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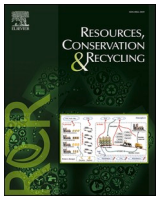

Full length article

A perceptive-emotional model of behavioural intention to consume food grown with nutrients recovered from wastewater

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ABSTRACT

Global food production is threatened by a scarcity of phosphorus, an essential component in most fertilisers. Recovering phosphorus from wastewater may be a potential solution. However, there may be social resistance to consuming food grown with these fertilisers. In this study, we propose a predictive perceptive-emotional model (PEM) that identifies the psychological factors that influence favourable behavioural intention towards the consumption of this kind of food. A total of 1,003 participants in Spain (n = 387), Sweden (n = 378) and the Netherlands (n = 238) answered an online survey. The results show that positive emotions are the main predictor of behavioural intention. Generating these emotions depends on trust in scientists, a low health risks perception and a high benefit perception. Managing these factors is key for governments and international institutions so that they are aware of how public acceptance is generated and can launch programmes to encourage the consumption of such food products.

1. Introduction

By 2100, the global population is expected to reach 11.2 billion people, leading to an unprecedented increase in demand for food (FAO, 2018). This is a challenging situation for the agricultural industry which depends on the use of NPK (nitrogen-phosphorus-potassium) fertilisers to produce food efficiently. Phosphorus is scarce, with uneven geographic distribution, primarily concentrated in Western Sahara and China (Reijnders, 2014). Approximately 80% of the extracted phosphorus is utilised as fertiliser for crops, while 5–10% serves as supplements for animal feed (Johnston et al., 2014). In this sense, the increased demand in fertiliser manufacturing and soil erosion is causing the depletion of available phosphorus reserves (Alewell et al., 2020). This shortage could have serious socio-economic consequences, such as an increase in food prices, a shortage crisis (Cordell et al., 2009) and even violent conflicts for the appropriation of this resource (Allouche, 2011).

In this context, society must look for efficient solutions that put an end to the phosphorus shortage. One promising solution is the recovery of nutrients from wastewater. Wastewater is liquid waste from households, companies or other establishments composed mainly of used water and excreta. Its high phosphorus content makes it an excellent source for the manufacture of fertilisers (Raheem et al., 2018; UN, 2017).

Despite its potential, the use of fertilisers derived from wastewater may be rejected by different sectors of society (Robinson et al., 2012). Some studies have identified strong negative stereotypes associated with wastewater reuse (Hou et al., 2021). Specifically, it has been identified that using these fertilisers would be rejected by around 20–86%, depending on the country (Simha et al., 2021). Therefore, the success of nutrient recovery from wastewater not only depends on its technical benefits, but also on public acceptance of consuming food grown with **FER**tilisers produced with **NU**trients **RE**covered from **WA**stewater (hereafter NUREWAFER).

Thus, it is important to understand the reasons why people decide to consume NUREWAFER foods or not. Like any personal choice, the consumption of these kinds of products is based on a decision-making process in which both perceptive and emotional factors intervene (Damasio, 1998). While previous models have studied certain perceptive and emotional variables separately (Hurlimann et al., 2008; Wester et al., 2016), to the best of our knowledge there are no studies that assess the interaction of both dimensions with each other. Furthermore, previous studies have highlighted the importance of negative emotions on wastewater reuse acceptance (Wester et al., 2016), but the influence of positive emotions and the interaction between both types of emotions has not yet been studied (Fielding et al., 2018). Hence, this study examines the relevance of these two psychological dimensions (perceptive and emotional) by proposing and testing a theoretical model of the

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intention to consume NUREWAFER foods. This allows us to understand, besides their simple effect, the interrelationship between the two dimensions and their joint effect. Additionally, previous studies in the field focus on predicting acceptance (Fielding et al., 2018). However, there is an important gap between attitude and behaviour (e. g., Bagozzi, 1981; Juvan and Dolnicar, 2014). In this sense, one of the main theoretical approaches to the prediction of human behaviour states that the attitude-behaviour relationship is mediated by intention. Whereas an attitude refers to a general assessment of favourability or unfavourability of a stimulus object, behavioural intention refers to the subjective likelihood of performing or not performing a specific action (Fishbein and Ajzen, 1975). Thus, this study goes a step further by trying to predict behavioural intention, the closest antecedent of behaviour. Our proposal is based on two premises. Firstly, people will assess both the agent guaranteeing the safety of NUREWAFER foods and their possible consequences. Secondly, as a result of the previous perception, an emotional reaction towards the foods will arise. This reaction may be positive or negative. Both dimensions combined will lead to a greater or smaller intention to consume these products.

2. Theoretical background

2.1. Perceptive dimension: trust in scientists, health risks perception and costs–benefits perception

The development of technological solutions, including nutrient recovery from wastewater, is essential to tackle any environmental issue. However, these technologies alone are not enough. People must also believe that NUREWAFER foods are an effective solution to a serious problem and that their consumption has no adverse effects. Otherwise, society will reject them and strongly oppose their commercialisation (Hurlimann and Dolnicar, 2010).

