB is significantly altered by different levels of capabilities.

A wide range of behaviors can be considered pro-environmental, and each of these behaviors differ in terms of cognitive, physical, and financial efforts (Kneebone et al., 2020). Therefore, the present research aims to validate its claims by testing the three hypotheses with "general PEB" and with two specific types of PEB that have been widely explored in the PEB literature, namely household waste and recycling (household waste PEB) (e.g., Andersson and von Borgstede, 2010; Goh et al., 2022; Ribeiro-Rodrigues et al., 2021), and environmental citizenship (citizenship PEB) (e.g., Larson et al., 2015; Zhang et al., 2017; Van Riper and Kyle, 2014; Yin et al., 2021). These PEB were also chosen because of the substantial difference among them: (1) general PEB aggregates an individual's perception about the overall plethora of PEB, (2) household waste PEB includes behaviors that directly deals with managing material waste (e.g., empty cans and paper), and (3) environmental citizenship is coupled to the relationships with society, such as social interaction with other individuals and organizations. It is expected that these particularities of each kind of behavior will present different relationships with human capabilities, as these behaviors perform in different efforts and contexts.

It is expected that the same direction in the relationship between personal norms toward general PEB and general PEB, household waste PEB, and citizenship PEB will be found (i.e., Hypothesis 1), but with a stronger effect size between personal norms and general PEB. This is because personal norms behavior has been measured toward general

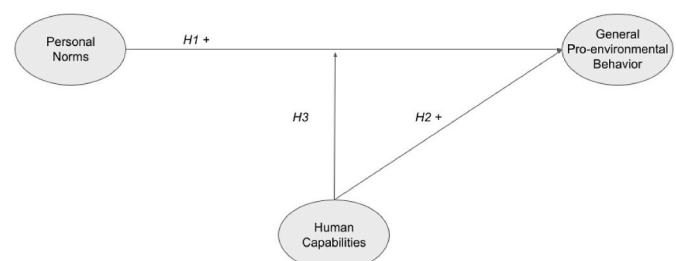


Fig. 1. Conceptual model and research hypothesis.

PEB rather than toward the two specific types of PEB (Steg et al., 2011; Van der Werff and Steg, 2015). For *Hypothesis 2*, it is expected that the two specific PEB will present similar results to the general PEB, being in accord with the affluence hypothesis (Duroy, 2008) and previous research on capabilities and PEB (Leßmann and Masson, 2015). For *Hypothesis 3*, it is expected that higher levels of human capabilities are linked with more pronounced relationships between personal norms and PEB, as higher levels of overall capabilities would increase an individual's set of capabilities, facilitating the realization of household waste PEB and citizenship PEB (Leßmann and Masson, 2015).

To further validate the hypotheses involving human capabilities, different measures of capabilities have been included in this study. Research applying the capability approach as a theoretical framework has suggested that capabilities are likely multi-dimensional (Nussbaum, 2000; Sen, 2010), while the empirical studies in this field have often analyzed it in an aggregated construct (Leßmann and Masson, 2015; Lorgelly et al., 2015; Simon et al., 2013). Based on this paradox in the literature, the present study aims to validate *Hypothesis 2* and *3* including the general measure of capabilities (i.e., aggregated dimension) but also the three specific dimensions of capabilities, as highlighted by Nielsen and Axelsen (2017) (i.e., human needs CAP, human agency CAP, and social being CAP). With this in mind, the further validation of *Hypothesis 2* and *3* also provide information of how specific dimensions of human capabilities are related to different PEB.

This research is a first exploration of to what extent it is useful to include a general index (aggregated) versus three disaggregated specific dimensions of capabilities to explain different types of PEB. Therefore, it is not possible to predict which dimensions will be more related to each PEB, more so since different PEB require a different set of effort (Kneebone et al., 2020) and conversion factors (Leßmann and Masson, 2015) to be performed. However, it is expected that a similar positive relationship between the capabilities and general and specific PEB (*Hypothesis 2*) will be found, regardless of whether capabilities were measured as an aggregated construct or in general dimensions. Such results would be aligned with previous assumptions about the positive relationship between capabilities and PEB (Leßmann and Masson, 2015; Sen, 2013). For *Hypothesis 3*, the prediction is more difficult, in that the expectation is to have both a negative and a positive moderating role of capabilities on the relationships between personal norms and general and specific PEB.

3. Method

3.1. Sampling and participants

The study used a convenience sampling strategy targeting Brazilians over 18 years old. To gather the data, an online questionnaire was distributed by email and social media (Facebook, LinkedIn, Instagram, and WhatsApp) through the first two authors' networks. Respondents were asked to share the questionnaire with other potential respondents (i.e., snowball sampling; Johnson, 2014).

This research was approved by the Ethic Committee of the Faculty of Sciences, São Paulo State University, Brazil, with the code number: 57949622.8.0000.5398. First, the questionnaire presented the research aims (to investigate the relationship among human capabilities, personal values, and PEB) and the ethical statements of anonymity, confidentiality, and the exclusively scientific purposes of the usage of the data collected, including the assured right to withdraw from the study at any moment without any type of loss. The consent to participate was given to those individuals who agreed with the ethical statement and were 18 years old or older.

A total of 766 individuals answered the questionnaire. After removing (1) the respondents who did not complete the attention questions ($n = 18$), who were not Brazilian ($n = 1$) or who were Brazilians living outside Brazil ($n = 10$), and (2) incomplete questionnaires ($n = 41$), the final sample was composed of 696 respondents. An a-priori

sample size calculation in G*Power (Faul et al., 2009) indicated that the research would need at least 114 individuals for an effect size of $f^2 = 0.10$ (De Groot et al., 2021), with a minimal statistical power of 0.80, probability level of 0.05, and three predictors (i.e., personal norms, human capabilities, and personal norms * human capabilities). Therefore, a sample of 696 respondents was deemed to provide sufficient statistical power for the aim of this research.

