

Consumer attitudes towards nanotechnology

The influence of naturalness

BSc thesis - Marketing and Consumer behavior group
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The aim of this study was to test if naturalness is a predictor of acceptance in the case of a food products produced with nanotechnology. This was tested with empirical research to set up a model and an online survey to test the model. It was expected that adding nanotechnology to a less natural product had a smaller effect on the willingness to buy compared to adding nanotechnology to a natural product. This model included the determinants 'level of processing' and 'produced with nanotechnology' influencing naturalness. Naturalness itself had an effect on affect, affect effects benefit and risks which both influence willingness to buy. Significant effects of naturalness on affect and affect on benefits, risks and willingness to buy were found. The expected difference of willingness to buy between a natural and a less natural product was found, proving that a part of the variance of willingness to buy is indirect influenced by the naturalness of the product.

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Introduction

Food has always been a crucial factor in our society. Therefore new food technologies are constantly being developed to make the production of food more efficient, sustainable and healthier; one of these new technologies is nanotechnology. This technology refers to a broad range of advanced applications that deal with particles and structures smaller than 100 nanometre (a sheet of paper is about 100,000 nanometres thick). This technology is useable for a wide range of products including food. Using nanotechnology to produce food can be useful for several applications; for example filtering drinking water for third world countries, decreasing food decay and food waste, adding better developed nutrition's to make food healthier or less fat (U.K. Royal Society and Royal Academy of Engineering 2004).

Nanotechnology is not frequently used for food products because the consumer acceptance is still unknown. The importance of consumer acceptance can be shown with an example from genetic modification. After implementation of this new food technology the consumers rejected these products. This made further implementation of genetic modification in products more difficult and expensive. Research has been done to get an overview of the important determinants influencing acceptance or rejection of a product to prevent a similar negative consumer response in the case of nanotechnology (U.K. Royal Society and Royal Academy of Engineering). Therefore public attitudes should be researched at an early stage of the development of nanotechnology.

Two of the important determinants influencing the acceptance of a product produced by nanotechnology are already known: trust in institutions and the personal importance for natural products of the consumer (Tenbült, Vries, Dreezens, & Martijn 2005; Siegrist, Cousin, Kastenholz & Wiek 2007). Trust has already been proven to have a significant effect on the acceptance of nanotechnology (Siegrist, Stampfli, Kastenholz, & Keller 2008) and Siegrist et al. 2007 found that personal importance for natural products also had an effect on the acceptance of nanotechnology. This raises the question if not only the personal importance for natural products but also the naturalness of the product itself could also be a factor influencing acceptance. Therefore the naturalness of a product as a factor influencing acceptance of nanotechnology was examined in this study.

Theoretical background

The first factor influencing acceptance, trust in institutions was studied by Siegrist et al. 2007. A model was used to test whether the factor trust in institutions influenced the willingness to buy a product produced with nanotechnology.

This model shows that trust in institutions has an influence on affect. Affect then effects benefits and risks which both have an effect on willingness to buy. Siegrist et al. (2007) found trust as a factor effecting the willingness to buy of a product produced with nanotechnology. Willingness to buy was in this case a measure to indicate acceptance. People do not know enough about nanotechnology to have an well considered opinion about this food application, therefore they need to trust the information given to them by scientific institutions, consumer protection agencies, food industry and retail (Siegrist et al. 2007).

Beside the factor trust in institutions also the personal preference of respondents was found to be a factor influencing willingness to buy. Respondents who attached a high importance to naturalness were less likely to buy a product produced with nanotechnology. According to Siegrist and colleagues (2008, p. 287) "Respondents for whom naturalness of food was important perceived more risks associated with nanotechnology compared with respondents for whom naturalness of foods was less important", also the importance of naturalness influenced the perceived benefits in a negative way.

Whether the naturalness of a product influences willingness to buy is to our knowledge not known yet. In a comparable study about the acceptance of genetic modification, Tenbült et al. (2005) found naturalness as a factor influencing the public acceptance of genetic modified food. This study showed that a product produced with genetic modified product which is processed is more likely to be accepted than a genetic modified product which is not processed. Gamble, Muggleston, Hedderley, Parminster & Vaughan (2000) suggested that the acceptance of genetic modification is food specific. Consumers are more interested in labels when they are purchasing a healthy item, than when they are purchasing a 'unhealthy' snack. According to Gamble et al. (2000) consumers care less about a possible unhealthy production technology if the product is already unhealthy itself compared to a healthy product.

Naturalness can be difficult to measure because it is influenced by multiple factors, for this study the guidelines of Rozin (2005) are used. Rozin showed that when people ranked naturalness of a product, the naturalness of a product tends to decrease by when the product had been processed. Depending on how the product was processed and what kind of additives and ingredients were used influenced the eventual score on naturalness.