The trust society places in whoever is providing the solution is essential to the generation of these perceptions (Eiser et al., 2002; Ryu et al., 2018), especially when the technological solution is new and unfamiliar (Siegrist and Cvetkovich, 2000). Trust is based on two key factors: (a) the competence attributed in the field —management, knowledge and expertise— and (b) the perceived intentions —integrity, honesty and fairness (Twyman et al., 2008). Both factors emerge from interaction with others and are shaped by the perception of tacit social agreements, so trust is a social construct (Cologna and Siegrist, 2020). Amongst the possible agents of influence, the scientific community is the institution that is trusted the most regarding environmental technologies (Fielding et al., 2015; Leviston et al., 2006).

Trust is critical because it is associated with two factors: (a) health risks perception, and (b) cost–benefit perception (Bronfman et al., 2008; Ross et al., 2014). Both are proximal variables for accepting wastewater reuse (Bronfman et al., 2008; Domènech and Saurí, 2010). This is the case because they respond to a basic human motive: to avoid harm and seek reward. Yet, the perception of risks and benefits is not necessarily a calculation of probabilities based on objective knowledge (Breakwell, 2014). Rather, it is related to the anticipation of harmful or beneficial, real or imaginary consequences that are derived from specific events (Slovic, 2000). People would be more motivated to consume NUREWAFER foods if they perceived mainly positive consequences. If, however, they anticipate negative ones, such as a potential health risk, people will be inclined to take protective and preventive action (Renner et al., 2015).

2.2. Emotional dimension: positive or negative emotions

According to the cognitive appraisal theory (Lazarus, 1982), perceptions and emotions are closely linked following a basic scheme: stimulus-evaluation-emotion-response. The theory states that the emotions experienced are the result of a subjective evaluation of the characteristics of the stimulus. Therefore, different emotions will be activated depending on how we perceive the origin, the familiarity/novelty or the perceived costs/risks and benefits of the object. A person who perceives a technological solution as a threat will experience emotions that are completely different from those felt by someone who perceives an opportunity (Venkatesh, 2000). In this regard, the possibility of consuming NUREWAFER foods will activate positive emotions if the benefits are perceived to be greater than the risks/costs. By contrast, if harm is anticipated, negative emotional reactions will be generated (Smith and Lazarus, 1990). Once activated, emotions act as signals that guide the individual's course of action (Lazarus, 1984). Despite the relevance of emotions in predicting pro-environmental behaviours, such as the use of recycled water (Carrus et al., 2008; Gao et al., 2019; Nancarrow et al., 2009), their specific influence on NUREWAFER foods consumption has not been analysed.

Due to the origin of NUREWAFER foods, it must be assumed that some people will experience negative emotional reactions just by thinking about consuming these kinds of products. They may believe that an element that has been in contact with a contaminant permanently acquires its harmful properties, even when it is guaranteed that said element has been fully purified. This psychological process has been referred to by different authors as "spiritual contagion" (Fu and Liu, 2017; Rozin et al., 1999, 2015). In this regard, NUREWAFER foods could provoke negative emotions, such as disgust, the physiological reaction of which is aimed at moving away and rejecting the provoking stimulus. As well as disgust, fear could arise as a response to the potential threat that these foods could pose to human health (Brader and Marcus, 2013). In addition to these two emotions that activate avoidance behaviour, there is a third one associated with tackling an unwanted situation: rage or anger. Rage is a way of channelling dissatisfaction with those responsible for a situation that threatens personal/collective wellbeing (Sabucedo et al., 2011; van Zomeren et al., 2008). If society perceives NUREWAFER foods as harmful, anger may trigger public condemnation of their promoters, and people may attempt to impede this environmental initiative (Russell and Firestone, 2021).

However, not all technological solutions to an environmental issue evoke negative emotions. They can also activate positive ones (Contzen et al., 2021). If people accept that consuming NUREWAFER foods is safe, a sense of ease will replace fear and worry (Brader and Marcus, 2013). Those committed to the environment could also experience a high degree of satisfaction and pride (de Young, 2000; Onwezen et al., 2013) for aligning their actions with their social identity (Tracy and Robins, 2007). This is especially relevant in societies where environmentally friendly attitudes are more likely to be considered the norm (e. g., European Green Deal or Youth for Climate). Acting in line with this normative context translates into the individual's social recognition, which, in turn, will allow them to experience pride. As a result, they will be more likely to continue behaving in a pro-environmental way (Bissing-Olson et al., 2016).

2.3. Objectives and proposed model

The objective of this study is to find out which psychological factors predict behavioural intention to consume NUREWAFER foods. To do this, we propose a predictive model based on the perceptive —trust in scientists, costs–benefits and health risks perception— and emotional —positive and negative emotions— dimensions: The Perceptive-Emotional Model (PEM, see Fig. 1). Based on cognitive appraisal theory and the above-mentioned insights on perception and emotion, we formulate the following hypothesis:

- *Hypothesis 1* – Trust in scientists will positively predict the perceived benefits of consuming NUREWAFER foods. The greater the trust in scientists, the greater the perceived benefits and the lower the costs.
- *Hypothesis 2* – Trust in scientists will negatively predict the perceived health risks of consuming NUREWAFER foods. The higher the trust in scientists, the lower the perceived health risks.