Of the final sample, 420 participants were women (60.34%) and 276 were men (39.66%), with ages ranging from 18 to 75 years old ($M = 37.280$, $SD = 11.622$). 556 individuals were white (79.89%), 30 were black (4.30%), 82 were "pardo" (a Brazilian connotation for multiracial individuals) (11.78%), 22 were Asian (3.15%), and 6 preferred not to answer (0.86%). The vast majority of the sample was composed of highly educated individuals, as 650 (93.4%) had completed at least some form of higher education. Also, most respondents had a medium to high income, 473 individuals (67.96%) having a monthly income equal or higher to R\$4848.00 (four times the Brazilian minimum wage). By contrast, around 51.1% of the Brazilian population is female (IBGE, 2023), 56.1% of Brazilians are black or "pardo" (IBGE, 2023), only 17.4% of the population over 25 years old has completed tertiary education (IBGE, 2023), and no more than 18% of households have a monthly income higher than R\$4127.41 (Carvalho, 2021). Therefore, the sample was determined to be one of convenience: overrepresenting female, white, well-educated and higher income individuals.

Using a convenience sample is a well-accepted approach in the PEB literature (e.g., De Groot et al., 2021; Ferrara et al., 2020; Jiménez-Parra et al., 2014; Kumar et al., 2021), as convenience sampling allows for a higher number of respondents and, consequently, increases statistical power, making comparisons with research findings across other studies easier. Furthermore, the aim of our study focused on testing internal validity (rather than external validity) between the relationships of interest (i.e., relationships between capabilities, personal norms, and PEB). For this aim, the advantage of a high statistical power outweighs the disadvantage of the representativeness of the sample (Etikan et al., 2016). Based on these reasons, the convenience sample of the present study was deemed sufficient.

3.2. Questionnaire and measures

An online questionnaire was created with Google Forms. The questionnaire started with questions regarding human capabilities followed by questions about personal norms toward general PEB. Next, respondents were asked about the frequency with which they perform some PEB. In the final part, respondents were asked socio demographic questions, before being thanked for their participation and then debriefed.

With the exception of the questions to measure the capabilities dimensions, all the questionnaire questions were based on validated scale items from previous studies (see Supplementary Material for an overview of all items of the questionnaire). All items related to the main constructs were answered on a 7-point Likert scale, ranging from 1 (strongly agree) to 7 (strongly disagree), unless stated otherwise below. The capabilities dimensions questions were developed based on the theoretical framework (Nielsen and Axelsen, 2017) and went through a correlation analysis validation (Taherdoost, 2016).

To increase the quality of the data, we included four attention questions (Bullock et al., 2017; He et al., 2022) (e.g., "Please, select number 5") and we removed the answers that did not pass these questions ($n = 18$). A pretest among the first author's network ($N = 14$) was made before applying the questionnaire. This was done to verify whether respondents might have difficulty in answering any aspects of the questionnaire. The respondents did not report any major issues in filling out the questionnaire. A few typing mistakes were identified and corrected before the official submission was prepared.

3.2.1. Human capabilities questionnaire

A specific aim of the present research was to make comparisons between the conceptual model and the research hypotheses (Fig. 1). As a consequence, we included a general measurement of capabilities in one model (Model 1) and the three dimensions of capabilities in another model (Model 2). Both models followed the same structure: that is, we tested the direct relationship of personal norms on PEB (H1), the direct relationships of human capabilities on PEB (H2), and the moderating role of capabilities on the relationship between personal norms and PEB (H3). Hence, the research relied on two approaches to measure human capabilities, the only difference between Model 1 and 2 being the way in which the human capabilities were measured.

3.2.1.1. General measurement of capabilities (model 1). For testing Model 1 (i.e., general capabilities), human capabilities were measured with the Oxford Capabilities Questionnaire-Mental Health (OxCAP-MH, Simon et al., 2013), which is a short-version of the scale developed by Anand et al. (2009) based on the theoretical works of Martha Nussbaum (2000). The OxCAP-MH has 16 questions following a 7-point Likert scale ranging from 1 (never/totally unsuitable/unsafe/unlikely/disagree) to 7 (always/totally suitable/safe/likely/agree). The scale aggregates all questions in a final capability score by calculating the average of the responses (Lorgelly et al., 2015; Simon et al., 2013). The present study used the Portuguese version of the instrument, adapted and validated by Luiz (2022) (Table S1).

3.2.1.2. Measurement of capabilities dimensions (model 2). For testing Model 2 (i.e., three dimensions of capabilities), we developed three single-item questions capturing each dimension integrally, as highlighted by Nielsen and Axelsen (2017; Table 1). We opted for single-item questions so respondents would rate their general perception of each dimension, similar to what is done with quality of life questionnaires, which is a construct related to capabilities (Lorgelly et al., 2015). The questions were structured as Likert scales ranging from 1 (totally disagree) to 7 (totally agree). We decided to develop these questions as the literature lacked a specific instrument for measuring the three capabilities dimensions, and the application of statistical tests to create dimensions based on other questionnaires, e.g., OxCAP-MH, did not present consistent results (Luiz et al., 2023).

To increase the chance that the three items that we developed based on face validity only were actually measuring the three dimensions of capabilities (i.e., the three theoretical constructs), we tested for its concurrent validity, that is, whether the instrument corresponded to an already established instrument used to measure the same construct (i.e., human capabilities) (Taherdoost, 2016). We relied on correlation analysis (Taherdoost, 2016) with the OxCAP-MH, an already validated instrument for measuring capabilities, and with a quality of life (QoL)¹ measurement, as QoL tends to correlate well with capabilities. This type of validation process has also been used to develop the OxCAP-MH

Table 1
Capabilities general dimensions questionnaire.

Capability dimension	Question
Capabilities related to biological and physical human needs (Human needs CAP)	<i>“My biological and physical needs are fulfilled”</i>
Capabilities related to fundamental interests of a human agent (Human agency CAP)	<i>“I have autonomy to develop myself in the areas that I desire”</i>
Capabilities related to fundamental interests of a social being (Social being CAP)	<i>“I am integrated into society as much as I would like”</i>

¹ Quality of life was measured with the Global Quality of Life Scale (QoL): *“Please, indicate your global quality of life according to the scale: (0 = no quality of life, and 10 = perfect quality of life)”* (Hyland and Sodergren, 1996).

instrument (Lorgelly et al., 2015).