In addition literature shows that people given the choice will prefer products which are perceived as more natural than other products. Both Tenbült et al. and Siegrist et al. (2008) found that adding technology to a natural product will have a larger impact on the perceived naturalness than adding technology on a less natural product.

Because nanotechnology is a technical appliance we expected the presence of nanotechnology in a food product to have a negative influence on the acceptance of the product where it would drop the initial perceived naturalness.

The influence of perceived naturalness of a product will be tested using the already existing model of (Siegrist et al. 2007)(figure 1).

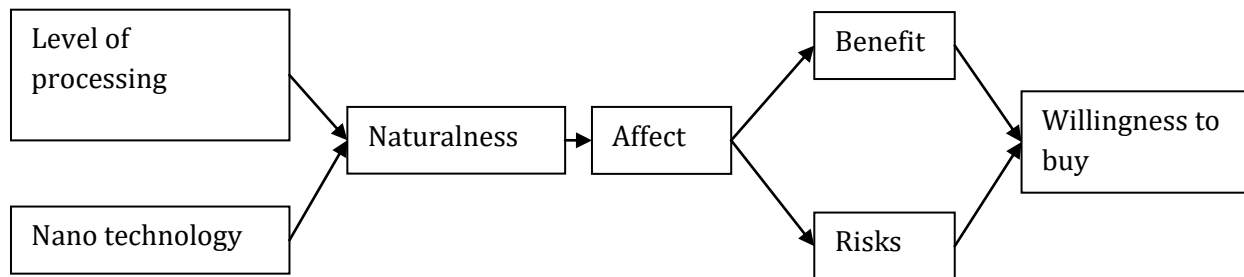


Figure 1: Willingness to buy a food product produced with nanotechnology influenced by naturalness

To test this model the following hypothesis's are formulated:

Hypothesis I: A product with a high level of processing will have a negative effect on the perceived naturalness of the product compared to a low level of processing.

Hypothesis II: If a product is produced with nanotechnology, it will be perceived less natural compared to the same product produced without nanotechnology.

Hypothesis III: The combination of a product which is produced with the help of nanotechnology and has a high level of processing will have a negative effect on the perceived naturalness.

Hypothesis IV: Perceived naturalness has a positive effect on the affect of people towards the product.

Hypothesis V: Positive affect has a positive effect on the perceived benefits of a product.

Hypothesis VI: Positive affect has a negative effect on the perceived risks of a product.

Method

An experiment was conducted to test the hypotheses. The survey used for this study can be found in annex 1.

Respondents

The respondents were a convenience sample of students of Wageningen University and personal friends. All together 217 voluntarily answered surveys were used for the results, not all surveys were filled in fully by respondents therefore the average scores were used. The group of respondents consisted for 67.7% of female and 32.2% of male respondents. The average age of the respondents was 22.6 years with a minimum of 17 years and a maximum of 62 years. The results show that the survey was filled in by highly educated people, the following numbers show the highest finished Dutch education level of the respondents (45% VWO, 32.9% WO BSc and 10.7% WO MSc). The respondents scored an average low score on neophobia on a 7 point scale ($\mu=2.85$, $sd=1.47$).

Design

The survey was filled in by two test groups, a control group and a nanotechnology group to test the hypotheses between groups. Also the hypotheses were tested within groups by a repeated measure of two products groups per test group. The control group answered questions about four products and the nanotechnology groups got the same four products but now produced with nanotechnology to test the hypotheses within groups.

Stimuli

The four products used into the survey were divided in two groups: the egg product group and the tomato product group. Within these groups the level of processing was manipulated. The egg product group had two products, one had a low level of processing (a boiled egg) and the other product had a high level of processing (egg salad). The tomato was manipulated the same way as the egg with snack tomatoes as product with a low level of processing and tomato puree as product with a high level of processing.

The influence of nanotechnology was manipulated by the two different test groups. The nanotechnology group had products produced with nanotechnology and the control group had the same products without nanotechnology.

Measures

Per product the respondent was asked to give a score on a 7 point scale (Miller, G.A. (1956)) for nine different questions. The first scale consisted of one question about naturalness, with score 1 = unnatural to score 7 = natural.

The following four questions were based on the affective circumplex (Russell, 1980) to measure affect. The objects on the horizontal negative/positive axis of the circumplex were used for the questionnaire (negative/positive, glad/miserable, sad/cheerful, upset/content) measuring the affect of the respondent towards the product.

The objects risks, benefits and acceptance were measured with questions based on the questions used by Siegrist et al. 2007 where willingness to buy is a measure for acceptance. Instead of a 5 point scale Siegrist and colleagues used, this study used a 7 point scale.