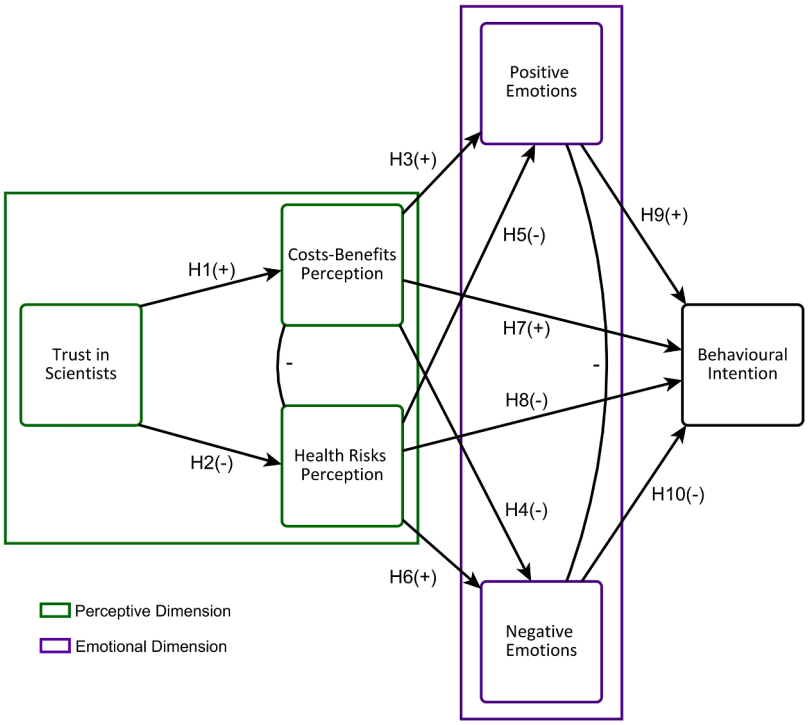

Fig. 1. Proposed Model: Perceptive-Emotional Model (PEM). The variables of the model are grouped into two theoretical dimensions: (a) the perceptive dimension, which includes trust in scientists, costs–benefits perception and health risks perception; and (b) the emotional dimension, which includes both positive and negative emotions. These two dimensions converge in the behavioural intention to consume NUREWAFER foods.

- *Hypothesis 3* – Perceived benefits will positively predict the experience of positive emotions. High perceived benefits and low perceived costs will be associated with higher positive emotions.
- *Hypothesis 4* – Perceived benefits will negatively predict the experience of negative emotions. High perceived benefits and low perceived costs will be associated with lower negative emotions.
- *Hypothesis 5* – Perceived health risks will negatively predict the experience of positive emotions. The more perceived risks, the less positive emotions.
- *Hypothesis 6* – Perceived health risks will positively predict the experience of negative emotions. The more perceived risks, the more negative emotions.
- *Hypothesis 7* – Perceived benefits will positively predict the behavioural intention to consume NUREWAFER foods. High perceived benefits and low perceived costs will be associated with higher behavioural intention.
- *Hypothesis 8* – Perceived health risks will negatively predict the behavioural intention to consume NUREWAFER foods. The more perceived risks, the less behavioural intention.
- *Hypothesis 9* – Positive emotions will positively predict behavioural intention to consume NUREWAFER foods. The more positive emotions, the more behavioural intention.
- *Hypothesis 10* – Negative emotions will negatively predict behavioural intention to consume NUREWAFER foods. The more negative emotions, the lower the behavioural intention.

3. Method

3.1. Participants and procedure

The model was originally tested with a sample of 387 randomly selected participants that were stratified by sex and age (52.2% females, M_{age} = 46.23, SD = 12.73, $Range$ = 18 - 86). The data was collected in Galicia, Spain, between 18 October and 11 December 2019. Subsequently, the study was reproduced with two convenience samples from different geographical locations. Specifically, data was collected in Scania, Sweden (n = 378, 58.4% females; M_{age} = 43.99, SD = 18.04, $Range$ = 18 - 89) between 15 June and 7 July 2021 and in Friesland, the Netherlands (n = 238, 50.2% females; M_{age} = 48.86, SD = 19.30, $Range$ = 18 - 88) between 15 and 23 July 2021. In total, 1003 people took part (54.1% females; M_{age} = 46.01, SD = 16.62, $Range$ = 18 - 89). The three sites were selected in response to the requirements of the international and multidisciplinary project in which this work is framed. The main reason for the selection of the three sites is the importance of the agricultural industry in the areas (European Statistical Office, 2023; ICEX, 2023; Skoglund, 2022). The use of animal manure as a fertiliser is common in these areas and could be complemented by the use of nutrients recovered from domestic or other treated sewage. This recovered nutrients could help fulfil the needs of farmers and fertiliser companies to effectively supply food to the population. The full description of the sample is available in the supplementary material.