3.2.2. Personal norms

Personal norms toward general PEB were measured with a scale adapted from Steg et al. (2011). For simplicity in answering the questionnaire, the research used only personal norms toward general PEB. This was done as the main behavior analyzed in the research was general PEB rather than the two specific types of PEB (i.e., household waste and recycling and environmental citizenship). We acknowledged that this decision would likely decrease the effect size of the relationship between personal norms and the two specific types of PEB. The scale comprised four questions: *“I feel morally obliged to act in a pro-environmental manner, regardless of what other people do”*, *“I feel it is morally right to act pro-environmentally as much as possible”*, *“I have a bad conscience if I do not act pro-environmentally when I can”*, and *“It would make me feel a better person if I was able to act in a more pro-environmental way”*. The questions ranged from 1 (totally disagree) to 7 (totally agree). To increase the reliability and validity of measuring personal norms with these four items, all questions were translated to Brazilian Portuguese with the back translation method provided by an English teacher (Brislin, 1970).

3.2.3. Pro-environmental behavior

PEB was measured with a 19-item questionnaire including self-reported behaviors based on previous instruments in the literature (Table S1) (Kaiser and Wilson, 2004; Markle, 2013; Obery and Bangert, 2017; Ribeiro-Rodrigues et al., 2021). The 19 questions included items to measure general PEB and a composite measure of household waste PEB and citizenship PEB. All the questions followed a 7-point Likert scale, ranging from 1 (totally disagree or never) to 7 (totally agree or always). As with personal norms, the items that were not available in Brazilian Portuguese were translated, with the back translation method provided by an English teacher (Brislin, 1970).

3.3. Analysis

Due to the nature of the variables studied, which can be better measured indirectly by aggregating indicators, the use of Structural Equation Modeling (SEM) was deemed most appropriate for the research. SEM can be described as a group of statistical techniques for analyzing the relationship between multiple variables based on factorial and regression analysis (Hair et al., 2022). PLS-SEM also does not require statistical assumptions about data distribution (normality for example), as it is a non-parametric technique (Sarstedt et al., 2014). These aspects also make the PLS-SEM appropriate for exploratory research, and it is commonly used in the PEB literature (e.g., Goh et al., 2022; Hein, 2022).

PLS-SEM also allows for the testing of moderation effects. In both models presented in this research, capabilities were used as moderators of the relationship between personal norms and PEB. In Model 1, the general measurement of capabilities was the moderator, while in Model 2 the dimensions of capabilities were the moderators. A complete bootstrapping with 10,000 subsamples was performed in order to test the loadings and path coefficients in the structural model. The statistical significance of the coefficients was established using two-tailed hypothesis tests, which must be considered when interpreting the reported ρ values. The analysis was made using the SmartPLS 4 (Ringle et al., 2022) and RStudio software.

To control the models for possible confounding effects on PEB from other variables, we included control variables for age, education, gender, and income. These are sociodemographic variables recognized for their possible relationships with PEB (Blankenberg and Alhusen, 2019; Lamm et al., 2022; Leßmann and Masson, 2015; Lima et al., 2023; Yuriev et al., 2020). There are indications in the literature for a positive and negative effect of age on PEB (Wiernik et al., 2013). Past research has indicated that older individuals might present higher levels of PEB (Wang et al., 2021). This higher tendency to perform PEB may be related

to more autonomy that individuals have when they reach maturity, such as being responsible for their own purchases (Binder et al., 2020), seeking meaning from life or pro-social goals during later stages of life (Wang et al., 2021; Wang et al., 2021). Higher levels of education can be related to higher concern toward social welfare and an increased importance in the perception of environmental issues (Meyer, 2015). The theoretical explanation for the positive relationship between women and nature has ranged from different perspectives throughout the years, such as biological, social, material, and ideological (see Meizen-Dick et al., 2014 for a review). Although a precise explanation is still under discussion, empirical studies have found a higher propensity for women to engage in PEB rather than men (e.g., Vicente-Molina et al., 2018). Research has found both positive and negative effects of income on PEB (Blankenberg and Alhusen, 2019). In the positive relationship, PEB becomes more feasible after securing the basic needs of individuals that are strongly related to financial resources (Binder et al., 2020) and that are associated with the higher costs of some PEB, e.g., choosing organic food (Bullock et al., 2017). In the negative relationship, available financial resources may lead to an increase in consumption (Chitnis et al., 2013), which has a negative effect on the environment. Thus, although these control variables depend on the type of PEB to understand the direction of the relationship (Wiernik et al., 2013), they could potentially affect the relationships of interest in the present study, especially because these factors are also related to capabilities (Anand and Sen, 2000; Sen, 2010) (e.g., higher income, as well as a higher educational level, usually provide more opportunities in life).

4. Results

4.1. Test of validity for the capabilities dimension measurement

To analyze if the questions developed to measure the three capabilities dimensions used in Model 2 were measuring capabilities in a valid way, this research examined the correlations between these dimensions, the OxCAP-MH, and QoL (Taherdoost, 2016). The correlations between the three capabilities dimensions and the OxCAP-MH were: human needs CAP: 0.537, $p < 0.001$; human agency CAP: 0.553, $p < 0.001$; and social being CAP: 0.601, $p < 0.001$. The correlations between the three capability dimensions with QoL were: human needs CAP: 0.532, $p < 0.001$; human agency CAP: 0.457, $p < 0.001$; and social being CAP: 0.514, $p < 0.001$. Considering that capabilities are multi-dimensional (Henderson and Follett, 2020), we made an index by giving equal weights to the three dimensions and comparing them to the OxCAP-MH and the QoL. The composite index created with the dimensions presented higher correlations than the isolated dimensions, (0.683, $p < 0.001$) and (0.605, $p < 0.001$) (Figs. S1 and S2), respectively, which reinforces the validity of the instrument. Correlations between 0.36 and 0.67 can be considered moderate and correlations higher than 0.68 can be considered strong (Taylor, 1990). Thus, the instrument developed to measure the general dimensions of capabilities was considered valid for the initial exploration proposed in this research. In the next section we present the validity tests of the full measurement model.