The scale on healthiness was self constructed and based on the former questions to measure the healthiness of the product.

To measure neophobia, the ten questions of (Pliner & Hobden, 1992) based on an existing Dutch translation (Landelijk kenniscentrum kinder- en jeugdpsychiatrie, n.d.).

The nanotechnology group had to answer two extra questions to measure the knowledge on nanotechnology. These questions were self-constructed and based on the questions of Siegrist 2007. The first question was whether they ever heard about nanotechnology before, answering with yes or no, and an indication on a 7 point scale how much they already knew about nanotechnology according to themselves.

The demographical factors included gender, age and last completed education of the respondent.

Procedure

The questionnaire started with an introduction. After the introduction the respondents were randomly assigned to two groups, either the nanotechnology group (N=108) or the control group (N=109).

Each group filled in the questions about naturalness, affect, risks, benefits, healthiness and acceptance in a pre-set order for all the products. The order of the objects asked in the questionnaire was based on the theoretical framework. With the objects on the left side first going further to the right. The order of the products with its corresponding questions was randomised.

After answering the questions about all the products, the neophobia questions were asked in a pre-set order followed in case of the nanotechnology test group, by the nanotechnology knowledge questions.

The last questions were the demographical questions followed by a message to thank the respondent for filling in the questionnaire.

Pilot study

A pilot questionnaire (N=8) was conducted to test the questions and which products were best suitable for this study (Annex 2). The products tested needed to have a similar level (on a 7 point scale) of healthiness, naturalness, processing, attitude and willingness to buy to keep the influences of externalities low. Also the so-called natural products were required to have a low level of processing. The products tested in the pilot can be found in *table 1*.

Table 1: Products tested in the pilot

Natural product	Processed product
Boiled egg	Egg salad
Muesli	Bread
Pre sliced apple	Apple sauce
Snack tomato's	Tomato puree

The products matching the requirements the best were egg and the snack tomatoes, all means and standard deviations of the pilot can be found in Annex 3. For healthiness both the snack tomato and the boiled egg scored high: egg($\mu= 5.50$;sd= 1.30) and snack tomatoes($\mu= 5.375$; sd=1.65). At naturalness the products both scored high: egg($\mu= 5.87$; sd=1.12) and snack tomatoes($\mu= 5.125$; sd=1.55) and for level of processing they scored the lowest of all products: egg($\mu= 3.500$; sd=2.330) and snack tomatoes($\mu= 3.375$; sd=1.84). Therefore the product group of egg and tomato were used for this study.

Cronbach's Alpha

For hypothesis VI all the scores on objects measuring affect (negative/positive, glad/miserable, sad/cheerful, upset/content) had to be combined into one variable and also all the scores on naturalness had to be combined into one variable. Therefore Cronbach's Alpha was used to test reliability of the total naturalness and total affect scales. All scores were above $\alpha= 0.8$, showing that the reliability was high enough to combine the individual objects into one variable.

For hypothesis V the benefit scores of all the products and groups were combined. Combining all the benefits scores into one benefits variable was tested and reliable according to the Cronbach's Alpha test (0.817). The same was done for the risk scores of all the products among both groups with a Cronbach's Alpha of (0.831) for one overall risk variable.

Results

For effect sizes we use the ranges suggested by Kotrlik & Williams 2003, for η^2 0.010-0.059 small, 0.059-0.138 medium more than 0.138 large and for R^2 0.0196-0.13 small, 0.13-0.26 medium more than 0.26 large effect sizes.

Knowledge of the respondents

The nanotechnology group was asked to give an indication on a 7 point scale how much they already knew about nanotechnology. The results show ($\mu=2.60$, $sd=1.315$) that the respondents did not have a lot of knowledge about nanotechnology. The respondents who already heard about nanotechnology before (27.3%) showed a higher score on knowledge of nanotechnology compared to the people who never heard of nanotechnology.

Testing hypotheses

Hypothesis I: A product with a high level of processing will have a negative effect on the perceived naturalness of the product compared to a product with a low level of processing.

Repeated measures was used to test the effect of the level of processing on the perceived naturalness across the two product groups (tomato and egg), $F(2, 148) = 23.20$, $p < 0.001$, $\eta^2 = 0.24$. Showing an significant decrease of naturalness when level of processing was high. The level of processing explains 24% of the variance of perceived naturalness, which is a large effect size.

Hypothesis II: If a product contains nanotechnology the product will be perceived less natural than the same product without nanotechnology.

Repeated measures was used to test the effect of the use of nanotechnology on the perceived naturalness. There was a significant effect of the use of nanotechnology on the perceived naturalness, $F(2, 148) = 60.26$, $p < 0.001$ $\eta^2 = 0.45$. Showing that the use of nanotechnology explains 45% of the variance of perceived naturalness, which is a large effect size.