Participants answered an online survey that was administered in Galicia by a company that specialises in market research. The company distributes the questionnaire by drawing on a pool of participants, based on the quotas established for the sample. At the other two sites, staff from the project research team imported and distributed the survey using the SurveyMonkey platform. Although no specific quotas were specified in the recruitment, the Scania and Friesland samples had a similar demographic composition to the initial Spanish sample. The University of Santiago de Compostela's bioethics committee approved the study. Before starting the survey, the participants received information about the study's objectives and conditions, and they provided consent for the processing of their data.

3.2. Measurements

The survey included six different measures that are described in more detail in the following sections. For all of them, we used ordered response categories with specific labels at each end that were adapted to the item's content (Saris et al., 2010).

3.2.1. Trust in scientists

Trust in scientists was measured with the following statement based on previous studies on acceptance (Eiser et al., 2002; Hurlimann et al., 2008): "To what degree do you trust scientists to guarantee the safety to consume foods (fruit, vegetables, legumes, etc.) grown with fertiliser-s/composts produced with nutrients recovered from treated wastewater?" (from 0 = *I do not trust them at all* to 10 = *I trust them a lot*).

3.2.2. Costs–benefits perception

Costs–benefits perception was measured through three items based on previous studies by Hurlimann et al. (2008) and Mankad et al. (2011). The participants had to answer whether they "consider that consuming these kinds of foods would be harmful or beneficial for… (a) The environment, (b) The economy and (c) Future generations" (from 0 = *Harmful* to 10 = *Beneficial*). The value of Cronbach's alpha coefficient was .872 for Galicia, .894 for Scania and .879 for Friesland.

3.2.3. Health risks perception

Health risks perception was measured with a scale involving three items based on previous studies (Fielding and Roiko, 2014; Nancarrow et al., 2009). The participants were asked to indicate to what degree they "consider that consuming these kinds of foods is a health risk for… (a) The population in general, (b) Children or the elderly and (c) You and your family" (Galicia: from 0 = *No risk* to 10 = *High risk*; Scania and Friesland: from 1 = *No risk* to 7 = *High risk*). For model estimation purposes, the scores have been standardised (*Z* values). Cronbach's alpha coefficient was .967 for Galicia, .946 for Scania and .933 for Friesland.

3.2.4. Positive and negative emotions

Emotions were assessed with six items based on studies by Ekman and Cordaro (2011) and Fielding and Roiko (2014). Participants had to express how they felt when thinking about consuming NUREWAFER foods (from 0 = *Not at all* to 10 = *A lot*). Three of the items referred to positive emotions: Proud, Satisfied, Calm (Cronbach's α Galicia = .931; Scania = .916 and Friesland = .852). The three remaining ones referred to negative emotions: Worried, Disgusted, Angry (Cronbach's α Galicia = .847, Scania = .863 and Friesland = .852).

3.2.5. Behavioural intention

Behavioural intention was made up of three items that were created by the study team, which consider different aspects of behavioural intention regarding NUREWAFER foods: recommending their consumption, voting in favour of promoting their sale and buying these kinds of foods. These items were written as follows: "Would you recommend the consumption of foods (fruit, vegetables, legumes, etc.) grown with fertilisers/composts produced with nutrients recovered from treated wastewater?"; "Would you vote in favour of the government encouraging the sale of these foods?"; and "Would you buy these kinds of foods?" The participants had to answer from 0 (*Certainly not*) to 10 (*Certainly yes*). Cronbach's alpha coefficient was .964 for Galicia, .957 for Scania and .900 for Friesland.

3.3. Data analysis

We used the Structural Equation Modelling statistics technique to assess the predictive capacity of the model and find out the contribution of each one of the variables to behavioural intention towards NUREWAFER foods. To check model fit, we used the following reference values (Hu and Bentler, 1999): .95 for CFI (Comparative Fit Index) and for TLI (Tucker-Lewis Index), .06 for RMSEA (Root Mean Square Error of Approximation), and .08 for SRMR (Standardised Root Mean Square Residual). The estimations were made with version 7.4 of Mplus using the maximum likelihood with robust standard errors method (MLR), because the assumption of normal distribution of the variables in this sample was not fulfilled (Yuan and Bentler, 1998).