4.2. Validity and reliability of human capabilities, personal norms and pro-environmental behavior

To assess the measurement models, the reflective constructs (i.e., personal norms and PEB) were evaluated regarding their internal consistency and convergent and discriminant validity. When all the questions were present in the constructs, the outer loading of the variables were between 0.400 and 0.700 for the household waste PEB and citizenship PEB. In cases where the outer loadings are between 0.400 and 0.700 the rule of thumb is to exclude the indicator and check whether the outer loading increases or not (Hair et al., 2009). After excluding the

variables household waste PEB1, household waste PEB6, household waste PEB7 and household waste PEB8, and citizenship PEB4, citizenship PEB5, and citizenship PEB6, the outer loadings surpassed the threshold point of 0.700 (Hair et al., 2009). Thus, we decided to maintain the models without these variables. After applying the necessary changes to the models, all Cronbach's alphas were above 0.700, the Average Variance Extracted (AVE) were above 0.500, and all the Composite Reliability (CR) were above 0.700. These are all considered to be valid values (Hair et al., 2021) (Table 2).

The discriminant validity was assessed using the heterotrait-monotrait ratio of correlations (HTMT, Table 3). All values were below 0.850, and therefore considered valid (Henseler et al., 2015). All the variance inflation factors (VIFs) were below 3.300, which indicates that the model is free of common method bias, including multicollinearity issues (Kock, 2015). Considering that the results from both models were very similar, and due to space constraint, only the tables relating to the results of the Model 2 are presented here (results from Model 1 are available upon request). In the next section, we checked the structural models for Model 1 and Model 2.

4.3. Relationships between human capabilities, personal norms and pro-environmental behavior

To test the hypotheses presented in this research, we checked the structural analysis of both models (Model 1 and Model 2). Considering the exploratory nature of the research, in which even predicting the direction of the moderating effect of capabilities on the personal norms and PEB relationship is difficult, we considered a less stringent threshold for significant ρ values (i.e., $\rho < 0.10$) (Dahiru, 2008). The relationships between personal norms, the general capabilities measure (Model 1), the three capability dimensions (Model 2), and the moderator terms between personal norms and capabilities on general PEB, household waste PEB, and citizenship PEB are shown in Table 4 (Model 1) and Table 5 (Model 2).

Model 1, including personal norms toward general PEB and the general capabilities measurement (i.e., OxCAP-MH), explained 36.6% of variance for general PEB ($R^2 = 0.326$), 14.0% for household waste PEB ($R^2 = 0.140$), and 18.9% for citizenship PEB ($R^2 = 0.189$).² The standardized root mean square residual (SRMR) of the model was 0.114, which is above the accepted value of < 0.100 (Hu and Bentler, 1998). However, as debate on the precision of the model fitness assessment in PLS-SEM remains open (Hair et al., 2021; Schuberth et al., 2022), we decided to continue the analysis with the model. Personal norms presented a significant positive relationship with all three PEB: general PEB ($\beta = 0.521$, $\rho = 0.000$), household waste PEB ($\beta = 0.225$, $\rho = 0.000$), and citizenship PEB ($\beta = 0.320$, $\rho = 0.000$), supporting Hypothesis 1. General capabilities only presented a positive and significant relationship with general PEB ($\beta = 0.099$, $\rho = 0.005$); the relationships with household waste PEB ($\beta = 0.055$, $\rho = 0.115$), and citizenship PEB ($\beta = 0.014$, $\rho = 0.708$), were not significant, which provided limited support for Hypothesis 2. The moderator effects of general capabilities on the effect of personal norms on any of the three PEB were not significant: general PEB ($\beta = -0.009$, $\rho = 0.835$), household waste PEB ($\beta = 0.050$, $\rho = 0.240$), citizenship PEB ($\beta = 0.006$, $\rho = 0.868$). Therefore, Hypothesis 3 was rejected.

Model 2, including personal norms toward general PEB with the three capabilities dimensions, explained 33.31% of variance for general PEB ($R^2 = 0.331$), 15.6% for household waste PEB ($R^2 = 0.156$), and 20.6% for citizenship PEB ($R^2 = 0.206$). Although the SRMR of 0.104 from Model 2 is somewhat better than Model 1, it is still at the upper end

² We opted for R^2 and not the adjusted R^2 "But because of the correction factor introduced to account for data and model size, the adjusted R^2 is not a precise indication of an endogenous construct's explained variance" (Hair et al., 2021).

Table 2
Internal consistency and convergent validity.

Construct	Items (reflexive measure)	Outer loading	p(t)	Cronbach's α	AVE	Composite reliability (Rho_a)	Composite reliability (Rho_c)
PN	PN1	0.801	29.542	0.789	0.611	0.812	0.862
	PN2	0.836	38.634				
	PN3	0.816	40.005				
	PN4	0.663	16.218				
General PEB	General PEB1	0.875	84.869	0.843	0.679	0.855	0.894
	General PEB2	0.797	34.493				
	General PEB3	0.812	36.055				
	General PEB4	0.809	47.516				
Household waste PEB	Household waste PEB2	0.786	20.748	0.709	0.536	0.718	0.821
	Household waste PEB3	0.790	20.336				
	Household waste PEB4	0.705	17.386				
	Household waste PEB5	0.636	12.105				
Citizenship PEB	Citizenship PEB1	0.796	43.007	0.752	0.574	0.776	0.842
	Citizenship PEB2	0.813	44.124				
	Citizenship PEB3	0.788	37.685				
	Citizenship PEB6	0.616	16.220				

Notes. PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior.

Table 3
Descriptive statistic and discriminant validity (HTMT-ratio).