Hypothesis III: The combination of a product which is produced with the help of nanotechnology and has a high level of processing will have a negative effect on the perceived naturalness.

Repeated measures was used to test the combined effect of the use of nanotechnology and the level of processing on perceived naturalness. This effect was significant, $F(2, 148) = 52.54$, $p < 0.001$, $\eta^2 = 0.42$. Showing that the use of nanotechnology and the level of processing explain 42% of the variance of perceived naturalness, which is a large effect size.

The means of naturalness for the groups tested with hypothesis I, II and III are graphically depicted in figure 3.

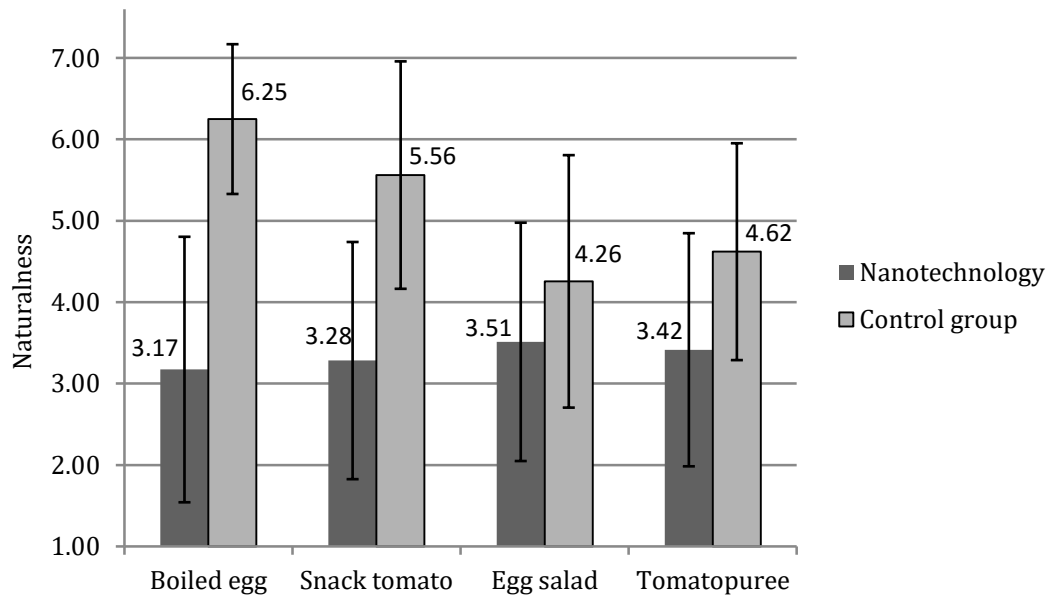


Figure 3: Means (standard deviation) of perceived naturalness for different levels of processing, nanotechnology and product. (1 = unnatural, 7 = natural)

Hypothesis IV: Perceived Naturalness has a positive effect on the affect towards the product.

A regression analysis showed a positive effect of naturalness on affect, $F(1, 172) = 94.85$, $p < 0.001$, $R^2 = 0.357$. Showing that naturalness explains 35.7% of the variance of affect, which is a large effect size.

Hypothesis V: Positive affect has a positive effect on the perceived benefits of a product.

The positive effect of affect on the perceived benefits was found significant, $F(1, 172) = 54.147$, $p < 0.001$, $R^2 = 0.240$. Showing that affect explains 24% of the variance of perceived benefits, which is a medium effect size.

Hypothesis VI: Positive affect has a negative effect on the perceived risks of a product.

The positive effect of affect on the perceived risks was found significant, $F(1, 172) = 115.37$, $p < 0.001$, $R^2 = 0.402$. Note that high perceived risk had a low score(1) and no risk was a high score(7) on the 7 point scale, thus increasing naturalness decreased perceived risk. This effect shows that affect explains 40,2% of the variance of the perceived risks, which is a large effect size.

Hence the combined effect of perceived benefits and risks on willingness to buy was tested with a regression and found significant, $F(2, 172) = 56.526$, $p < 0.001$, $R^2 = 0.399$. This shows that perceived benefits and risks explain 39.9% of the variance of willingness to buy. Looking at these predictors individually shows a significant regression of the perceived benefits on the willingness to buy, $t(172) = 4.674$, $p < 0.001$, $B = 0.343$. The individual regression of perceived risks on willingness to buy was also found significant, $t(172) = 7.489$, $p < 0.001$, $B = 0.532$.