4. Results

The descriptive results relative to means, standard deviations and correlations between variables of the three samples are available in the

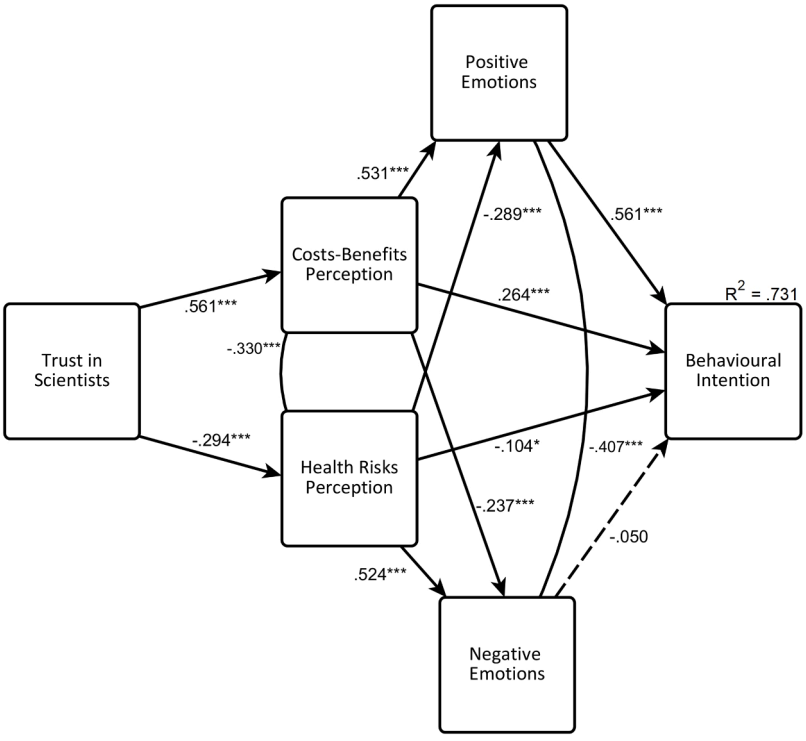

Fig. 2. Perceptive-Emotional Model (PEM) of Behavioural Intention to Consume NUREWAFER Foods in Galicia. The statistics represented by a straight line correspond to standardised regression coefficients (β). The statistics represented by a curved line are residual correlations. The relationships represented by a discontinuous line indicate that the relationship is not significant. *$p < .05$. ** $p < .01$. *** $p < .001$.

supplementary material.

4.1. Structural model in Galicia (Spain)

The PEM showed a good fit and predictive capacity: χ^2 (3, N = 387) = 4.929, p = .177; CFI = .997; TLI = .984; RMSEA = .041 (90% CI [.000, .103]); SRMR = .016; R^2 = .731, p < .001.

The results indicate that people who trust the scientific community perceived that more benefits and fewer health risks derive from consuming NUREWAFER foods. This perception of few risks and great benefits encouraged positive emotions towards NUREWAFER foods, while perceiving high risks and low benefits generated negative emotional reactions. Regarding the direct predictors of behavioural intention, positive emotions had the greatest impact, followed by perceived benefits and health risks (see Fig. 2).

In contrast to positive emotions, negative emotions were not a significant predictor of behavioural intention in the model. However, when we analysed the relationship on its own, negative emotions had a large and significant effect on behavioural intention (β = −.596, p < .001). This may be because although negative emotions have an effect on intention, their contribution is not unique and can be explained by the rest of the predictors included in the model. Indeed, as shown in the model, the partial regression coefficient (controlling for positive emotions and the perception of benefits and risks) was not significant (β = −.050, p = .305; similar effects in the other two sites, see supplementary material).

4.2. Reproduction of the model in Scania (Sweden) and Friesland (The Netherlands)

The original model in Scania showed a good predictive capacity. However, the TLI and RMSEA indexes did not reach the adequate fit values in the model: χ^2 (3, N = 378) = 38.678, p = .001; CFI = .954; TLI = .771; RMSEA = .179 (90% CI [.131, .231]); SRMR = .045; R^2 = .712, p < .001. This may reflect that the original model is not considering all significant relationships between the variables. For this reason, we included two new relationships based on the fit modification indices suggested by the Mplus software: (a) trust in scientists → positive emotions and (b) trust in scientists → behavioural intention. That is, a high level of trust in scientists predicts the activation of positive emotions and greater behavioural intention to consume NUREWAFER foods. Fig. 3 indicates the estimated relationships for the original model and the modified model, which showed a good fit: χ^2 (1, N = 378) = 0.155, p = .694; CFI = 1.000; TLI = 1.000; RMSEA = .001 (90% CI [.001, .101]); SRMR = .003; R^2 = .730, p < .001.

The results for the model in Friesland were similar to those from Scania. The predictive capacity of the model was good. However, the TLI and RMSEA indexes did not reach the adequate fit values in the model either: χ^2 (3, N = 238) = 21.787, p = .001; CFI = .947; TLI = .737; RMSEA = .163 (90% CI [.103, .230]); SRMR = .043; R^2 = .625, p < .001. The modification indices provided by the Mplus software suggested the inclusion of the two relationships that were also proposed for Scania: (a) trust in scientists → positive emotions and (b) trust in scientists → behavioural intention. Fig. 4 shows the estimated relationships for the original model and the modified, which showed a good fit: χ^2 (1, N = 238) = 1.168, p = .280; CFI = 1.000; TLI = .993; RMSEA = .027 (90% CI [.001, .177]); SRMR = .010; R^2 = .637, p < .001.