Variable	M	SD	PN	General PEB	Household waste PEB	Citizenship PEB	Human needs CAP	Human agency CAP	Social being CAP	Age	Gender	Income	Level of education
PN	6.152	1.316											
General PEB	5.692	1.380	0.637										
Household waste PEB	4.759	2.105	0.340	0.674									
Citizenship PEB	3.965	1.810	0.443	0.722	0.694								
Human needs CAP	5.605	1.412	0.054	0.046	0.079	0.047							
Human agency CAP	5.693	1.429	0.039	0.022	0.084	0.102	0.222						
Social being CAP	4.846	1.429	0.050	0.016	0.044	0.036	0.436	0.206					
Age	37.280	11.622	0.103	0.191	0.265	0.273	0.060	0.068	0.006				
Gender	-	-	0.207	0.111	0.162	0.173	0.054	0.115	0.059	0.067			
Income	-	-	0.031	0.015	0.128	0.029	0.100	0.123	0.119	0.364	0.133		
Level of education	-	-	0.077	0.144	0.231	0.189	0.020	0.006	0.058	0.394	0.053	0.262	

PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior, Human needs CAP = capabilities related to human needs, Human agency CAP = capabilities related to human agent, and Social being CAP = capabilities related to social being.

of the accepted value of <0.100 (Hu and Bentler, 1998). Personal norms showed a significant positive relationship with all the three PEB: general PEB ($\beta = 0.535, \rho = 0.000$), household waste PEB ($\beta = 0.249, \rho = 0.000$), and citizenship PEB ($\beta = 0.308, \rho = 0.000$), supporting Hypothesis 1. Considering the capabilities dimensions, human needs CAP were not related to general PEB ($\beta = 0.056, \rho = 0.114$), were positively related to household waste PEB ($\beta = 0.081, \rho = 0.046$), and were not related to citizenship PEB ($\beta = 0.022, \rho = 0.577$). Human agency CAP were not related to general PEB ($\beta = 0.022, \rho = 0.519$) nor household waste PEB ($\beta = -0.029, \rho = 0.463$), and were negatively related to citizenship PEB ($\beta = -0.080, \rho = 0.024$). Social being CAP were not related to any of the PEB: general PEB ($\beta = 0.001, \rho = 0.965$), household waste PEB ($\beta = 0.006, \rho = 0.893$), citizenship PEB ($\beta = 0.026, \rho = 0.515$). Therefore, considering that there were only some positive significant relationships with small effect sizes, Hypothesis 2 was limitedly supported.

The moderation analysis in Model 2 shows that the human needs CAP did not moderate the relationship between personal norms and general PEB ($\beta = -0.008, \rho = 0.832, f^2 = 0.000$) nor the relationship between personal norms and household waste PEB ($\beta = -0.031, \rho = 0.497, f^2 = 0.001$). However, it did positively moderate the relationship

between personal norms and citizenship PEB ($\beta = 0.062, \rho = 0.087, f^2 = 0.004$). The human agency CAP moderated the relationship between personal norms and the three PEBs negatively: general PEB ($\beta = -0.094, \rho = 0.024, f^2 = 0.011$), household waste PEB ($\beta = -0.089, \rho = 0.042, f^2 = 0.008$), and citizenship PEB ($\beta = -0.093, \rho = 0.013, f^2 = 0.009$). The social being CAP did not moderate the relationship between personal norms and general PEB ($\beta = 0.036, \rho = 0.359, f^2 = 0.002$), while it positively moderated the relationship between personal norms and household waste PEB ($\beta = 0.073, \rho = 0.095, f^2 = 0.005$); it did not moderate the relationship between personal norms and citizenship PEB ($\beta = -0.053, \rho = 0.116, f^2 = 0.003$). All the f^2 for the significant moderations of capabilities on the personal norms-PEB relationships correspond to small effect sizes (Aguinis et al., 2005). Therefore, considering there were some weak significant relationships, Hypothesis 3 was partially supported.

4.4. Control variables

In Model 1 and 2, age, gender, income, and education were included as control variables due to their possible confounding effect on PEB

Table 4
Results of the structural analysis of Model 1.

Direct effect	β	M	SE	t	p	f^2
PN → General PEB	0.521	0.522	0.035	14.992	0.000	0.385
PN → Household waste PEB	0.225	0.226	0.042	5.324	0.000	0.056
PN → Citizenship PEB	0.320	0.322	0.034	9.455	0.000	0.121
General CAP → General PEB	0.099	0.099	0.036	2.790	0.005	0.013
General CAP → Household waste PEB	0.055	0.055	0.039	1.421	0.155	0.003
General CAP → Citizenship PEB	0.014	0.015	0.039	0.374	0.708	0.000
Moderation effect	β	M	SE	t	p	f^2
PN * General CAP → General PEB	-0.009	-0.006	0.041	0.209	0.835	0.000
PN * General CAP → Household waste PEB	-0.050	-0.047	0.043	1.176	0.240	0.003
PN * General CAP → Citizenship PEB	0.006	0.006	0.036	0.166	0.868	0.000
Control Variables	β	M	SE	t	p	f^2
Age → General PEB	0.141	0.216	0.033	4.249	0.000	0.023
Age → Household waste PEB	0.176	0.176	0.039	4.554	0.000	0.027
Age → Citizenship PEB	0.216	0.216	0.037	5.790	0.000	0.044
Gender → General PEB	0.038	0.035	0.067	0.565	0.572	0.000
Gender → Household waste PEB	0.217	0.216	0.077	2.813	0.005	0.012
Gender → Citizenship PEB	0.196	0.195	0.075	2.610	0.009	0.010
Income → General PEB	-0.100	-0.100	0.038	2.637	0.008	0.012
Income → Household waste PEB	-0.029	-0.029	0.045	0.634	0.526	0.001
Income → Citizenship PEB	-0.066	-0.067	0.038	1.724	0.085	0.004
Level of education → General PEB	0.054	0.055	0.033	1.657	0.097	0.004
Level of education → Household waste PEB	0.109	0.110	0.039	2.811	0.005	0.011
Level of education → Citizenship PEB	0.065	0.065	0.038	1.691	0.091	0.004

PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior, Human needs CAP = capabilities related to human needs, Human agency CAP = capabilities related to human agent, and Social being CAP = capabilities related to social being.