In addition the repeated measures analysis was repeated to estimate the effect of nanotechnology and levels of processing on willingness to pay across tomato and egg products. The effect of nanotechnology was significant, $F(2, 148) = 11.73$, $p < 0.001$, $\eta^2 = 0.14$, as was the effect of processing, $F(2, 148) = 14.35$, $p < 0.001$, $\eta^2 = 0.16$, and their interaction, $F(2, 148) = 18.74$, $p < 0.001$, $\eta^2 = 0.20$. These effects are all large effect sizes. The means and the standard deviations of willingness to buy per product and test group are graphically depicted in figure 4.

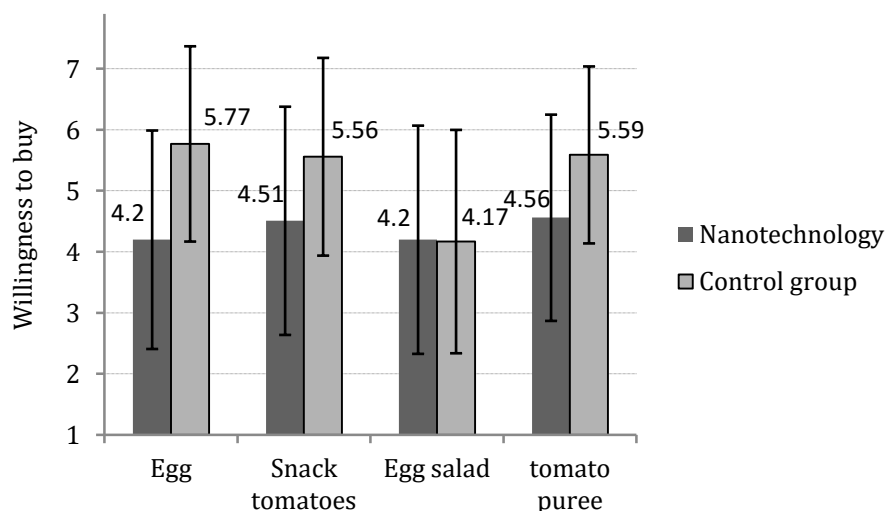


Figure 4: Willingness to buy with nanotechnology and level of processing as dependent factors per product. (1 = I would not buy this product, 7 = I would buy this product)

The results of the hypotheses above in combination with the empirical research are depicted in the following model, figure 5. This model is based on the assumption that there are only direct relations from one object to another.

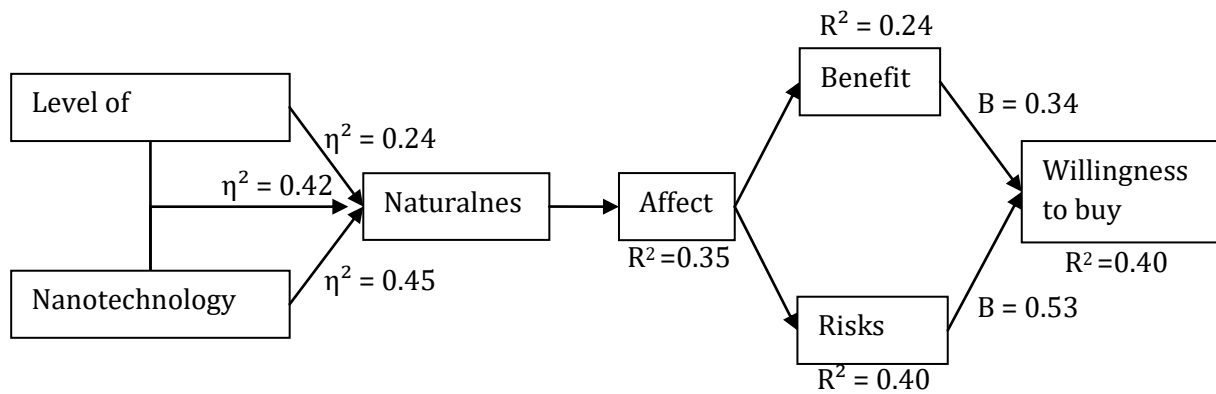


Figure 5: Theoretical model with direct relations, showing effect sizes and beta's

The model of figure 3 assumes that the effects of naturalness and affect on willingness to pay are fully mediated by perceived benefits and risks. A regression analysis was performed to test the effect of affect and perceived naturalness on willingness to buy. The regression included perceived benefits, perceived risks, affect and naturalness as depended variables on willingness to buy. Adding affect to a model with the effects of perceived benefits and perceived risks on willingness to buy resulted in a significant improvement of the model from $F(2,170)= 56.526$, $p<0.001$, $R^2=0.40$ with a significant increase $F(1,169)= 120.57$, $p<0.001$ to $R^2= 0.65$ by adding affect as a determent of willingness to buy and so did subsequent inclusion of naturalness, $F(1,168)= 8.09$, $p= 0.005$, $R^2= 0.67$. Combining naturalness, affect, perceived benefits and perceived risks resulted in a significant combined effect of, $R^2=0.666$, which is a large effect showing that 66.6% of the variance of willingness to buy is explained by these four objects. The results are depicted in figure 6.