Accordingly, we considered it relevant to test these two new relationships in the model from the original Galician sample. Both were not significant: trust in scientists → positive emotions (β = .028, p = .579); trust in scientists → behavioural intention (β = .083, p = .061). Interestingly, the Galician sample shows significantly more trusts in scientists than the other two samples ($M_{Galicia}$ = 7.35, SD = 2.23; M_{Scania} = 6.30, SD = 2.72; $M_{Friesland}$ = 6.36, SD = 2.27; $F_{(2, 993)}$ = 21.16, p < .001).

5. Discussion

The objective of this study was to identify the main psychological predictors of behavioural intention to consume NUREWAFER foods. To this end, we proposed a prediction model (PEM) with two dimensions: (a) a perceptive dimension—trust in scientists, health risks perception and costs–benefits perception—and (b) an emotional dimension—-positive and negative emotions.

5.1. The role of perceptions in behavioural intention towards nurewafer foods

The results highlight the relevant role of trust in scientists to consume NUREWAFER foods. In Galicia, this influence is indirect, with a higher perception of benefits and a lower perception of health risks. In the other two samples, in addition to this indirect influence, a direct influence on behavioural intention to consume such foods can also be observed. These results highlight the impact of trustworthy sources on

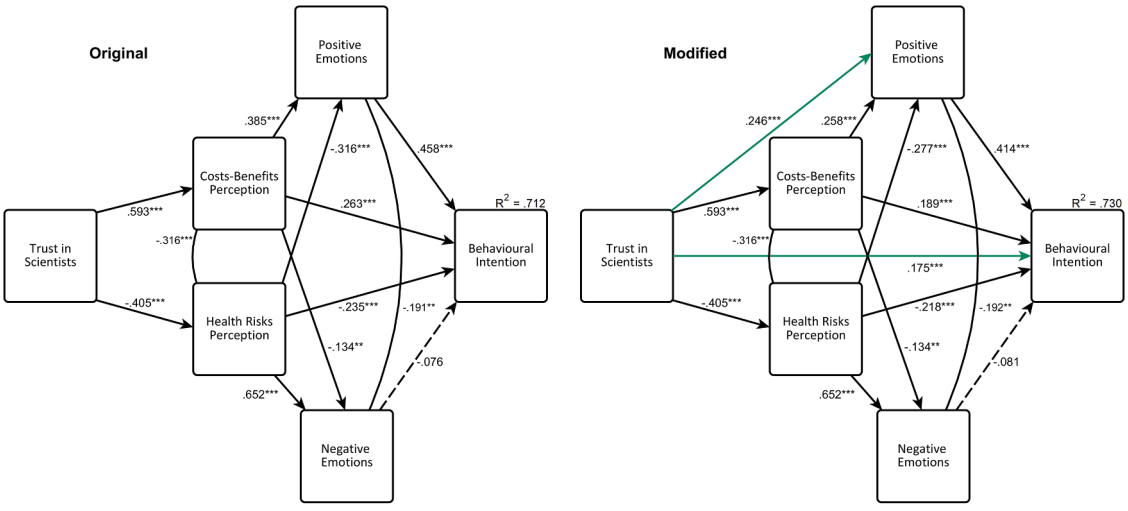

Fig. 3. Original Model and Modified Model of Behavioural Intention to Consume NUREWAFER Foods in Scania. The relationships represented by a green line were incorporated into the original model based on the model modification indications proposed by Mplus. The statistics represented by a straight line correspond to standardised regression coefficients (β). The statistics represented by a curved lined are residual correlations. The relationships represented by a discontinuous line indicate that the relationship is not significant. *p < .05. ** p < .01. *** p < .001.