(Blankenberg and Alhusen, 2019; Lamm et al., 2022; Leßmann and Masson, 2015; Lima et al., 2023; Yuriev et al., 2020; see Tables 4 and 5). Considering that all the control variables presented at least one significant relationship, the four were kept in both models. In Model 1, with the general capability measurement, age was positively related to the three PEB: general PEB ($\beta = 0.141$, $\rho = 0.000$), household waste PEB ($\beta = 0.176$, $\rho = 0.000$), and citizenship PEB ($\beta = 0.216$, $\rho = 0.000$). Gender was positively related to household waste PEB ($\beta = 0.217$, $\rho = 0.005$) and citizenship PEB ($\beta = 0.196$, $\rho = 0.009$). Income was negatively related to general PEB ($\beta = -0.100$, $\rho = 0.008$), and environmental PEB ($\beta = -0.066$, $\rho = 0.085$). Education was positively related to the three PEB: general PEB ($\beta = 0.054$, $\rho = 0.097$), household waste PEB ($\beta = 0.109$, $\rho = 0.005$), and citizenship PEB ($\beta = 0.065$, $\rho = 0.091$) (Table 4).

In Model 2, age was positively related to the three PEB: general PEB ($\beta = 0.153$, $\rho = 0.000$), household waste PEB ($\beta = 0.185$, $\rho = 0.000$), and citizenship PEB ($\beta = 0.224$, $\rho = 0.000$). Gender was positively related to household waste PEB ($\beta = 0.201$, $\rho = 0.010$), and citizenship PEB ($\beta =$

Table 5
Results of the structural analysis of Model 2.

Direct effect	β	M	SE	t	p	f^2
PN → General PEB	0.535	0.536	0.036	14.848	0.000	0.387
PN → Household waste PEB	0.249	0.249	0.040	6.288	0.000	0.067
PN → Citizenship PEB	0.308	0.311	0.035	8.798	0.000	0.108
Human needs CAP → General PEB	0.056	0.056	0.036	1.579	0.114	0.004
Human needs CAP → Household waste PEB	0.081	0.081	0.041	1.999	0.046	0.006
Human needs CAP → Citizenship PEB	0.022	0.020	0.039	0.557	0.577	0.000
Human agency CAP → General PEB	0.022	0.021	0.033	0.645	0.519	0.001
Human agency CAP → Household waste PEB	-0.029	-0.031	0.040	0.733	0.463	0.001
Human agency CAP → Citizenship PEB	-0.080	-0.081	0.036	2.255	0.024	0.007
Social being CAP → General PEB	0.001	0.002	0.034	0.044	0.965	0.000
Social being CAP → Household waste PEB	0.006	0.007	0.041	0.135	0.893	0.000
Social being CAP → Citizenship PEB	0.026	0.028	0.040	0.651	0.515	0.001
Moderation effect	β	M	SE	t	p	f^2
PN * Human needs CAP → General PEB	-0.008	-0.003	0.0039	0.212	0.832	0.000
PN * Human needs CAP → Household waste PEB	-0.031	-0.0225	0.046	0.678	0.497	0.001
PN * Human needs CAP → Citizenship PEB	0.062	0.064	0.036	1.709	0.087	0.004
PN * Human agency CAP → General PEB	-0.094	-0.090	0.042	2.251	0.024	0.011
PN * Human agency CAP → Household waste PEB	-0.089	-0.084	0.044	2.032	0.042	0.008
PN * Human agency CAP → Citizenship PEB	-0.093	-0.093	0.037	2.494	0.013	0.009
PN * Social being CAP → General PEB	0.036	0.035	0.040	0.917	0.359	0.002
PN * Social being CAP → Household waste PEB	0.073	0.068	0.043	1.670	0.095	0.005
PN * Social being CAP → Citizenship PEB	-0.053	-0.056	0.034	1.571	0.116	0.003
Control Variables	β	M	SE	t	p	f^2
Age → General PEB	0.153	0.152	0.044	4.576	0.000	0.027
Age → Household waste PEB	0.185	0.185	0.039	4.807	0.000	0.031
Age → Citizenship PEB	0.224	0.224	0.037	6.005	0.000	0.048
Gender → General PEB	0.027	0.025	0.067	0.405	0.685	0.000

(continued on next page)

Table 5 (continued)

Direct effect	β	M	SE	t	p	f ²
Gender → Household waste PEB	0.201	0.199	0.078	2.585	0.010	0.011
Gender → Citizenship PEB	0.195	0.195	0.075	2.614	0.009	0.011
Income → General PEB	-0.084	-0.085	0.036	2.311	0.021	0.009
Income → Household waste PEB	-0.028	-0.029	0.044	0.641	0.522	0.001
Income → Citizenship PEB	-0.049	-0.051	0.037	1.329	0.184	0.002
Level of education → General PEB	0.047	0.048	0.033	1.425	0.154	0.003
Level of education → Household waste PEB	0.104	0.106	0.039	2.690	0.007	0.010
Level of education → Citizenship PEB	0.056	0.057	0.039	1.443	0.149	0.003

PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior, Human needs CAP = capabilities related to human needs, Human agency CAP = capabilities related to human agent, and Social being CAP = capabilities related to social being.

0.195, $\rho = 0.009$). Income was negatively related to general PEB ($\beta = -0.084$, $\rho = 0.009$). Education was positively related to household waste PEB ($\beta = 0.104$, $\rho = 0.007$) (Table 5). Therefore, the results of the structural models as reported in this paper were corrected for the demographics age, education, gender and income.

5. Discussion

The present research examined the relationships between general and three specific dimensions of capabilities, personal norms and different types of PEB. To validate these relationships, we examined them across three different types of PEB (i.e., general PEB, household waste PEB, and citizenship PEB) in two models: the first model relied on an established aggregated measurement of human capabilities (Lorgelly et al., 2015), and the second model included a subdivision of capabilities in three dimensions of capabilities, as suggested by Nielsen and Axelsen (2017).