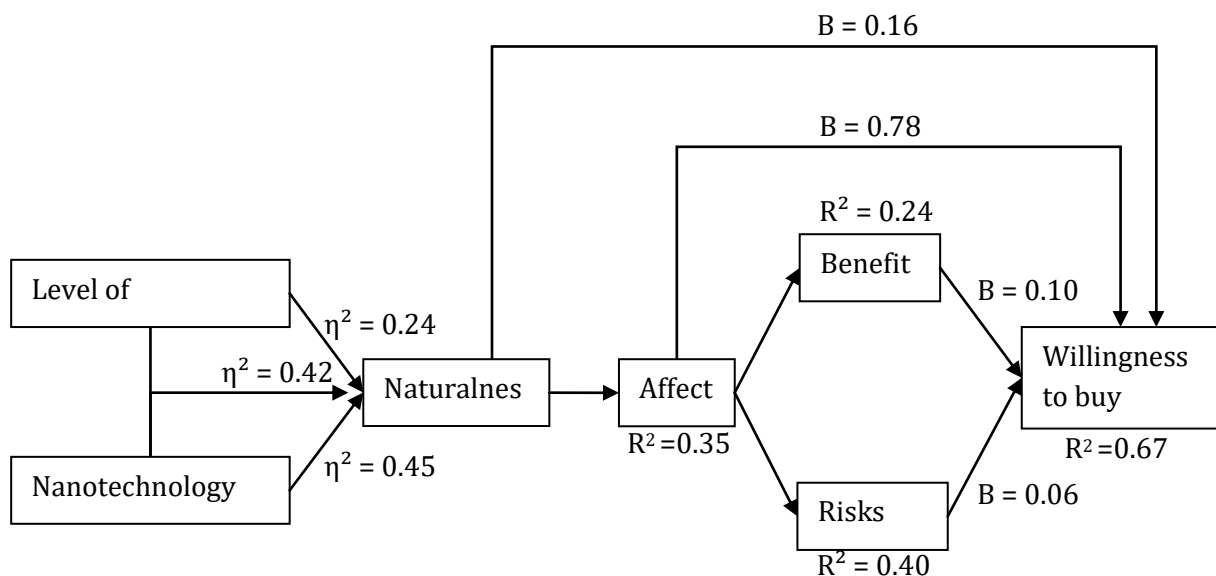


Figure 6: Theoretical model with indirect relations showing effect sizes and beta's

General discussion

The findings of the first three hypotheses were in line with the studies of Tenbült et al. and Siegrist et al.. The results of these hypotheses showed large effect sizes indicating both level of processing and the presence of nanotechnology in a product have an individual and combined effect on the perceived naturalness. As this was also found in the case of genetic modification. The current study contributes to the literature through extending the findings of Tenbült and colleagues from genetic modification to nanotechnology. The findings of the current study combined with Tenbült et al. makes it likely that naturalness, technology and level of processing of a product are relevant to the acceptance of multiple technologies and products. In addition the ideas of Tenbült et al. about perceived naturalness are combined with evaluation of new technologies through affect, risk and benefit as shown by Siegrist and colleagues.

Hypothesis IV shows as expected that naturalness has an effect on affect. This means that the findings of Tenbült et al. was confirmed in the case of nanotechnology showing that people have a positive affect regarding naturalness. It should be taken into account that naturalness was manipulated within groups by changing the level of processing. Processing is not the only factor influencing naturalness, also healthiness of the product and the type of added ingredients influences the perceived naturalness (Rozin 2005). The two processed products in this study, egg salad and tomato puree, are produced with other ingredients. Egg salad is produced with more ingredients compared to tomato puree. This should be taken into account for further research.

Hypothesis V and VI showed results in line with Siegrist et al., where benefits and risks are influenced by affect. Affect in turn had a large significant effect on willingness to buy. Adding the direct effect from affect tot willingness to buy to the effect of risk and benefit improved the model substantially. This indicates that affect has a large direct effect on willingness to buy. When affect and naturalness are added as predictors of willingness to buy the influence of risks and benefits decreased, due to remaining correlation. This may indicate some underlying mechanism slightly different from our model. This could be taken into account in further research.