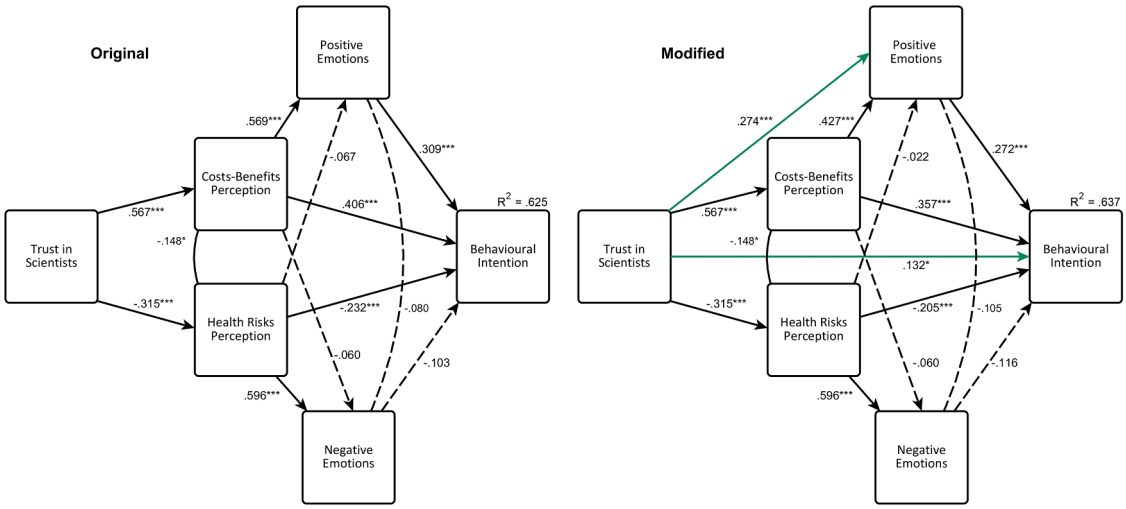

Fig. 4. Original Model and Modified Model of Behavioural Intention to Consume NUREWAFER Foods in Friesland. The relationships represented by a green line were incorporated into the original model based on the model modification indications proposed by Mplus. The statistics represented by a straight line correspond to standardised regression coefficients (β). The statistics represented by a curved lined are residual correlations. The relationships represented by a discontinuous line indicate that the relationship is not significant. *$p < .05$. ** $p < .01$. *** $p < .001$.

people's perceptions and behaviours, particularly regarding unfamiliar topics such as NUREWAFER foods (Eiser et al., 2002; Siegrist and Cvetkovich, 2000; Ryu et al., 2018). The lack of information or technical background to understand how they work generates uncertainty about how to act. This uncertainty provokes anxiety, which is an unpleasant psychological state that people try to avoid. In this way, epistemic demand is activated, which is satisfied by following the guidelines set by reference groups (Sabucedo et al., 2020). In the context of the production of new foods and their relationship with health, many people look to science for answers (Cologna and Siegrist, 2020). This allows them to adopt a position, which in turn causes the uncertainty to disappear.

In view of the results found, appointing scientists as agents to disseminate information could be relevant to reduce perceived risks and costs and increase perceived benefits. However, this will only be relevant for those who trust in scientists. In this regard, it is important to note that people also trust other agents beyond scientists, who can influence public opinion with their positions (Cologna and Siegrist, 2020). If these actors are against or express doubts about consuming NUREWAFER foods, it could lead to a trust crisis and strong opposition (Hurlimann and Dolnicar, 2010). Therefore, before presenting the project to society, it is necessary to seek the support from different influential agents. To this end, it is important to design participation policies with all sectors concerned with these topics (e. g., consumer organisations or environmental groups). This will allow for the creation of shared diagnoses regarding the food issue and alternative solutions, and thus reduce mistrust towards the consumption of NUREWAFER foods.

Encouraging participation is proposed as a means to generate trust and can impact the perception of risks and benefits, which is fundamental to the acceptance of wastewater reuse (Bronfman et al., 2008; Domènech and Saurí, 2010). Our study assessed, beyond acceptance, the closest antecedent of behaviour: behavioural intention. The PEM shows that people were more willing to consume NUREWAFER foods if they perceive few health risks and great benefits.

Of these two variables, benefit perception has a greater impact on behavioural intention in two of the samples (Galicia and Friesland), and a similar effect to risk perception in Scania. This result differs from previous research, which identified risk perception as the most significant factor (Fielding et al., 2018). This discrepancy could be attributed to the type of behaviour/solution being analysed, as well as the type of sample and context. The use of animal excrements as a fertiliser is common in the European areas where this study was performed. As this practice has been implemented without adverse effects over time, people may not perceive it as something negative. As a result of these experiences, a "resonance" effect is produced in the context of NUREWAFER foods. They are no longer perceived as new and threatening, becoming instead "familiar" and, as a result, controllable (Slovic, 2000). Additionally, it is also worth considering the perceived risk–benefit relationship. People tend to understand that a certain level of risk is acceptable when there is a perception of great benefits (Starr, 1969).

5.2. *The relevance of positive emotions in behavioural intention towards nurewafer foods*

The PEM shows that the effects of the perception of risks and benefits on intention are essentially due to their capacity to activate emotions associated with NUREWAFER foods. As stated in the cognitive appraisal theory, the outcome of the perceptive analysis will determine the kind of emotion and its direction: positive or negative (Lazarus, 1982). Specifically, perceived harms, losses or threats often trigger negative emotions, such as anger, anxiety, fear, sadness or disgust. In contrast, perceived benefits can promote positive emotions, such as happiness, joy, pride or gratitude (Lazarus, 1991). Consistent with cognitive appraisal theory, the PEM identifies that perceiving a high level of risks and costs leads to negative emotional reactions. In turn, the perception of few risks and great benefits encourages the appearance of positive emotions. However, only positive emotions predict behavioural intention to consume NUREWAFER foods.

This finding contrasts with previous studies, which indicates that negative emotions, such as the "yuck factor" (Schmidt, 2008), are a significant barrier to the acceptance of wastewater reuse (Etale et al., 2020; Wester et al., 2016). However, these studies did not consider either the single effect of positive emotions or their interaction with negative emotions (Fielding et al., 2018). Previous models analysed negative emotions exclusively (Wester et al., 2016), or used a bipolar scale (negative–positive) (Nancarrow et al., 2009). As a result, the effect of positive emotions may have been underestimated and the effect of negative emotions may have been overestimated. The PEM responds to the gap in the literature by assessing the effect of both emotional reactions on behavioural intention to consume NUREWAFER foods, showing that positive emotions, but not negative emotions, have a significant impact.