The results of both models supported Hypothesis 1, that is, personal norms toward general PEB are positively related to general PEB, household waste PEB, and citizenship PEB. These results are in accordance with previous research indicating personal norms as positively related to PEB (e.g., Van der Werff and Steg, 2015), household waste PEB (e.g., Andersson and von Borgstede, 2010; Goh et al., 2022), and citizenship PEB (e.g., Zhang et al., 2017; Steg et al., 2011; Van Riper and Kyle, 2014). The findings provide further evidence for the assumption that PEB is strongly embedded in moral considerations, such as represented in personal norms, and as indicated by theories such as the norm activation theory (Schwartz, 1977) or its extension the value-belief-norm theory (Stern, 2000). The stronger relationship between personal norms in terms of general PEB rather than specific types of PEB in both models confirms that personal norms are better predictors when they have been specified to the specific type of behavioral context (Van der Werff and Steg, 2015; Steg et al., 2011).

The research findings of both models showed mixed results regarding the relationship between human capabilities and general and specific types of PEB. More precisely, Model 1 only presented a weak positive relationship between capabilities and general PEB, and Model 2 only presented a weak positive relationship between human needs CAP and household waste PEB, and a weak negative relationship between human

agency CAP and citizenship PEB. Thus, Hypothesis 2 was only supported to a limited extent. These results therefore offer little support for the affluence hypothesis (Duroy, 2008), which assumes that higher levels of capabilities could be linked to a greater occurrence of PEB. Moreover, Model 2 presented a negative relationship between one dimension of capabilities and a specific type of PEB, contradicting the expectation that increasing capabilities would be associated with higher levels of PEB (Leßmann and Masson, 2015). Therefore, capabilities could be useful to include in PEB research, but not merely because capabilities increase one's opportunities to perform PEB, but equally because, depending on its specific dimension, it might provide barriers to performing certain types of PEB. Future research could examine these specific boundary conditions of the relationship between different dimensions of human capabilities on different kinds of PEB in more detail. Moreover, future studies could analyze the relationships between capabilities and other variables usually employed in the PEB, such as self-efficacy.

The findings of both models presented mixed results regarding the moderating role of human capabilities in the relationship between personal norms and general and specific types of PEB. Model 1 showed no significant moderating effect of the aggregated measure of capabilities, personal norms and (specific types of) PEB. Model 2 showed (1) a positive moderating effect of human needs CAP on the relationship between personal norms and citizenship PEB; (2) negative moderating effects of human agency CAP on the relationship between personal norms and general PEB, household waste PEB, and citizenship PEB relationships; and, (3) a positive moderating effect of social being CAP on the relationship between personal norms and household waste PEB. All these moderating effects showed small effect sizes. Thus, Hypothesis 3 was only limitedly supported. Although based on the literature higher capabilities function as higher opportunities (Leßmann and Masson, 2015) to act upon one's personal norms and consequently act in line with this norm, our findings suggest that this relationship is more complex than suggested. Specifically, the results show that only specific dimensions of capabilities (rather than the aggregated construct) moderate the relationship between personal norms and PEB, and that this moderator effect largely depends on the specific dimension of capabilities as well as the specific type of PEB.

For the PEB analyzed in this research, the human agency CAP dimension was the one that resonated more significantly with PEB, as it presented moderating relationships with all the PEB considered in the research. The capability approach literature highlights that individuals can be agents of change, capable of transforming their surroundings if they have enough opportunities to do so (Sen, 2010, 2013). Interestingly, however, our findings indicate that the opportunities to develop oneself worked as a barrier rather than an opportunity in the PEB analyzed. This result contradicts the affluence hypothesis (Duroy, 2008) and previous assumptions in the capability approach literature (Leßmann and Masson, 2015; Sen, 2013). These negative effects could be explained by the increase in the difficulty of optimizing choices when individuals have more options to opt for (Schwartz, 2004). Thus, even though individuals might have a moral willingness to perform a PEB, they might opt for a less environmentally friendly option that becomes available due to an increase in their abilities. For example, an individual might have the moral motivation to avoid driving a car to go to work, but knowing how to drive and having a driving license might increase the predisposition to drive to work. Considering that it is not reasonable to reduce individuals' autonomy (capabilities) from the capability approach perspective (Sen, 2013), it will be important to examine under which circumstances certain capabilities dimensions work as such a barrier rather than an opportunity for promoting PEB.

5.1. Theoretical implications

The findings of the present research have several theoretical implications, especially in relation to Hypothesis 3. First, relying solely on an aggregated measure of capabilities does not seem to address the extent

to which capabilities can strengthen or weaken the relationship of important motivational factors, such as personal norms within the plethora of PEB. Hence, the complexity of the role of capabilities might not be captured by operationalizing it as an aggregated construct. The literature using the capability approach in relation to PEB should therefore acknowledge, use, and further develop the dimensional structure of capabilities.

Furthermore, the theoretical assumptions, such as the affluence hypothesis (Duroy, 2008), which have been popular in the human development literature (Milfont and Markowitz (2016), seem not to provide a sufficient understanding of how capabilities can explain the (lack of) performing different types of PEB. In particular, our findings show that, in contrast to the affluence hypothesis, human development could actually constrain the adoption of PEB. Consequently, next to the positive influence of capabilities on performing PEB, the human development literature should consider and further understand the barriers that increasing capabilities can create to perform PEB as well. Such knowledge will help to design ways to mitigate these negative side-effects without constraining human development as a whole.

Finally, popular normative theories in relation to explaining PEB, such as the norm activation theory (Schwartz, 1977), or, its extension, the value-belief-norm theory (Stern, 2000), often do not acknowledge the importance of specific barriers and opportunities that can strengthen or weaken the relationship between normative motivations and PEB. Our results show that, under some circumstances, human capabilities can offer such specific barriers or opportunities. Therefore, normative theories could benefit from incorporating capabilities within their theoretical framework to further understand such barriers and opportunities.

5.2. Practical and policy implications

The human development literature has found positive relationships between human development and sustainability (e.g., Furlan and Mariano, 2022; Lima et al., 2022). However, our findings show that, within the PEB context, these relationships are more complex than expected. That is, some specific capabilities might offer barriers for the adoption of PEB rather than opportunities. These findings can offer a new perspective on work that has recently been done by policy makers. For example, the United Nations Development Programme has been testing a new version of the Human Development Index adjusted by carbon dioxide emissions per person and material footprint per capita (i.e., Human Development Index adjusted for Planetary Pressures (PHDI); HDR, 2023). These adjustments were made to consider human pressure on the environment, with the aim of incentivizing a sustainable transformation. Further variations of this index could include analysis based on specific dimensions of human development (e.g., health, education) and environmental subjects (e.g., waste generation, sustainable transportation).