The final effect of perceived naturalness on the willingness to buy was significant although the additional explained variance was small with direct effect of naturalness on willingness to buy and an effect through the other objects in the model. The direct and indirect effect of naturalness on willingness to buy shows that naturalness itself is not mainly influencing affect which influences through benefits and risks willingness to buy but has a direct effect on the willingness to buy.

An interesting part of the results was the willingness to buy of egg salad, neither the willingness to buy of the control group nor the nanotechnology group scored high. The average scores and standard deviation were nearly the same of the two test groups. This is in line with the expectation that adding nanotechnology to a processed product would have a smaller effect on the acceptance than adding nanotechnology to a natural product.

This was also expected to happen in the case of the tomato products but the results show that adding nanotechnology to tomato puree has almost the same effect on willingness to buy as the natural product. This could be accounted to the fact that the processed products are not the same type of products, tomato puree is a half product often used in preparing dishes as one of the many ingredients and egg salad is an end product which is ready to eat. Although this still not fully explains the fact that adding nanotechnology to egg salad has a smaller decrease of willingness to buy than adding it to tomato puree this should be taken into account for further research.

Another aspect of the products influencing the willingness to buy is the price of a product, the time a consumer will spend on choosing and evaluating a product will probably be larger if the price of the product is higher. In this study two cheap products were used of which tomato puree is extreme cheap. Further research should take the prices of products into account. Also the findings of Gamble et al. should be researched further to understand the acceptance of nanotechnology in food products. If consumers care less about the healthiness of a product when consuming a unhealthy product we would assume that the acceptance of unhealthy food produced with nanotechnology would be higher compared to a healthy product.

Concluding it can be confirmed that the naturalness of a product influences the acceptance of a product produced with nanotechnology. A nanotechnology product which is perceived as more natural has a smaller chance to be accepted compared to a product which is not perceived as natural. Combining these results with the empirical research also raises the question whether the effect of naturalness on willingness to buy is also influenced by the findings of Siegrist et al. 2008 stating that respondents favouring natural food are more risk associated than people to whom naturalness of food is less important. This could be taken into account for further research.

In the future, research could test more and different kind of food products to find more about the different acceptance of consumers also taking different type of products, product prices and healthiness into account. Also the sample of respondents could be improved by selecting a group of respondents who give a better representation of the current society.

In addition real behaviour of respondents could be tested in for example a real life scenario to see if they will respond in the same way as they did in the questionnaire.

Business application

Concluding from this study we would recommend to be careful adding nanotechnology to a food product. The likelihood of acceptance will be higher if nanotechnology is added to a processed product compared to a more natural product. The results of this study indicate that it won't be a good idea to produce natural products with the help of nanotechnology because it effects the willingness to buy in a negative way. Because producing a processed product with nanotechnology is less likely to lead to reduced acceptance of the processed products than adding nanotechnology to an unprocessed product would we recommend to test the willingness to buy of the product before further implementation. In this study one of the processed products produced with nanotechnology had almost the same willingness to buy as the control group. The other product did not show the same effect. This indicates that the difference of naturalness has an indirect influence on the acceptance of a product which is produced with nanotechnology but this differs between products. Therefore it is important to research the willingness to buy per individual product to be sure whether the product will be accepted or not.

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Annex

Annex 1 – Design pilot questionnaire (Dutch)

Introductie

Beste deelnemer,

Dank voor het deelnemen aan deze studie.

In de volgende vragenlijst zal u vier verschillende producten te zien krijgen. Per product zijn er een aantal vragen waarbij u een score kan geven tussen 1 en 7. De score die u hierbij geeft is persoonlijk en daarbij zijn er geen goede of foute antwoorden.

De resultaten zullen uiteindelijk gebruikt worden voor een bachelor thesis van de leerstoelgroep Marktkunde en Consumentengedrag aan de Wageningen Universiteit, hierbij zullen de resultaten anoniem verwerkt worden. Het invullen van de vragenlijst zal ongeveer 5 minuten in beslag nemen.

Product vragen

In de controle groep werden de vragen als volgt gepresenteerd, per pagina werd een ander product getoond met de bijbehorende vragen.



Hoe denkt u over het consumeren van snacktomaatjes?

	1	2	3	4	5	6	7	
Onnatuurlijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Natuurlijk
Negatief	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Positief
Ongelukkig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Gelukkig
Verdrietig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Blij
Ontdaan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Tevreden
Veel risico	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Geen risico
Geen voordelen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Veel voordelen
Niet gezond	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Erg gezond
Ik zou dit product niet kopen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Ik zou dit product kopen

De vragen voor nanotechnologie groep zag er als volgt uit per product:

Nanotechnologie: een techniek waar men werkt met deeltjes in de grootte-orde van nanometers (één mensenhaar heeft de dikte van 80.000 nanometer). Deze extreem kleine deeltjes kunnen voor veel verschillende toepassingen gebruikt worden, een van deze toepassingen is voeding.