The reason for which the effect of negative emotions is displaced by

the effect of positive emotions could be due, alongside the aforementioned familiarity factor, to the level of contact with NUREWAFER foods. If contact with the contaminating stimulus is high, people perceive contagion and feel disgust to avoid possible sources of disease (Fielding et al., 2018; Rozin et al., 2016). However, this may not be the case for NUREWAFER foods, as their contact with the contaminant stimulus is indirect. First, the phosphorus is separated from wastewater. Then, this phosphorus is used to produce fertilisers. And, finally, these are used to grow the food.

The significant influence of positive emotions may be due to their role as a reinforcement mechanism for pro-environmental behaviour. In contexts where it is socially valued, the anticipation of emotions such as pleasure and satisfaction drive people to act pro-environmentally (Hartmann et al., 2017). Similarly, people will experience pride if they perceive that their pro-environmental behaviour leads to social recognition or an increase in their social prestige (Tracy and Robins, 2007). In this regard, public institutions and companies should publicly recognise people's efforts to change their shopping habits for the greater good (Uren et al., 2021). By creating social norms favourable to NUREWAFER foods, a sense of moral obligation to meet social expectations can be activated (Steg et al., 2005). This can lead people to feel like better citizens (Venhoeven et al., 2016), and they will experience more satisfaction and pride for doing what they believe is right (Sabucedo et al., 2018).

5.3. *Practical implications, limitations and further steps*

This study addresses some of the factors that influence behavioural intentions related to the consumption of NUREWAFER foods. Based on the results of the study, we offer several key recommendations for the promotion of NUREWAFER foods.

First, the high level of trust placed in scientists underscores their key role as trustworthy sources who can effectively prevent the activation of biases and misperceptions concerning NUREWAFER foods. Second, messages aimed at the promotion of these foods should focus on the advantages and benefits associated with their consumption. Mentions of low health risks could be counterproductive. Cognitive activation of the concept of "risk", even if expressed as minimal, may result in protective behaviours, and dissuade potential consumers. Lastly, campaigns should take into consideration the activation of positive emotions, given their importance in predicting behavioural intention. One strategy to do this is to integrate real-world examples of individuals and communities actively choosing NUREWAFER foods, preferably examples that people can identify with (Schultz and Fielding, 2014). Such examples should highlight their contributions to building a more sustainable future. This approach, on the one hand, would foster a sense of calmness regarding consumption. On the other hand, it could help establish a favourable normative framework, encouraging people to anticipate feelings of pride and satisfaction when consuming these sustainable food options.

The relationships established in this study must be interpreted in a predictive sense, not a causal one. Discovering these relationships is of great value. With them, we can identify which psychological factors that are involved in people's behavioural intention to consume NUREWAFER foods. However, it's necessary to recognize certain limitations. First, the questionnaire emphasises that fertilisers are produced with organic faecal matter from households (highlighted in bold). In principle, participants should easily understand the meaning of the sentence. But to be sure that this is the case, a check question can be incorporated in future work. Second, it is necessary to mention the presence of the intention–behaviour gap, a phenomenon extensively documented in pro-environmental behaviour studies (Grimmer and Miles, 2017; Hassan et al., 2016). While studying behavioural intention provides a closer approximation to behaviour compared to the study of attitudes (acceptance), we consider it necessary to conduct research focusing on actual behaviour. Finally, future studies should design experimental situations that can establish whether causal relationships exist between the variables studied.

6. Conclusions

NUREWAFER foods have emerged as a sustainable alternative to solve the anticipated fertiliser shortage crisis, growing food by transforming waste into a resource. Even though NUREWAFER foods may be a step forward, it is still possible that society might oppose their consumption. This study addresses some of the reasons that impact behavioural intention to consume NUREWAFER foods. First, according to the findings, scientists can be used as agents to present the technology since they are trustworthy and confident in handling the product. Second, people will be more accepting if they perceive that NUREWAFER foods do not pose health risks and benefit the economy, the environment and future generations. Third, the results also show that these perceptions are linked to strong positive emotions, which increase society's willingness to consume NUREWAFER foods. Managing these factors is key so that governments and international institutions can implement, if necessary, programmes that encourage the consumption of such foods. Finally, contrary to what was hypothesised, negative emotions did not have a significant effect on behavioural intention towards NUREWAFER foods. In sum, technology is essential to achieve sustainability and circular economy goals. Yet, as this study shows, so is society's willingness to accept or reject the proposed policies and technologies. And for this, it is necessary to consider people's perceptive–emotional processes towards these new sustainable behaviours.

CRediT authorship contribution statement

Sergio Vila-Tojo: Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Jose-Manuel Sabucedo:** Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing. **Elena Andrade:** Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Cristina Gómez-Román:** Conceptualization, Methodology.

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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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.resconrec.2023.107386.

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