Developing countries, such as Brazil, are in a process of increasing their level of economic and human development. This development entails a process of expanding individuals' capabilities. Because capabilities do not only result in opportunities to adopt PEB (hence, a growth in "environmental" development), but may also trigger certain barriers to adopting them, initiatives should be developed and evaluated to optimize these opportunities while simultaneously minimizing the barriers. Special attention should be given to the human agency aspect of capabilities, as our findings show that this capability dimension is most likely to function as a barrier to performing PEB. In this way, environments that play a vital role in expanding individuals' agency capabilities (i.e., individuals' intellectual, cognitive and technical development), such as technical schools, universities, and workplaces should facilitate and highlight the importance of PEB, not only to be performed within these places, but to stimulate the adoption of these behaviors in other places and on other occasions.

5.3. Limitations and future research

The present study presents some limitations. The first limitation relates to our operationalization and measurement of capabilities. The research only relied on a self-developed instrument for measuring capabilities dimensions based on face and concurrent validity, because there is no formal validated three-dimensional operationalization of human capabilities as yet. Although these items were not developed through an extensive validating process, they seemed sufficient for this study, because the study merely aimed for a first exploration of whether it is useful to distinguish these dimensions. Indeed, the results strongly suggest that the three-dimensional distinction in capabilities seem to be more useful than operationalizing capabilities as an aggregated construct only when related to boundary conditions of normative psychological factors and PEB. Thus, future research could benefit from the development and further refinement of a measurement instrument to measure the three general dimensions of human capabilities.

The second limitation concerns our sample. The respondent sample considered in this research presents relatively high levels of income and education compared to the Brazilian average, and these variables are correlated to capabilities (Lorgelly et al., 2015). Thus, the research probably covered individuals with high levels of capabilities, that is, the "affluent" population within the affluence hypothesis. Individuals with lower levels of capabilities face more restrictions, i.e., have less opportunities/freedom, such as a lack of adequate sanitation and other basic services. In this way, the elasticity of capabilities may not be the same as those compared to individuals with higher capabilities, that is, an increase of one unit of capabilities would have more effect in lower levels than in higher levels (Anand and Sen, 2000). Thus, the effect sizes of the direct and moderating relationship of capabilities on individuals with lower capabilities might be higher than for higher levels of capabilities. Future studies could analyze a sample with a different profile covering a wider-range of capabilities levels, especially the lower levels that were largely not present in this research.

The third limitation is related to our measurement of PEB. This research has only presented one general and two specific types of PEB (i.e., household waste PEB and citizenship PEB), which were employed for validating purposes. These behaviors were selected because they encompass the different sets of physical, social, and contextual factors to be performed. Yet, even among these differences, we found some similar results, especially considering the moderation role of human agency CAP on the personal norms and PEB relationships, which support the validity of our findings. The other results, those that present differences according to the type of PEB, indicate that the relationship between capabilities and PEB are context dependent, that is, vary according to the PEB. Therefore, future research should consider more specific types of PEB (e.g., water and energy saving behavior, sustainable transportation, and biodiversity conservation) and structure the dimensions of these types of PEB (e.g., cognitive, physical, and financial effort; impact of the behavior; and capacity for change, Kneebone et al., 2020; Selinske et al., 2020), in order to establish what types of behavioral contexts capabilities could be a useful addition to explain PEB.

The fourth limitation includes the explorative nature of the present study. That is, our study was correlational in nature, which means that no causal inferences can be made (i.e., PLS-SEM is based only on factor analysis and regression and, therefore, is unable to detect causal relationships). In order to understand the plausibility of the directions of our hypothesized relationships, we relied solely on the causality of directions implied by existing literature and theories about human capabilities and PEB. Future studies could apply less explorative methods, such as randomized control trials (commonly applied in health sciences) or differences in differences (an econometric method), to enable scholars to more fully understand the causality of the relationships.

Our final limitation concerns the measurement of personal norms. In the present study personal norms were measured towards general PEB and not (also) towards the two specific types of PEB (i.e., household

waste and recycling and environmental citizenship). Based on past research (e.g., Steg et al., 2011), personal norms that are more strongly specified towards the specific behavioral context show stronger relationships with PEB. Although the main goal of this study was to examine the relationship of personal norms on general PEB, the other two behaviors being included for validating purposes, future research relying on the capability approach should specify personal norms towards the specific PEB.

6. Conclusion

The present research tested the assumption that expanding human capabilities, i.e., opportunities in life, would be related to PEB within a framework integrating the capability approach with personal norms, which is one of the main predictors of PEB. To achieve this goal, the research relied on two approaches to measure human capabilities: capabilities as an aggregated construct and capabilities as a multidimensional construct. The findings suggest that capabilities have, under some circumstances only, a positive relationship with PEB and a capacity to enhance or diminish the relationship between personal norms and PEB. These results contradict and further extend the theoretical assumptions in the human development literature which suggests that increasing human capabilities always has a positive relationship with PEB. In particular, our results suggest that the direction and strength of the relationships between capabilities, personal norms and PEB strongly depend on the specific dimensions of capabilities and the type of PEB. Therefore, scholars could benefit from adding the capability approach in their (normative) theoretical frameworks to better understand PEB, as long as they acknowledge the complexity of dimensions of capabilities in relation to the specific behavioral context of the PEB.

CRedit authorship contribution statement

Pedro Augusto Bertucci Lima: Conceptualization, Methodology, Formal analysis, Writing – original draft. **Octaviano Rojas Luiz:** Conceptualization, Methodology, Software, Formal analysis, Writing – review & editing. **Fernanda Pereira Sartori Falguera:** Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Marcelo Furlan:** Methodology, Software, Formal analysis, Writing – review & editing. **Enzo Barberio Mariano:** Supervision, Writing – review & editing. **Judith Irene Maria de Groot:** Methodology, Validation, Supervision, Writing – review & editing.

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.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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