Hieronder staat een voedingsproduct dat geproduceerd is met behulp van nanotechnologie.



Hoe denkt u over het consumeren van een gekookt ei dat geproduceerd is met behulp van nanotechnologie?

	1	2	3	4	5	6	7	
Onnatuurlijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Natuurlijk
Negatief	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Positief
Ongelukkig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Gelukkig
Verdrietig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Blij
Ontdaan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Tevreden
Veel risico	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Geen risico
Geen voordelen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Veel voordelen
Niet gezond	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Erg gezond
Ik zou dit product niet kopen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Ik zou dit product kopen

Neophobie vragen

Voor beide groepen waren de neophobie vragen gelijk, deze werden als volgt gesteld:

Geef bij de volgende stellingen aan of deze op u van toepassing zijn.

Ik probeer constant nieuw en verschillend eten.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik vertrouw nieuw voedsel niet.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Als ik niet weet waaruit een voedselproduct bestaat, probeer ik het niet.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik houd van eten uit verschillende landen.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Buitenlands voedsel ziet er te vreemd uit om te eten.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Tijdens etentjes probeer ik nieuwe dingen.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik ben bang om iets te eten wat ik nog nooit eerder heb gehad.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik ben erg kieskeurig over het eten dat ik eet.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik eet bijna alles

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik probeer graag nieuwe buitenlandse restaurants.

Helemaal oneens 1	2	3	4	5	6	Helemaal eens 7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Vragen kennis nanotechnologie

Ik ben voor dit onderzoek al eens met nanotechnologie in aanraking gekomen.

- ☐ Ja
☐ Nee

Geef op de schaal van 1-7 aan hoeveel u over nanotechnologie weet.

- | | | | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Geen kennis 1 | 2 | 3 | 4 | 5 | 6 | 7 Veel kennis |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Achtergrond vragen respondenten

Geef uw leeftijd in jaren

Wat is uw geslacht?

- ☐ Man
☐ Vrouw

Wat is uw hoogst voltooide opleiding?

- ☐ VMBO BB/KB
☐ VMBO TL/MAVO
☐ HAVO
☐ VWO
☐ LBO
☐ MBO
☐ HBO
☐ WO BSC
☐ WO MSC

Afsluiting

Hartelijk dank voor het invullen van deze vragenlijst.

Met vriendelijke groet,
Fijke Duijnhouwer

Annex 2 – Pilot design

Introduction pilot

This pilot questionnaire will be used for a study about consumer acceptance of nanotechnology. It consists of 8 products with several questions. By filling in these questions you can help selecting the best fitting products for the final questionnaire. Please take into account that there are no right or wrong answers to the questions. Results will only be used for this study and anonymity will be guaranteed.

Questions about the products

The following questions were asked for a boiled egg, snack tomato's, muesli, pre sliced apple, egg salad, tomato puree, bread and apple sauce.

1. How do you feel about consuming **one of these eight products**:

Very negative						Very positive
1	2	3	4	5	6	7
Not natural						Really natural
1	2	3	4	5	6	7
Not healthy						Very healthy
1	2	3	4	5	6	7
Not processed						Heavily processed
1	2	3	4	5	6	7
I would not buy this product						I would buy this product
1	2	3	4	5	6	7

The questionnaire ended with the following questions:

Do you know what nanotechnology is?

☐ No

☐ Yes , it is

Thank you for filling in this questionnaire! If you had any problems or issues filling in this questionnaire please write them down here.

.....

.....

Annex 3 – Results pilot

Table 2: Results pilot, means and standard deviations per product on object

	Positive/negative		Naturalness		Healthiness		Processed		Willingness to buy	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Boiled egg	5.5	1.871	5.875	1.053	5.5	1.225	3.5	2.179	5.375	1.409
Muesli	5.625	1.495	5.875	0.927	6.125	0.599	4.5	1.658	4.875	1.763
Pre-sliced apple	2.25	1.714	3.75	1.920	4.5	1.732	5	1.658	2.125	1.615
Snack tomato's	4.375	1.798	5.125	1.452	5.375	1.576	3.375	1.728	3.75	1.984
Egg salad	4.625	1.317	4.375	1.111	4	0.5	5.375	0.696	4.5	1.322
Bread	5.75	1.089	5.5	1.5	5.5	1.581	5.125	1.452	5.5	1.414
Apple sauce	5	1.225	4.875	1.053	4.625	0.992	4.375	0.696	4.25	1.392
Tomato puree	4	1.5	4.375	0.992	4.5	0.866	5.375	0.857	3.75	1.561